BEHAVIOR OF POLLUTANTS PERCOLATION IN HOMOGENEOUS POROUS MEDIA

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ABSTRACT

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Spillage of petroleum products in soil, rivers and lakes is a problem since the advent of the petroleum era. Contamination of groundwater is one of the most important hazard of spill because it is a threat to animals, plants as well as human life. Fingerprinting of oil spills plays an important role in order to select the best treatment and cleanup method. Soil type, amount and type of contaminant, weathering conditions such as rainfall and wind are important factors that influence soil contamination. In this study, an experimental model was used to investigate the movement of a hydrocarbon liquid such as diesel oil, decane and gasoline in soil where crushed limestone was the soil medium. A plexiglass cylinder with three ports at three different depths (in order to collect samples) was constructed. It was filled with crushed limestone. The design enabled to collect samples, analyze them and understand the mechanism of contaminant downward movement. Porosity and permeability of porous media were measured. Samples were collected at different time intervals from ports and analyzed by gas chromatography to obtain chemical compositions of the contaminants. Depth of contaminant, effect of rainfall on contaminant downward movement, mechanism of contaminant movement in dry and wet soil were investigated in this study.

In one experiment, movement depth of contaminant in three ports which are located at different depths was analyzed. It was found that

- The more the depth of the ports, the less the concentration of the contaminant.
- Concentration of eight selected alkane components of diesel oil (C_{10}, C_{11}, C_{12}, C_{17}, C_{18}, C_{26}, C_{27} and C_{28}) increases with time in each port indicating the advancement of the contaminant with time.

Another experiment was run with decane as contaminant to understand impact of contaminant type on downward movement.

The downward movement rate of decane which is the lightest hydrocarbon present in diesel oil was 9 times higher in comparison to the diesel oil movement rate which is a mixture.

In order to understand the weathering effect on soil contamination, rainfall was simulated in one of the experiments by putting a constant amount of water at the top of sand pack before sample collection started.

- It was observed that rainfall has tangible impact on contaminant depth. It could be concluded that the rate and amount of contamination in deeper parts of soil increased with rainfall simulation.

Moreover, behavior of gasoline movement in the sand pack was analyzed by another experiment.

- It was observed that the rate of gasoline downward movement was 10 times higher than diesel oil in sand pack.
- Concentration of toluene and dimethylbenzene which are more toxic than the other components of gasoline was observed with time.
- It was observed that concentration of components increased with time in each port.

In order to estimate saturation profile of water, contaminant and air in the soil medium, NAPL (Non-Aqueous Phase Liquid) simulator was used. A brief investigation of the characteristics of the simulator revealed that saturation profile was not reliable because of the lack of suitable boundary conditions for our experimental setup.

Keywords: Spillage, gas chromatography, fingerprinting, NAPL, contamination, fingering.

ÖZ

KİRLETİCİLERİN HOMOJEN GÖZENEKLİ ORTAMDA SIZINTI DAVRANIŞI

Sepehri, Shirin
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Petrol ürünlerinin toprağa, akarsulara ve göllere dökülmesi petrol çağının başlamasından itibaren hep sorun olarak görülmüştür. Hayvanların ve bitkilerin yanı sıra insan hayatını da tehdit ettiği için yeraltı sularının kirlenmesi sızıntının en önemli tehlikelerinden biridir. Petrol sızıntısının arkasında bıraktığı izlerin takibi, en doğru uygulamanın ve temizleme yönteminin seçilmesi için büyük bir rol oynar. Toprağın türü, kirleticinin miktarı ve çeşidi, yağış, rüzgar gibi hava durumu koşulları toprak kirliliğinin en önemli faktörleridir. Bu çalışmada, dizel, dekan ve benzin gibi bir hidrokarbon sıvısının kireçtaşı toprağındaki hareketini incelemek için deneysel bir model kullanılmıştır. Üç değişik derinlikte üç bağlantısı (numune toplamak için) olan bir pleksiglas silindir kullanılmıştır. Silindir kırılmış kireçtaşı ile doldurulmuştur. Bu tasarım numune toplanmasını, bunların analizini ve kirletici hareketinin mekanizmasının anlaşılmasını sağlamıştır. Gözeneklilik ve geçirgenlikleri ölçülmüştür. Numuneler bağlantılardan farklı zaman aralıklarında toplanmış ve hareket halindeki kirleticinin kimyasal bileşimini elde etmek için gaz kromotografi cihazında analiz edilmiştir. Kirleticinin nüfuz derinliği, yağışın kirleticinin hareketine etkisi, kirleticinin kuru ve ıslak toprakta süzülme mekanizması bu çalışmada farklı deneylerle incelenmiştir. Bir deneyde, kirleticinin nüfuz derinliği, farklı derinliklerde olan üç bağlantıdan analiz edilmiş ve bağlantılar ne kadar derinde olursa, kirletici

derişiminin o kadar az olduğu sonucu çıkarılmıştır. Dizel petrolün seçilmiş sekiz alkan bileşeninin (C_{10}, C_{11}, C_{12}, C_{17}, C_{18}, C_{26}, C_{27} ve C_{28}) derişiminin zamanla her bağlantı noktasında artması kirleticinin zamanla ilerlediğini göstermektedir. Bir diğer deney, kirletici çeşidinin sızıntıdaki etkisini anlamak için dekan kullanılarak gerçekleştirilmiştir. Dizel petroldeki en hafif hidrokarbon olan dekanın süzülme oranı, karışım olan dizel petrolüyle karşılaştırıldığında daha yüksektir. Hava durumu koşullarının toprak kirliliğindeki etkisini anlamak için, deneylerden birinde, numune toplanmasına başlamadan önce kireçtaşının üstünden sabit miktarda su eklenerek yağış simule edilmiştir. Yağışın nüfuz derinliğine etkisinin somut olduğu gözlenmiştir. Kirlenme oranının ve miktarının toprağın daha derin kısımlarında yağış modellemesiyla arttığı sonucu çıkarılmıştır. Ayrıca, benzinin kum yığınındaki sızıntı davranışı bir başka deneyde analiz edilmiştir. Benzinin kum yığınındaki sızıntı hızının dizel petrolünden daha yüksek olduğu gözlemlenmiştir. Benzinin diğer bileşenlerinden daha kirletici olan toluen ve dimetilbenzen konsantrasyonu zamanla gözlemlenmiştir. Her bağlantıda bileşenlerin konsantrasyonunun arttığı görülmüştür. Suyun, kirleticinin ve havanın toprak ortamında doymuşluk profilini hesaplamak için NAPL simulatörü kullanılmıştır. Simulatör karakteristiklerinin araştırılması göstermiştir ki bu deneysel çalışma için uygun sınır koşulları yetersiz olduğu için elde edilen satürasyon profili güvenilir değildir.

Anahtar Kelimeler: Dökülme, gaz kromotografi, hidrokarbon iz takibi, NAPL, kontaminasyon, dağılarak yayılma.

To My Mom

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NAPL	Non-Aqueous Phase Liquid
cm	centimeter
UST	underground storage tank
L	liter
VAH	Volatile Aromatic Hydrocarbons
TPH	Total Petroleum Hydrocarbons
GC/MS	Gas Chromatography Mass Spectrometry
GC/FID	Gas Chromatography Flame Ionization Detector
cp	centipoise
mol	mole
atm	atmosphere
μm	micrometer
gr	gram
p.A	picoamper
mg	milligram

CHAPTER 1

INTRODUCTION

Oil spill from pipelines, gathering stations and failing of storage tanks which occur during exploration, production and transportation of petroleum products can generate series of environmental problems by contaminating soil and groundwater. This will likely lead to effects on public health by means of oral consumption, dermal tangency, breathing or maybe foodstuff chain coverage pathways (Chen, Huang, & Chakma, 2001).

Groundwater provides practically 50% of the drinking water in United States, 26% in Canada and even more than 70% in many of European countries. Groundwater usage is actually high in all kinds of other nations. The number of wells which are identified to become contaminated in North America and also European countries increased tremendously in the past 5-10 years (Cherry, John, 1987).

Groundwater supplies 65% of household water of the Netherlands, 71% of West Germany, East Germany, Switzerland, France and Belgium, and 93% in Italy and nearly 100% in Austria and Denmark (Milde et al. 1983).

An average of 287,280,000 L petroleum was launched into the waters of North America each year. The majority of spilled oils in environment tend to be fuels (48%) along with crude oils (29%)(M.Mudge, 2008). In Korea average amount of spilled petroleum products was about 827 kl (1000 L) and the number of seapages were 388 within the last few decade (Yim et al., 2011).

Nature of spill and accumulation of contaminant components in water determine the intensity of groundwater contamination.

In the United States, between 1994 and 1996, 83 leakages with an average amount of 50,000 barrels of crude oil for each occurred (“Ground Water Contamination by Crude Oil near Bemidji , Minnesota,” 1997).

There are 200,000 underground storage tanks inside Canada that has a human population of 20 million in their vicinity. About 70,000 of these tanks are generally situated on store petrol retailers. The remaining 13,000 used for industrial, agricultural and household consumption (Edgett, Jane; Coon, 1986). It was estimated that in 20% to 25% of storage tanks of Canada leakages has occurred. In 1979, nineteen spills occur followed by 35 water well contamination. In 1986, 89145 more wells were contaminated. Between 1979-1987, more than 1000 wells were contaminated by gasoline (Cherry, John, 1987). 11% to 25% of oil spills are related to gasoline and diesel spills respectively in Canada each year. It was estimated that 30%-50% of oil seagages are related to the human faults while 20% to 40% related to the equipment failure (Fingas, 2012).

Understanding the spreading mechanism of contaminations and its rates in soil plays an important role in minimizing consequences of leakages. For example, a rapid response needed in spillage in sandy soils while it is not very critical in clay soil. Moreover, lighter contaminants like gasoline spreads rapidly in comparison to diesel oil, so it needs more rapid actions (Halmemies et al. 2003).

As soon as oil has spilled to considerable degree in soil, recovery through digging can be impracticable. In these cases, wells have to be sunk, downstream from the spill, both to extract mobile oil, also to collect water which has percolated via oily soil and thus may always be polluted through soluble ingredients. Recovery of contaminated water is a time consuming process which may continue for many months.

When petroleum components float on the water table, it doesn't exceed more than 100 to 200 meters from the seapage. Even though the main mass of contaminant has a tendency to keep on being near to the spilled site, such mobile contaminant like benzene which tend to be inspired just weakly by adsorption with aquifer material, may be transferred several kilometers from the site (Cherry, John, 1987).

Usual surface contamination might be partitioned into various parts:

1) The part of contaminant which is near the surface and dissolved in water. Depending on soil saturation and gravity it can finds its way to the groundwater.
2) That part of contaminant which remains between soil particles and called residual saturation and,

3) The part that evaporates into the atmosphere (M. Amro et al., 2013).

The main objective of this study is to investigate the behavior of oil products in porous media. The main problems which was stated here were about contaminant circulation and downward movement which depend on soil type, contamination type and distance from contamination source. An experimental work was conducted in order to simulate migration of different contaminants in the porous medium. Depth of contaminant, movement rate, impacts of rainfall simulation and behavior of the contaminant in the dry and wet sand medium with time at different distances were analyzed.

Moreover, NAPL simulator which is a powerful mathematical model was used in order to model flow and transport of non-aqueous phase liquids which known as a group of soil and groundwater contaminants in subsurface.

CHAPTER 2

LITERATURE REVIEW

2.1 Experimental Method

Contamination of soil which leads to groundwater contamination, cause serious problems and damages to the environment by threatening the life of animals, human and soil microorganisms and consequently the life of plants. On the other hand, remediation of soil and groundwater is a very expensive and time consuming process. So, understanding the mechanism of contaminant distribution, factors controlling its downward movement in soil are very important issues.

Many researches and studies were conducted in order to understand the behavior of oil products percolation in porous media thoroughly, during the last decades. As a result, it was investigated that soil type, amount and type of contaminant, weathering conditions such as rainfall and wind are important factors that influence soil contamination. So, many researches concentrate on the impact of each factor. Following is a review over these studies.

2.1.1 Fingerprinting Spilled Oil

Aliphatic hydrocarbons which are the main petroleum by-products play an important role in soil physical property. They are destructed by increasing number of microorganisms that decay hydrocarbons. They also enable to fingerprint leaking oils to provide more information about the origin of spillage. In addition, it gives information about degradation extent of spilled oil (A. Serrano et al., 2009).

Soil microorganisms, staying inside intimate contact with the soil's atmosphere, are incredibly sensitive to any environmental perturbation, and are consequently regarded as the most beneficial signals of soil contamination. They might easily respond to the particular changes caused by equally organic in addition to anthropogenic elements. They are also a measure of the particular earth microbial task and so they are purely

associated with the particular nutritional fertility cycles and conversions. Another experimental study which was conducted from April 2004 to May 2005 in Spain, was done in order to review soil biological activity after oil spill in which the contaminant was diesel oil. For this purpose, simulation of diesel seepage from truck tank was simulated in the level of 1 L m^{-2} (liter per meter square). A 16 m^2 land which was divided in four 2m×2m area was used for study. Samples were collected at 0, 4, 8, 18, 26, 50, 100, 200, 300 and 400 days after the spill. After sample collection, from areas then they were transferred to laboratory in freezer in order to avoid evaporation of volatile hydrocarbon. Diesel oil consists of aliphatic (C_{11}-C_{27}) and aromatic hydrocarbons with the proportion of (80-90%) and (20-10%) respectively. Determination of volatile hydrocarbon was done by gas chromatography- mass spectrometer method while determination of aliphatic hydrocarbons was done by microwave assisted liquid-liquid extraction method at first and then assisted by gas chromatography-mass spectrometry (Antonio Serrano, Gallego, & González, 2006). In the first 18 days of experiment, it was understood that evaporation was the dominant process in decreasing the amount of leaked pollutant. At the end of experiment, it was investigated that volatile aromatic hydrocarbons disappeared fifty days after spill, while 1% of total aliphatic hydrocarbons remained in soil even after 400 days.

The results showed that in the first days of experiment, VAH had negative effect on soil microbial development. Through the time, TPH, prystine (n-C_{17}) and phitane (n-C_{18}) affect the increase of soil microbial activity. From 18 days onwards, soil microorganisms started to use aliphatic as a source of energy. After fifty days, soil pollutant biodegradation occurred by soil microorganisms (A. Serrano et al., 2009).

Another laboratory analysis was done in Canada by Xiong et al. for identifying the source of contamination by fingerprinting petroleum components with gas chromatograph mass spectrometer pre-screening analysis. For this purpose, a land which was a gasoline and diesel fuel station in 1959 was considered as study site. In the commercial building which was located south of the study area, an UST (underground storage tank) was removed in August 1984 with an unknown location and fuel type. The main objective of the study was to distinguish the source of contaminant in soil.

Fresh gasoline and diesel samples were collected directly from pump island at the study site. Groundwater samples were collected from monitoring wells and carried out

to the laboratory at 4° C. Then samples were analyzed in GC/MS and it was investigated that analysis of GC/FID for both diesel and gasoline was unique because gasoline was identified in volatile range while diesel was in the extractable range.

GC/MS analysis of fresh gasoline and monitoring well samples supported gasoline impacts to groundwater. GC/MS analysis of fresh diesel and monitoring well samples indicated that groundwater sample was weathered diesel and it didn't match to the fresh diesel so it was originated from another source or different refining processes or both of them.

Investigated contaminants using GC/FID, results of samples identified existence of both diesel and gasoline plumes in groundwater.

2.1.2 Mechanisms Affect Compositional Change in Contaminant

Chemical compounds are transported over the vadose region in soils in gas, aqueous and non-aqueous phase liquids, by means of advection, molecular diffusion along with mechanical dispersion.

2.1.2.1 Advection

Compound advection is usually the particular dominant transport procedure in soil. The term advection specified transportation of a solute by the bulk movement of groundwater, or in other word, it is the transport of any compound with the bulk movement of the phase (Looney & Falta, 2000). The one dimensional flux of the component through the porous medium could be described as:

$$J = v_x \times C \times n_e \qquad (2\text{-}1)$$

In the equation above J indicates mass flux per unit area per unit time, v_x indicates average linear groundwater velocity in the direction of flow, C is concentration in mass per unit volume of solution and n_e in effective porosity of porous medium. In a one dimensional model advection can be the result of burial, compaction and externally impressed flow.

2.1.2.2 Diffusion

Also the movement of pollutants is the function of their chemical kinetic activity through regions of higher concentration to regions of lower one which is classified as diffusion. It could be usually expressed that advection and dispersion are predominant

processes in the formations with medium to high hydraulic conductivity. While, in the cases of low hydraulic conductivity, diffusive transport process is dominant (LaGrega et al., 1994).). The one dimensional diffusion flux can be determined with:

$$J = -D\frac{\partial C}{\partial x} \tag{2-2}$$

The equation known as Fick's First Low where J and D indicates diffusion flux (amount of substance per unit area per unit time) and diffusivity (area per unit time), respectively. Its dimension is area per unit time. C is concentration of which the dimension is amount of substance per unit volume and x is position, the dimension of which is length.

2.1.2.3 Dispersion

The mixing which is the result of variations in the velocity from one flow channel to another and also in one flow channel is defined as dispersion. In the porous media, the available paths are not the same. Some are more constricted in which the flow is harder. In the more open paths, fluid moves faster than the bulk velocity. As these open path are separate from each other, the solute mass spreads out. The distinction between the flow paths cause mixing of fluid.

In the case where fingering occurs in porous media, dispersion and diffusion play an important role in miscible displacement (Arya et al., 1988).

2.1.2.4 Evaporation

Evaporation is the predominant process after contaminant spill occurs on soil. It plays an important role in determine the life time of the spill and estimating the changes in contaminant properties with time. The rate of evaporation depends on temperature, the concentration difference between the liquid and gas phases and vapor pressure of the component. It defines as the pressure exerted by a vapor that is in equilibrium with its solid or liquid form. The vapor pressure indicates the tendency of each component to evaporate. It is calculated from the average boiling point and temperature of the component. Components of non-aqueous phase liquid evaporate into the soil atmosphere with a vapor pressure equal to the mole fraction of the component times its vapor pressure (Reed et al., 1999).

2.1.3 Soil and Pollutant Types

Understanding the distribution of contaminants and also its rate of spreading in soils is very important simply because it may help to minimize the effects of spills.

Halmemis et al. investigated behavior of different pollutants, percolation in different soil types and, estimation of the optimum time period in order to prevent groundwater contamination after a spillage were the goal of the experimental work in Finland.

The experiments were done in a PVC pipe with an inner diameter of 10 cm and length of 90 cm. gasoline and diesel oil were used as contaminant in experiments in three different soil types as gravely sand, sandy till and peat. Dry bulk density, hydraulic conductivity and moisture content of samples were determined. Soils were packed in columns. One litre of pollutants (colored with a red indicator) were put at the top of soils in columns. By fixing a measuring tape on the outside of column, seepage infiltration level was recorded. So, seepage velocity could be calculated. In addition, two more experiments were done with gasoline in both vertical and horizontal columns with the same dimensions. The amount of gasoline was kept constant 1.5 cm layer thickness over the top level of the column. Beside these experiments, the Saku model which was a simple Excel based calculation model was conducted in order to calculate vaporization data such as vapour pressure, rate, time and vaporization amount, spill data like thickness of spill, seepage amount and velocity of gasoline and retention (amount of pollutant which is considered gasoline in this model hold and not hold). At the end of the experiments, it was investigated that penetration of both fuels in gravely sand lasted less than 20 minutes while in sandy till and peat, the depth of penetration didn't exceed from few decimeters even after 2 hours. So, seepage velocity of gasoline in gravely sand was 40 and 70 times higher than in peat and sandy till respectively. Moreover, seepage velocities associated with gasoline have been identified being 3-5 times higher than with diesel oil in sandy till or peat and gravely sand, respectively. Base on the results obtained by the Saku model, it was obvious that the large proportion of spill can be vaporized before penetration occurs. Also, it was investigated that moisture content of soil plays an important role in seepage velocity but not on retention. The very best retention valuations was related to peat. It can hold fuel 62% (gasoline) to 90% (diesel oil) regarding its own mass or one fourth of gasoline and one third diesel regarding its volume (Halmemies et al., 2003).

The Abadan refinery which is located between Arvandrud and Bahmanshir rivers of Abadan in Iran provides urban, industrial and agricultural waters to the highly populated Abadan city. The Abadan Refinery started in 1912, it was among the globe's most significant oil refinery until it had been ruined during 1980, through Iraq Iran war. A huge oil spill from the pipelines and storage tanks of Abadan Refinery took place during the war to the encompassing surroundings. In order to determine extension of oil seapage in surrounding region a comprehensive study was conducted. First of all, twenty boreholes were drilled and some data such as porosity, oil saturation, density were identified. Moreover, determination of geologic features, and stratigraphy were done. During one year period, pattern of groundwater movement and its connection with nearby rivers were investigated by using water table fluctuation measurements. Spilled petroleum was identified in all drilled boreholes. 6,424,674 barrels of spilled oil in place was calculated by using volumetric method. The average oil and water saturation and porosity were calculated as 52%, 48% and 54% respectively. The depth of leaked pollutant was 4.45 meters. Moreover, it was investigated that sand, silt and clay were three types of soils in the area but the refinery was built on deltaic formation so much of the area consists of clay. The results showed that, as the clay particles are chemically active, a huge amount of spilled petroleum was adsorbed by clay particles which plays an important role in preventing contamination of surrounding rivers (Zoveidavianpoor, Oil, Company, Iranian, & Company, 2010).

Another experimental work was conducted by Colombo et al. (2005) in order to evaluate behavior of aromatic and aliphatic hydrocarbons in water, soils and sediments after oil spill in Rio de la Plata estuary, Argentina. Samples were collected on June 1999, February 2000 and July 2001, 6, 13 and 42 months after the spill with stainless steel spatulas. They were carried to the laboratory in pre-cleaned glass jars. Ultrasonic extractions, silica gel fractionation and HRGC-FID were used in order to determine hydrocarbons of samples. Moreover, aliphatic and aromatic hydrocarbons were identified by HRGC-MSD, using an Agilent 6850 gas chromatograph and Agilent 5973N MSD. After evaluation, it was found that hydrocarbon levels in soils were 100-1000 times higher and more homogeneous than in sediments. Moreover, results showed that offshore waters were less affected because of rapid wind-driven transport. It was also found that aliphatic hydrocarbons drop faster in comparison to aromatic

hydrocarbons which have higher concentrations during the second sampling campaigns. Based on the results, 6 months after the spill, 40% of hydrocarbon residues in sediments were lost with a complete recovery at 4 years, while recovery in soils occurs at 3 months and less than 3 years. Average loss rates of lower molecular weight hydrocarbons and n-Alkanes were lower in comparison to the higher molecular weight hydrocarbons (Colombo et al., 2005).

2.1.4 Dry and Wet System

Amro et al. designed an experimental model in order to investigate behavior of crude oil migration and its rate of penetration in soils. In the experiment two separate columns were filled with soil and other rock types. Sandy soil and gravel were used in one column while in the other column gravel and limestone were used. As a contaminant, crude oil with a viscosity of 28 cp and API gravity of 31° was used. Both columns had the same dimensions (29 cm in diameter) and five ports in order to collect samples. One of them was at a dry state while the other was at wet state by rainfall simulation through spiral part of pipe consists of various holes. The movement of fluid was compared in both systems. Digital video camera, microscopic analyses and other measurements were used to observe penetration depth of oil in columns. As a result, the rate of penetration was high in wet system in comparison to dry one while adsorption was found higher in very low infiltration depth in dry system. Among some factors like rock and fluid properties, weathering conditions and time play important role in the penetration of contaminant in soil (M Amro et al., 2009).

2.1.5 Weathering Characteristics

In December 2007, the Hebei Spirit oil spill occurred, which was the combination of three different Middle East crude oil in Western Korea. About 10,900 ton crude oil spilled into the sea from the tanker. When the oil spills into the marine environment, it was expose to many weathering processes such as evaporation, dissolution, adsorption, and emulsification on the seabed. Weathering information can provide many valuable information in order to decide on the best remediation method. In total, 28 samples were collected from 19 stations of Chungnam Province and Jeolla Province between December 2007 and August 2008. 0.4 gram of samples were

weighted and dissolved in hexane up to the volume of five milliliter then they were analyzed in GC/MS and GC/FID. The physical property of three types of oil were the same. Asphaltene and resin content of oils which affect emulsion formation were different. The first step was the identification of spillage source. For this purpose, GC/FID was used and provide information about oil source and weathering status which plays an important role in selection of remediation method and ecotoxicolagical study.

It was investigated that evaporation is the main weathering process in the primary period of spillage and the next one is dispersion. Moreover, it was identified that the samples which were collected after 8 months of spillage were in extreme weathering stages (Yim et al., 2011).

2.2 Numerical Models

Recognizing pollution sources, modelling of subsurface pollutants flow and transportation, analysis of uncertainties, environmental risk evaluations are the general steps of dealing with petroleum contaminated site (Chen et al., 2001).

Non-aqueous phase liquids are a group of contaminants which consist of petroleum products and insoluble in water. They can be divided in two light and dense groups. Light non- aqueous phase liquids (LNAPL) are less dense than water like diesel fuel and gasoline while dense non- aqueous phase liquids (DLNAPL) are denser than water.

Multiflow and transport models have been developed in order to figure out contamination in two phase (aqueous-nonaqueous phase liquid, NAPL) and three phase (aqueous-gas-NAPL) systems (ZHOU et al., 2014).

Abriola and Pinder suggested a method to simulate transportation of non-aqueous phase, solute component of water phase and mobile fraction of gas phase (Abriola, LM. Pinder, 1985). Simulation of organic components multi-phase flow was formulated with finite element model by Kaluarachi et al.(Kaluarachichi, J.J. and Parker, 1989). With an assumption of the first order decay, Katyal et al. used a two dimensional finite element program to multi-phase and multi-component transport simulation (Katyal et al., 1991). As gasoline fractions show different migration behavior, Fagerlund and Niemi (Fagerlund F, 2007) used a partially coupled, fraction-by-fraction method to model spill scenario. Distribution of contaminants in soil, was modeled by Pollard et al. (2008). National Risk Management Research Laboratory of

the USEPA developed a mathematical model, NAPL simulator to simulate subsurface flow and transportation of contaminants (ZHOU et al., 2014).

Chen et al. simulated transportation of pollutants in subsurface based on a Monte Carlo method. Pollutant transportation in heterogeneous porous media, distribution of pollutant concentrations were considered in the research. The site which was located in western Canada with three leaking underground storage tanks (UST) was selected for simulation. The simulated area was supposed to be 300×400 m^2. After simulation, it was observed that concentration of pollutants were high in two zones which are close to the UST 2 and UST 3, so they were considered as pollutant sources. Sandy loam, clay and silty clay were three soil types of the area. Simulation results from one Monte Carlo showed that groundwater as drinking water supply of the area has been contaminated by pollutants. Moreover, it was investigated that the concentrations are in the range of 0~0.005 mg/L (Chen et al., 2001).

Zhou et al. used column test data to test possibility of NAPL simulator under water table fluctuation conditions to obtain residual saturation. An acrylic column with an inner diameter and length of 3.5 cm and 50 cm respectively was used in the test. As the sandy porous medium, toyoura sand with the density of 2.64 gr/cm^3 and uniformity coefficient of 1.68 was used. Sodium chloride solution with 0.05 mol/L concentration was used as initial pore water and Paraffin was utilized as LNAPL sample. Sand was poured into the column by using funnel in uniform layers. At the same time in each step of filling column, water table kept 5 cm above the sand level. A pair of tensiometer and an electrical conductivity probe were used in order to measure capillary pressure. Hydrophobic and hydrophilic tensiometers were used to measure pore LNAPL and water pressures. During the test, porous medium was isolated from the air and there was always 1 cm layer of water above the sand pack. Also, the same volume of LNAPL infiltrated into the sand pack from the top of sand. There was always 1cm layer of LNAPL over the sand during water table fluctuations. At the first step, relations of saturation-capillary pressure were measured under water table fluctuation. Test was lasted for 313 hours and consisted of four periods: first falling of water table (0-89^{th} hour), first rising of water table (89^{th}-150^{th} hour), second falling of water table (150^{th}-216^{th} hour) and second rising of water table (216^{th}-313^{th} hour). So, there were two imbibition and drainage processes during 313 hours. 1.0, 0.22, 0.5, 0.3 and 0.47 were water saturations at 0^{th}, 89^{th}, 150^{th}, 216^{th} and 313^{th} hour respectively.

The LNAPL saturations of the same time intervals were 0.0, 0.78, 0.5, 0.7 and 0.53 (0.78 and 0.7 were initial LNAPL saturations in the two imbibition processes). The results demonstrated that, hysteresis played an important role on the migration of LNAPL during the drainage and imbibition processes. The second step was to simulate entrapment and release of LNAPL with the simulator. 44 cm and 3.5 cm were length and diameter of simulated area respectively which was discretized into 44×4 rectangle mesh elements and 225 nodes. The simulation was considered as four steps the same as column test because of water table changes. In order to fit the S-p relation data, Van Genuchten model (Van Genuchtan M, 1980) was used. In order to calculate the difference between NAPL simulator data and those measured in column test, water saturations at 86^{th}, 150^{th}, 200^{th} and 300^{th} hour were selected because they were stable for a long time. 7.63%, 13.40%, 46.04% and 36.55% were simulation errors at selected times respectively. It was obvious that error of the first falling of water table was small and then it got bigger by rising water table. In order to find the reason of differences between original NAPL simulation and column test, simulation was repeated for many times. It was found that the residual saturation is the function of time and space, and incomplete imbibition process was the main reason of this big differences. Capillary pressure was not close to zero or infinite in two imbibition and drainage processes because they are incomplete and this is because of water table fluctuation. So, it could be concluded that NAPL simulator is not suitable for the cases that water table fluctuates (ZHOU et al., 2014).

CHAPTER 3

STATEMENT OF THE PROBLEM

This experimental study was conducted to understand the mechanism of contamination of sand pack by petroleum products which are diesel oil, decane and gasoline. The amount of contaminant components were determined by gas chromatography. Concentration of each component was calculated by gravimetric calculations. Moreover, an attempt was made to use the NAPL simulator was used in order to obtain the saturation profiles of air, water and pollutant.

CHAPTER 4

EXPERIMENTAL SET UP AND PROCEDURE

A model was constructed to meet the goals given in the statement of the problem (Fig 4-1). The proposed experimental setup is composed of a plexiglass cylinder (Fig: 4-1(a)) which is characterized by an inner diameter of 4.8 centimeter and length of 49 centimeter. Three ports were located at the distance of 5, 15 ad 25 centimeters from the bottom of the cylinder for the purpose of sample collection (Fig: 4-1(b)). These intervals were considered to diagnose penetration depth of contaminant in the column. The column was filled with Midyat unconsolidated limestone (32 cm) at the lower part (Fig: 4-1(c)) and the upper part (Fig: 4-1(d)) was filled with the contaminant. The experiment conducted in two separate modes. In the first experiment, no rainfall was simulated. But in the second one, sand pack was subjected to rainfall that was simulated by placing specific amount of water (63.3 cm^3) at top of the column which was supplied by ISCO pump after contaminant percolation has finished. Three valves (Fig: 4-1(e)) were considered in the system. One is located at the bottom of the column (which is open during the experiment) in order to show when contaminant reaches the bottom of column and collect it in the measurement cylinder. The other two valves were adjusted at the top of column in order to adjust rainfall from ISCO pump (Fig:4-1(f)). During the experiments, samples were collected in different time intervals and were analyzed by gas chromatography to determine the composition of hydrocarbon fractions. A sieve which was smaller than size of the grains was located at the bottom of the sand pack to prevent any sand loss during the experiment (Fig: 4-1(g)).

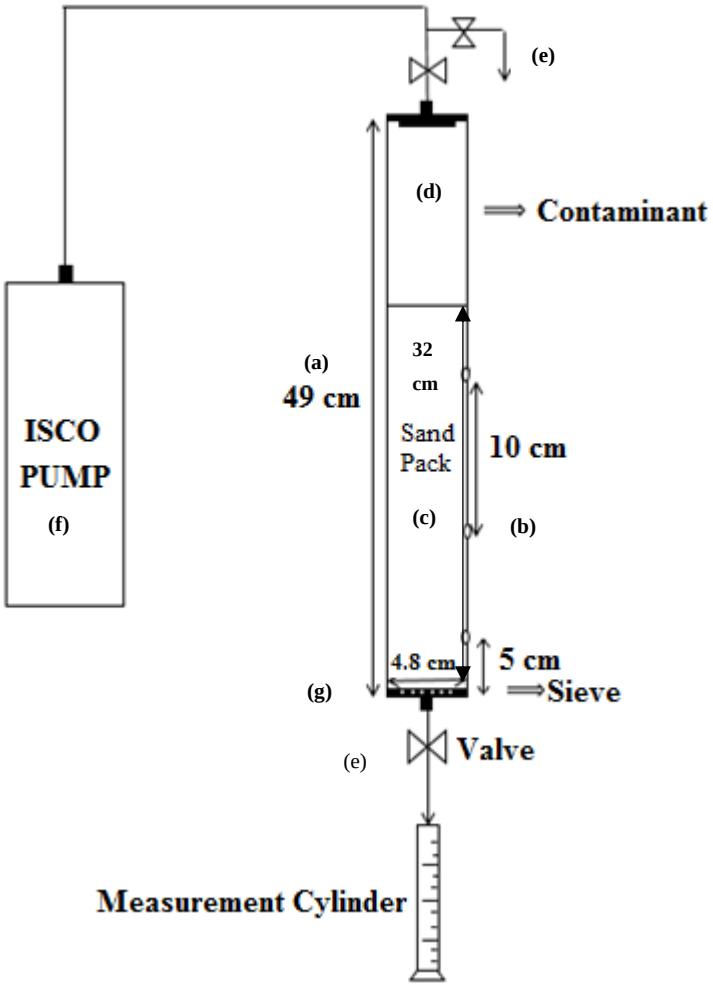

Figure 4-1: Experimental Setup.

Table 4-1: Dimensions of core holder.

L_c(cm)	49
ID_c(cm)	4.8
A_c(cm^2)	18.1
V_c(cm^3)	886.7

Figure 4-2: Experimental Set Up

4.1 Rock Properties

Rock properties such as porosity and permeability play an important role in fluid flow in the porous media. So measurement of these properties is the first step to initialize the experiments. Porosity and permeability measurements of the sand pack sample were done in a Plexiglas cylinder.

4.1.1 Porosity measurement

In order to measure porosity of porous medium, the crushed limestone was packed in the Plexiglas cylinder. Then, it had been vacuumed and weighted. Afterwards, the column was exposed to a certain pressure by injecting water until the soil was saturated. Then the saturated sand pack was weighed again. The difference between the two measurements is the weight of the water which is in the pores.

Since the density of water is equal to 1 gr/cm^3, the volume of water can be determined which is the pore volume of the pack. The porosity of the pack was found as 40.1%.

4.1.2 Permeability measurement

The other property that was measured in the laboratory was permeability. It was done by injecting water in a packed sand in the cylinder with a constant flow rate of 1 cm^3/sec and initial pressure of 5.355 atm, after the sand pack was saturated with water. Final pressure was noted as 1 atm and by using Darcy equation permeability was calculated as 785.1 millidarcy. The calculation process of porosity and permeability is explained in detail in Appendix A.

Properties of the crushed limestone which was packed in the cylinder are shown in Table (4-2).

Table 4-2: Properties of the limestone packed column.

Grain size(μm)	88-297
Permeability (mD)	785.1
Porosity, Φ	40.1%
Vs (Volume of cylinder filled with sand pack (cm^3))	579.2
Pore volume (cm^3)	232.3
Limestone density, ρ_s ($\frac{gr}{cm^3}$)	2.32

4.2 Contaminant Characteristics

In this experiment, the applied contaminant in three experiments were diesel oil with a density of 0.8340 gr/cm^3 at 15°C and API gravity of 36° and gasoline with a density of 0.73 gr/cm^3. According to the American Petroleum Institute, it can be classified as light hydrocarbon. The chemical composition of the diesel was determined by using gas chromatography.

Contaminants properties which were utilized in this study are listed in Table (4-3).

Table 4-3: Properties of fluids used as contaminant.

Water saturation (%)	53.3
Water density, ρ_W ($\frac{gr}{cm^3}$)	1.00
Density of diesel oil, ρ_d ($\frac{gr}{cm^3}$) at 25 °C	0.8430
API gravity of diesel oil	36
Density of decane ($\frac{gr}{cm^3}$) at 25 °C	0.73
Density of gasoline ρ_g ($\frac{gr}{cm^3}$) at 25 °C	0.72
Contaminant Volume (cm^3)	54.3
Gasoline viscosity (cp) at 20 °C	0.6
Diesel viscosity (cp) at 25 °C	4.746

In order to observe changes in sand pack, samples were collected from the ports and analyzed in laboratory by gas chromatography.

4.3 Sample Collection

Three ports which can be opened and closed were designed to get samples from inside the sand pack. In order to collect samples, test tubes with 0.25 inch (0.635 cm) in diameter and 8 cm in length were used. Tubes were pushed into the sand pack from the ports and then pulled back and samples were collected separately in a small glass jars with lids. A total of 33 samples were collected from three ports at 11 time intervals during the first and second experiments

4.4 Experimental Procedure

The limestone was crushed to 88 μm to 297 μm size. It has been assumed that during experiment no chemical reaction was occurring between the materials in the circulating fluid. Unconsolidated limestone was packed in a cylinder and was fully saturated with water and then displaced with air. Since the crushed limestone in the

system was water wet, when air was injected into the system, water from larger pores was coming out. The remaining water saturation in smaller pores is defined as irreducible water saturation which was 53.3%. Then, 54.3 cm^3 contaminant was put at the top of sand pack.

4.4.1 Experiment 1

In the first experiment diesel oil was used as contaminant. 33 samples were collected during the experiment. 18 samples were collected during first day at 30^{th}, 60^{th}, 90^{th}, 120^{th}, 180^{th}, 240^{th} and three were collected at 1440^{th} minute before rainfall simulation from three ports. Then the rate of contaminant downward movement was calculated for each time interval in each experiment. Contaminant downward movement rate of each experiment is mentioned in Appendix B. There was no rainfall simulation in the first day of experiment. In the second day, 63.3 cm^3 water was put at the top of sand pack after all diesel moved in the sand pack in order to simulate rainfall and observe the effect of it on contaminant movement in the system. 12 samples were collected at 1500^{th}, 1560^{th}, 1629^{th} and 1680^{th} minutes.

4.4.2 Experiment 2

Decane was used as contaminant in the second experiment. This experiment was the same as first experiment. 54.3 cm^3 decane was used as contaminant and 18 samples were collected in the first day at 30^{th}, 60^{th}, 90^{th}, 120^{th}, 180^{th} and 240^{th} minutes, 3 were collected at 1440^{th} minute from three ports in the second day before rainfall simulation and at 1500^{th}, 1560^{th}, 1620^{th} and 1680^{th} minute 12 were collected after placing 63.3 cm^3 water at the top of sand pack from ports.

4.5 Dry and Wet System Cases

Third and fourth experiments were done in order to compare the contamination and movement of contaminants in both dry and wet systems. They were done in the same sand pack with the same amount of contaminant which was diesel oil in both of them.

4.5.1 Experiment 3

Third experiment was designed to be at dry state of column. Unlike the other experiments, sand column was not saturated with water. The third experiment lasted for 5 days. In total, 50 samples were collected in five days at 24 different time intervals from three ports. 10 were collected in the first day of experiment at 30^{th}, 60^{th}, 90^{th},

120^{th}, 180^{th}, and 240^{th} minutes. In the second day 10 samples were collected at 1440^{th}, 1500^{th}, 1560^{th}, 1620^{th} and 1680^{th} minutes. 10 samples were collected in the third day at 2880^{th}, 2940^{th}, 3000^{th} and 3060^{th} minutes from first and second ports. In the fourth day of experiment 10 samples were collected from all ports at 4320^{th}, 4380^{th}, 4440^{th} and 4500^{th} minutes and at least, 10 samples were collected at 5760^{th}, 5820^{th}, 5880^{th} and 5940^{th} minutes from first and second ports at the same time.

4.5.2 Experiment 4

In this experiment, the sand pack was 100% saturated with water and then displaced with air. Then as before, the same amount of diesel oil (54.3 cm^3) was put at the top of column. Number of samples and time of sample collections were the same as third experiment. It is important to note that alkane hydrocarbons were identified with Simulated Distillation (SIMDIS) GC in the first, second, third and the fourth experiments.

4.5.3 Experiment 5

The fifth experiment was done in order to observe downward movement behavior of gasoline in sand pack. Subjected to benzene (one of the components of gasoline) for long time can cause diseases like cancer and aplastic anemia. Nausea, sleeping disorders, unconsciousness and even death are effects of inhaling toluene in high levels for a short time. So, it is very important to follow behavior of pollutant components after seapage of contaminant.

Sand pack was fully saturated with water and displaced with air. Then, 54.3 cm^3 of gasoline was put at the top of sand pack. In total 33 samples were collected in two days. 18 samples were collected at 30^{th}, 60^{th}, 90^{th}, 120^{th}, 180^{th} and 240^{th} minutes in the first day of experiment. In the second day of experiment, 15 samples were collected at 1440^{th}, 1500^{th}, 1560^{th}, 1620^{th} and 1680^{th} minutes from three ports. Samples were analyzed in detailed hydrocarbon analysis gas chromatography. As the GC gives mass percent of each component in gasoline, in this experiment samples were not put in the oven.

Summary of all experimental conditions is shown in Table (4-4).

Table 4-4: Experimental Conditions.

Experiment	Contaminant	Duration (min)	Rainfall Simulation	Downward movement Time (min)	No. of Samples
Ex.1	Diesel Oil	1680	Yes	400	33
Ex.2	Decane	1680	Yes	45	33
Ex.3 (Dry)	Diesel Oil	6000	No	285	50
Ex.4 (Wet)	Diesel Oil	6000	No	390	50
Ex.5	Gasoline	1680	No	40	33

4.6 Analysis of Samples

After collecting samples, constant volume of hexane (3 mL) was used as solvent to extract contaminant from the samples. Then the mixture of hexane and contaminant was analyzed in gas chromatography. They were analyzed by gas chromatogram for determining the composition of hydrocarbon fractions. On the other hand, the remaining part of samples which is the mixture of soil, water and remaining hexane and contaminant were put in oven in order to separate and calculate the amount of contaminant, water and crushed sand of each sample in the first four experiments.

4.6.1 Gas Chromatography

Gas chromatography is used in order to separate and analyze components which can be vaporized without decomposition. It consists of sample injection port, carrier gas, columns and detectors. There are mobile phase (carrier gas) and stationary phase (layer of liquid) in the gas chromatography. Separating the compounds in a mixture is accomplished between a liquid stationary phase and a gas mobile phase. Gas phase passes through the column in an oven in which the temperature can be controlled. Components of a mixture separate based on boiling point (or vapor pressure) differences in gas chromatography.

In this study, sample analysis were done with an Agilent 7890A with three detectors with four detector signals. Maximum temperature ramp rate is 120°C/min for column

oven. The range of temperature is between +4˚C to 450˚C and the carrier gas is helium. Gas chromatograph gives some information about the hydrocarbon components. Figure (4-3) shows a gas chromatograph of one of the samples that was collected from the first port (the port which is near to the surface of sand pack) after 90 minutes of putting contaminant at the top of it.

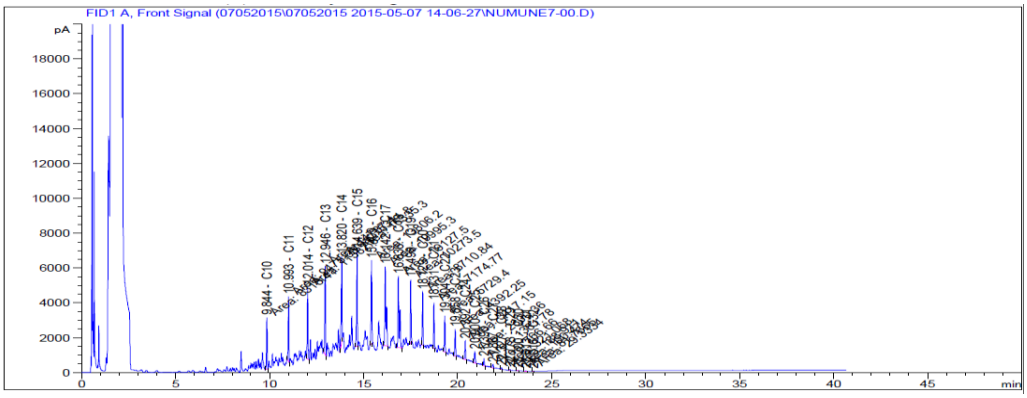

Figure 4-3: An example of gas chromatogram (port:1, Time:90 minute).

In the figure each peak is related to a specific component. Y-axis in the gas chromatograph refers to the signal of each peak whereas X-axis refers to the retention time of each component .From the gas chromatography, it can be observed that diesel oil consists of many hydrocarbons which were in the range of C_{10} to C_{32} with different proportions as (mg) in liter of solution. In order to have a good comparison between our samples, amount of each component as milligram was calculated, which is explained in detail in Appendix C.

Table (4-5) shows the components and their fractions of diesel oil in the sample from the first port at 90th minute.

Table 4-5: Alkane Components of diesel oil

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.844	8318.41406	207.72818	0.62318454	**C_{10}**
10.993	9475.02832	247.22218	0.74166654	**C_{11}**
12.014	1.14E^{+04}	291.82268	0.87546804	**C_{12}**
12.946	1.48E^{+04}	384.46987	1.15340961	**C_{13}**
13.82	1.53E^{+04}	387.49534	1.16248602	**C_{14}**

Table 4-5 Continued.

14.639	$1.63E^{+04}$	406.25474	1.21876422	**C_{15}**
15.409	$1.38E^{+04}$	344.95555	1.03486665	**C_{16}**
16.142	$2.00E^{+04}$	502.12732	1.50638196	**C_{17}**
16.836	$1.91E^{+04}$	474.20575	1.42261725	**C_{18}**
17.498	$1.03E^{+04}$	256.10309	0.76830927	**C_{19}**
18.129	8710.84473	216.78505	0.65035515	**C_{20}**
18.731	7174.77344	181.95845	0.54587535	**C_{21}**
19.304	5729.40137	144.64727	0.43394181	**C_{22}**
19.858	4392.25049	110.86068	0.33258204	**C_{23}**
20.392	3117.14673	79.17785	0.23753355	**C_{24}**
20.9	2300.35547	57.90555	0.17371665	**C_{25}**
21.39	1361.78162	35.14948	0.10544844	**C_{26}**
21.867	766.6601	20.25855	0.06077565	**C_{27}**
22.327	321.06772	8.60193	0.02580579	**C_{28}**
22.773	188.91063	5.38965	0.01616895	**C_{29}**
23.2	100.47388	0	0	**C_{30}**
23.613	81.76646	3.06989	0.00920967	**C_{31}**
24.016	29.33337	0	0	**C_{32}**

On the other hand, beside the samples, compositional fraction of diesel itself in gas chromatograph in three different volumes, namely 0.1, 0.5 and 1 milliliter were analyzed. Concentration of components in three different volumes of diesel oil are listed in the Table (4-6). As the concentration of components are close in three different volumes, the average of concentrations were calculated and utilized as reference concentration for each component.

Table 4-6: Components' concentration in 0.1, 0.5 and 1 mL diesel oil.

	Components' Concentration			
Component	**0.1 mL Diesel**	**0.5 mL Diesel**	**1 mL Diesel**	**Average**
C_{10}	0.011	0.008	0.007	0.009
C_{11}	0.015	0.010	0.009	0.011
C_{12}	0.015	0.010	0.008	0.011
C_{17}	0.031	0.021	0.019	0.024
C_{18}	0.026	0.0178	0.0172	0.020
C_{26}	0.0018	0.00126	0.0011	0.0014
C_{27}	0.0008	0.000677	0.0006	0.0007
C_{28}	0.0004	0.0003	0.0003	0.0004

4.6.2 Oven

To have a better comparison and analysis of the samples, total amount of contaminant in each sample should be calculated. The weight of each sample was measured after collected from the ports. Each sample consists of sand, water (which was used to saturate sand), hexane (which was used as solvent) and contaminant. For this purpose, all the samples (in the first, second, third and fourth experiments) were put in oven in two steps. First, all of them were put in the oven for 75 minutes at 50° C. The purpose of this step was to evaporate hexane which has boiling point of 68° C. To evaporate water of the samples, all were put in oven at 100° C for 60 minutes. At last, amount of water, sand and contaminant were obtained which are described in detail in Appendix C.

4.7 Evaporation Rate

As it is mentioned before, evaporation is the predominant process after spillage of petroleum products. Evaporation of a component is a function of its vapor pressure. The lower the vapor pressure, the higher the evaporation rate of the component. In this study, gasoline is more volatile in comparison to diesel oil. So, in order to investigate whether evaporation of gasoline has any impact in the experimental results, an experiment was conducted. 54.3 cm^3 gasoline poured in a beaker which is open to the atmosphere. 3 samples were collected from the beaker at 60^{th}, 120^{th} and 240^{th} minutes.

Samples were analyzed in GC. Concentration of components in samples were compared with the components concentration in gasoline which was analyzed before separately. Result are mentioned in the Appendix F.

CHAPTER 5

NON-AQUEOUS PHASE LIQUID (NAPL) SIMULATION

NAPL simulator is a three-dimensional three phase simulator which has the main objective of developing a mathematical transport model in order to analyze NAPL movement in granular soils. Infiltration, dissolution and consequently advection and transport as a vapor phase are the three basic migration mechanisms of organic fluids. According to the NAPL documentation which was prepared by the United States Environmental Protection Agency in the National risk Management Laboratory in Oklahoma (1997) multiphase flow, interphase mass transfer and constituent mass transport are three fundamental physical processes that have been identified.

Entrapment and release of fluid, advective and dispersive transport in water and gas phase, hysteresis in the k_r-s-p_c where k_r represents relative permeability and p_c represents capillary pressure have been quantified by simulator.
Using NAPL simulator in addition to a specified pre- and post-processing software (which is excel here) for data input and output visualization will be an effective engineering tool to be used for analysis. A set of nonlinear partial differential balance equations was defined in order to describe the physical problem mathematically (Guarnaccia, George, & Fishman, 1997).

5.1 Limitations and Capabilities of Model

Similar to other simulators, NAPL has its limitations and also capabilities which are listed below:
It can be applicable in one, two and three spatial dimensions. Rectangular elements are used by the finite element mesh. In order to quantify water, NAPL and gas-phase advection Darcy's law and for diffusion processes Fick's law are used. It is assumed

that water phase is incompressible and consists of water and dissolved NAPL. NAPL-phase also is considered incompressible, could be dissolved into the aqueous phase (water) and vaporize into the gas-phase. Characterization of gas-phase is defined as incompressible, consists of gas and dissolved NAPL. Moreover, its properties depend on contaminant concentration. Besides, porous medium considered non-deforming and mostly heterogeneous and isotropic; consists of soil and adsorbed contaminant and may be saturated by one, two or three phases.

During the simulation, temperature is considered constant, in other word isothermal conditions are dominant. Wettability plays an important role in defining relationships between relative permeability, saturation and capillary pressure. Water has more wettability in comparison to NAPL and gas has lower in comparison to water and NAPL. As a boundary condition, Drichlet boundary condition was considered for transportation of contaminant. The code was written in FORTRAN77.

Mathematical model consists of two major mass balance equations, in which the distribution of primary variables in time and space is defined and the constitutive equations in which the inter relationship between primary (which are advanced in time and space by solving mass balance equations) and secondary variables (which are functions of primary variables) were defined.

5.2 Mass Balance

The conservation of mass of each phase is described by mass balance equations and it can be generated for all species as:

$$\frac{\partial(\varepsilon S_\alpha \rho_\iota^\alpha)}{\partial t}+\nabla\bullet[\varepsilon S_\alpha \rho_\iota^\alpha V^\alpha] - \nabla \bullet \left[\varepsilon S_\alpha \rho^\alpha D^\alpha \bullet \nabla(\frac{\rho_\iota^\alpha}{\rho^\alpha})\right] + \varepsilon S_\alpha \kappa_\iota^\alpha \rho_\iota^\alpha = \rho_\iota^\alpha Q^\alpha + \hat{\rho}_\iota^\alpha \quad (5\text{-}1)$$

In the above equation (ι, α) pair, represent species ι in a α fluid phase. Porosity of porous medium is defined by ε by equation where S_α shows α-phase saturation. Mass concentration of species ι in α-phase is shown by ρ_ι^α and v^α represents the mass velocity of phase α. Moreover, α-phase dispersion coefficient indicated with D^α and decay coefficient for species ι in the α-phase represented by $\kappa^\alpha{}_\iota$, source of mass for species ι in the α-phase and the point source(+) or sink (-)α-phase mass represented by $\hat{\rho}_\iota{}^\alpha$ and Q^α, respectively.

Mass balance equations for water, NAPL and gas phase are:

For water phase:

$$\frac{\partial(\varepsilon S_w \rho^w)}{\partial t} + \nabla \bullet [\varepsilon S_w \rho^w v^w] = \rho^w Q^w + E_n^w - E_{n/w}^w - E_{n/w}^s \quad (5\text{-}2)$$

For NAPL phase:

$$\frac{\partial(\varepsilon S_N \rho^N)}{\partial t} + \nabla \bullet [\varepsilon S_N \rho^N v^N] = \rho^N Q^N + -E_n^w - E_n^G \quad (5\text{-}3)$$

And for gas phase:

$$\frac{\partial(\varepsilon S_G \rho^G)}{\partial t} + \nabla \bullet [\varepsilon S_G \rho^G v^G] = \rho^G Q^g + E_n^G + E_{n/w}^G \quad (5\text{-}4)$$

where, E_n^w, $E_{n/w}^G$, E_n^G and $E_{n/w}^s$ represent dissoulution mass transfer of the NAPL from NAPL phase to water phase, volatilization mass transfer of the NAPL from water to the gas phase; volatilization mass transfer of NAPL from NAPL phase to gas phase and adsorption mass transfer of the NAPL from the water phase to the soil phase, respectively.

And for saturation:

$$\mathbf{S_W + S_N + S_G = 1} \quad (5\text{-}5)$$

5.3 Boundary Condition

Three types of boundary conditions were defined for the simulator. First type boundary condition is Drichlet in which function value is determined at the node. In the second type boundary condition (Neuman) the values of derivatives of the solution are specified of the domain. Mixed boundary condition (third type) is the linear combination of Drichlet and Neuman conditions which is defined the node. In this survey, the type of boundary condition is Drichlet which was applied to a node in x-y plane (x is vertical and y is horizontal axis).

In order to represent initial condition of the experiment, water drainage was simulated in NAPL simulator. The conditions in the experimental work and simulation work were not similar. In the experiment, sand pack was fully saturated with water. There is no flow from the two sides of the column. The column was open to the atmosphere from the bottom. Water was displaced with constant pressure air (2 atmosphere) which is imposed from the top of the sand pack. In the simulation, the water in the column was drained under the influence of the gravity.

Column. Figure (5-1) shows the one dimensional grid structure which was considered in the simulator.

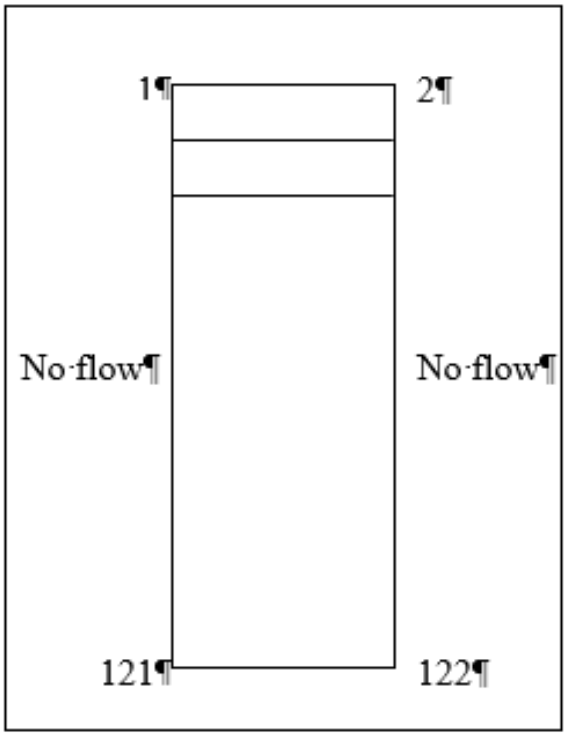

Figure 5-1:1-D grid construction.

5.4 Simulation Parameters

The water saturation profile at different depth is obtained with NAPL simulator. In the second step, NAPL spill was simulated in the sand pack.

Table (5-1) shows the parameters that was utilized to simulate migration of LNAPL in the column.

Table 5-1: Parameters utilized in Simulation

Parameter	Value
Element number	32
Nodes number	122
Mesh size (dx)	0.53
Simulation time (s)	Initial time:3600 (s) Time step:3600 (s) Final time:86400 (s)
Intrinsic permeability(k/cm^2)	$7.75E^{-9}$
Porosity	0.4
Sand bulk density	2.32
NAPL density($g.cm^{-3}$)	0.843
Air density (g/cm^3)	0.00129
Water density(g/cm^3)	1.0
Contaminant rate (cm^3/sec)	0.141

After simulating water drainage in the column, next step is to simulate contaminant in the porous media. Spillage of contaminant is defined for the simulator specified with a constant rate which is not the case in the experimental model. So, simulation of contaminant movement in the porous media could not done in this study.

CHAPTER 6

RESULTS AND DISCUSSION

6.1 Experimental Results

As it was described in chapter four, the amount of water, sand and contaminant of all samples were calculated. As the gas chromatogram gives information about the amount of each component of contaminant, the concentration of each component was obtained by dividing milligram of each component to the total amount of contaminant in sample. It is important to note that, GC identified only alkanes which exist in diesel oil. Aromatics also present in diesel oil which were not identified by GC. Based on the results obtained from gas chromatography, it was obvious that the alkane components of diesel oil could be divided into three classes. The first class involves components containing hydrocarbons between C_{10} to C_{16}. This class of hydrocarbon components has moderate level of concentration in diesel oil. The second class, having the highest concentration in diesel oil, is related to the components containing hydrocarbons C_{17} and C_{18}. Finally, the third class involves components containing hydrocarbons between C_{19} to C_{32}, which has the lowest amount in diesel oil.

From all the hydrocarbons existing in all three classes, to have a more efficient discussion, 8 hydrocarbons were taken into consideration. These hydrocarbons are C_{10}, C_{11}, C_{12}, C_{17}, C_{18}, C_{26}, C_{27} and C_{28}. Concentration of each hydrocarbon was calculated in each sample by dividing the amount of hydrocarbon (which was obtained from gas chromatograph) by total amount of contaminant in sample (which was calculated after separation stages by vaporization process in oven). Besides, 0.1, 0.5, and 1 mL of diesel oil were analyzed separately in gas chromatograph and the average concentration of all eight components were calculated to have more reliable comparing results.

When it comes to gasoline analysis experiment, samples were analyzed with Detailed Hydrocarbon Analysis (DHA) GC. Among gasoline components, toluene and benzene are more dangerous pollutants which have double bonds in their chemical structures and categorized as aromatic hydrocarbons. Their percolation behavior are also analyzed in this study.

6.1.1 Contaminant Depth

The goal of first experiment was to investigate the behavior of contaminant (which was diesel oil). Figure (6-1) shows the concentration of selected components of samples which were collected at 60^{th}, 120^{th} and 240^{th} minutes from three different ports. The ports were located at 7, 17 and 27 cm from the top of sand pack. Concentration of components at 60^{th} minutes is shown by grey series while green and blue series show concentration of 120^{th} and 240^{th} minutes of experiment. Moreover, the red series shows concentration of components in diesel oil which were analyzed in gas chromatography separately. Considering Figure (6-1), there is an obvious increment in concentration of all components with time in all three ports.

In all series, C_{26}, C_{27} and C_{28} have the lowest and C_{17} and C_{18} have highest concentrations.

In the first port which is the nearest port to the top of sand pack, concentration of all components are high in comparison to the second and third ports which are located in the middle and bottom of the column, respectively. At all the time steps, concentration of all the hydrocarbons is significant in the first port, unlike the second and the third ones. In the second port, concentration of all components were increased with time, but the level of this increment is less compared to the first port.

Components concentration are negligible in the third port at the same time steps with regards to the first and second ports. It can be concluded that diesel could not reach to the third port in the first day of experiment. In order to see the concentration changes, secondary Y-axis with lower scale were considered in the second and third ports. The related x and y axis is shown for each series with the series color.

Moreover, percentage of the water, contaminant and hexane content of each sample (which were obtained after putting in oven) is shown in the text box on the right corner of each figure. They have been shown with the same color of the series which are collected at the specific time. They were obtained by calculating the amount of water,

contaminant and hexane to the total amount of liquid (water, contaminant and hexane) in the sample.

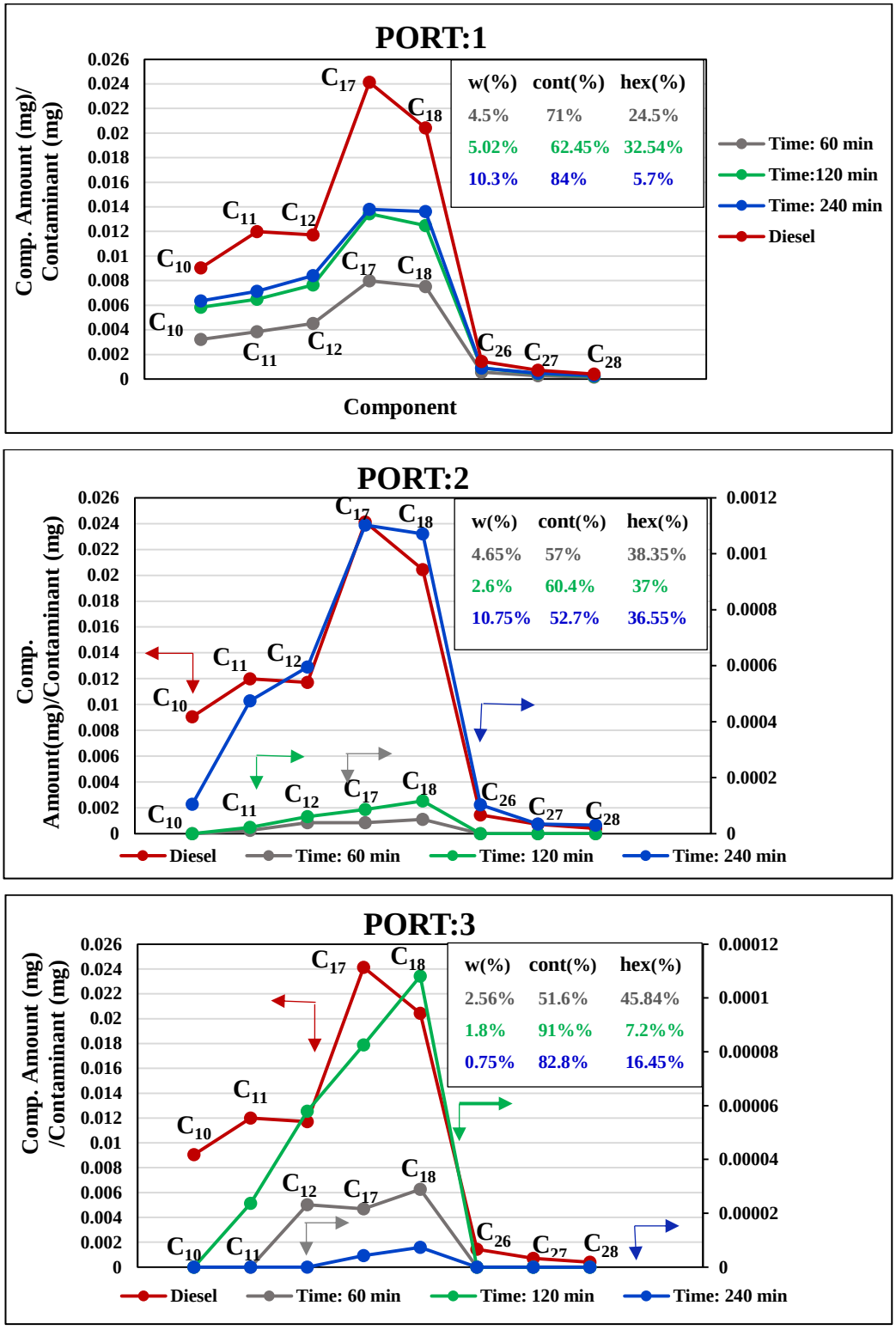

Figure 6-1: Diesel concentration in three ports (first day results of first experiment).

On the other hand, amount of each component in each sample to the original amount of each component in pure diesel oil was calculated for each time step. With this calculation, proportion of each component to its original amount at different depth and time intervals could be obtained. These calculations and results are mentioned in Appendix E. It can be concluded that in the first port, concentration of all components between the first and second hour of the experiment increased 95% in average. In the second and third ports, it is 47% and 41% respectively. With time, this increment decreases in the first port and increases in the second and third ports.

Figure (6-2) shows concentration of components in three ports after 24 hours (1440 minutes). In comparison to the results of the first day, concentration of all the components was increased with time in the first port which is shown by pink series in Figure (6-2). The concentration of selected hydrocarbons in the second port (green series) are higher in comparison to the first day of experiment. Moreover, concentration increment in the second port is more perceptible compared to the first port because of mass movement of the contaminant with time. The concentration of the components in the third port (indicated with the navy blue series), was increased in the second day. Still, concentration of components was not considerable compared to the increment observed in the first day and is shown with secondary y-axis.

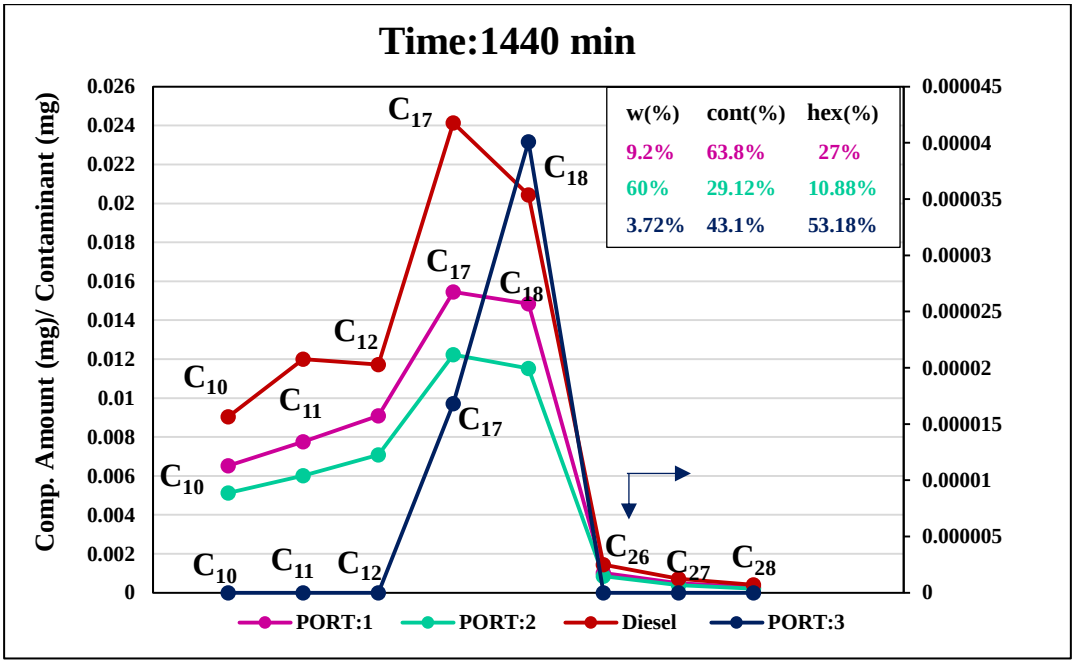

Figure 6-2: Diesel concentration in three ports (second day results of first experiment).

6.1.2 Decane as the Contaminant

Second experiment was done with decane as contaminant to understand the impact of contaminant types on movement in porous media. First of all, it is noteworthy that the downward movement rate of decane (which is the lightest hydrocarbon present in diesel oil) was higher than diesel oil, as a mixture hydrocarbon. The same amount of contaminants (54.3 cm^3) was placed at the top of sand pack in both experiments. Time needed to infiltrate all the decane in the sand pack was 45 minutes, where it was 400 minutes for diesel oil which could be observed in Figure (6-3). The downward movement rate of decane was 9 times more than diesel oil.

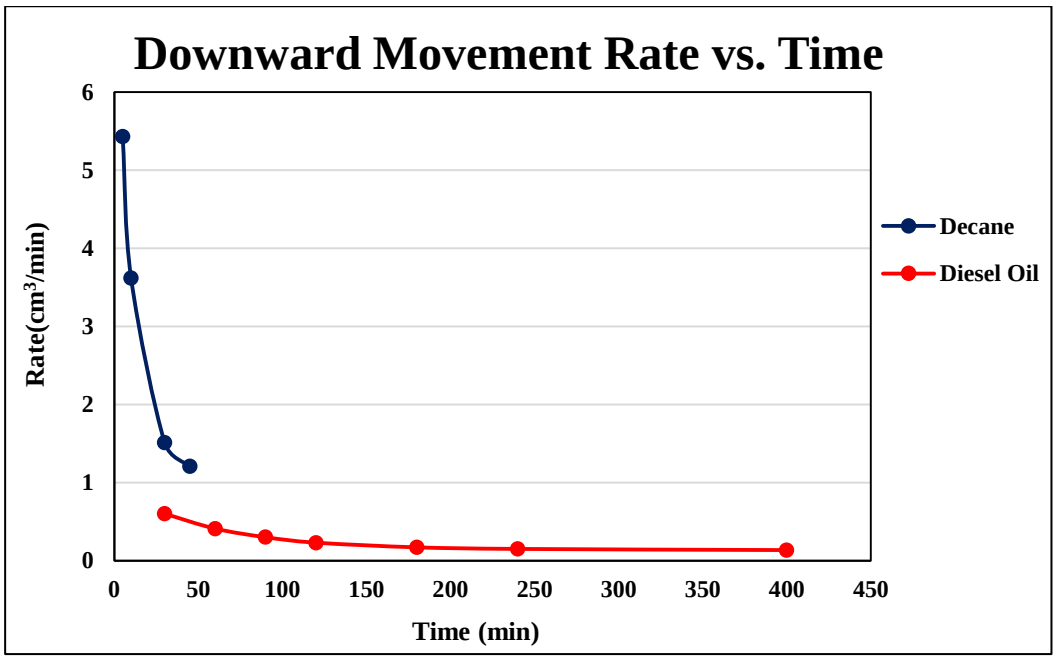

Figure 6-3: Downward movement rate of decane and diesel oil vs. time.

The downward movement rate of contaminants in all experiments are given in Appendix B.

Figure (6-4) shows the changes of the C_{10} concentration in diesel oil and decane in the first port. It is obvious that C_{10} concentration in the experiment which was done with decane (which is a lighter hydrocarbon) at the same time interval is higher in comparison to the experiment which was done with diesel oil.

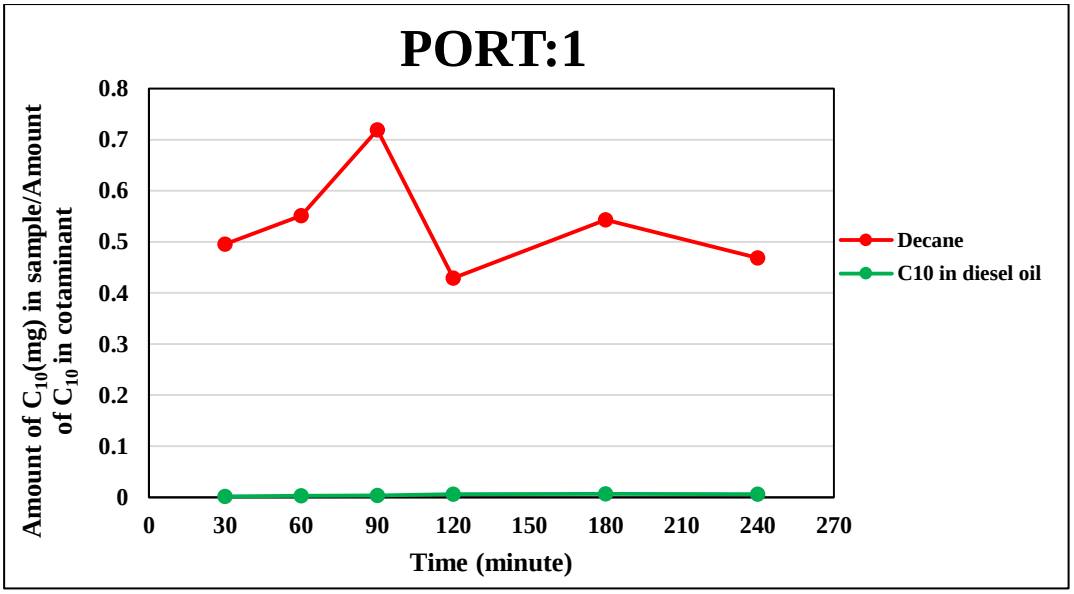

Figure 6-4: Concentration changes of C_{10} vs. time in diesel and decane in the first port.

Figure (6-5(a)) shows concentration of C_{10} in diesel oil versus distance. There are four different series in the figure. Grey, green and blue series indicate concentration of C_{10} at 60^{th}, 120^{th} and 240^{th} minutes, respectively for all the ports. Moreover, concentration of C_{10} in pure diesel was shown by red series. It can be concluded that the concentration of C_{10} in the first port is higher than both second and third ports. On the other hand, it is noticeable that the concentration of C_{10} at 240^{th} minute is higher than the 120^{th} and they both are higher than 60^{th} minute. Therefore, C_{10} concentration was increased with time in all the ports.

Figure (6-5(b)) shows concentration of decane (C_{10}) versus distance. It was expected that the concentration of decane in the first port to be higher than the second and accordingly the third port. But the results show that maximum concentration is found to be in the second port.

The concentration of decane in the first port is lower than the second port which is not expected. Actually, it is expected that concentration will increase with time in all three ports like diesel oil in the first experiment. The continuous increase of the contaminant concentration with time is reasonable in the third port. Though, in the first and second ports, concentration increased between 60^{th} and 120^{th} minute and then decreased at 240^{th} minute, unexpectedly. Based on these results, low level of concentration in the first port can be explained by fingering phenomenon. Viscous fingering is a condition

by which the interface of oil and water bypasses the section of porous medium creating fingered profile. It means that the contaminant does not have a piston like movement because of instability between displacing and displaced phases. It creates channels in porous medium and allows the displacing phase bypass the displaced phase.

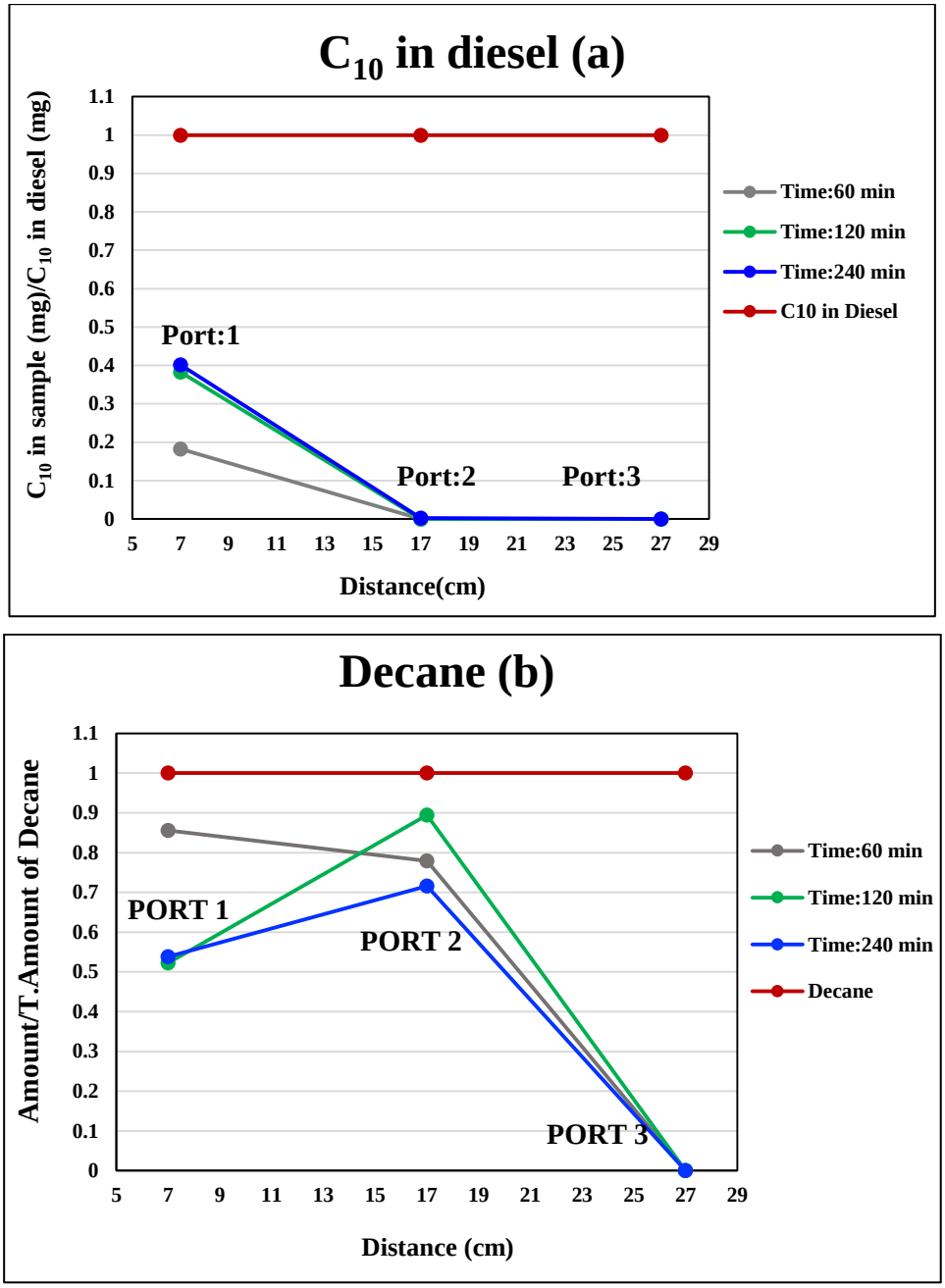

Figure 6-5: Concentration of C_{10} in diesel (a) and decane (b) vs. time.

6.1.3 Weathering Effects

As it was explained before, rainfall was simulated in the first experiment in order to investigate weathering effects on the movement of contaminant. Therefore, concentration of selected components at specified time steps in three different ports were calculated in the first and fourth experiments. Rainfall simulation, which was done in the first experiment, is the only difference between the two experiments.

Rainfall effects on components concentration are shown separately in the first, second and third ports in Figures [(6-6), (6-7) and (6-8)], respectively.

6.1.3.1 First Port Results With and Without Rainfall Simulation

Figure (6-6(a)) shows concentration of components in the first port of fourth experiment which was done without rainfall simulation at 1500^{th} (navy blue series), 1560^{th} (blue series), 1620^{th} (green series) and 1680^{th} (pink series) minutes. The concentration was increased between 1500 and 1560 minutes, then it started to decrease till 1620^{th} minute which is turn to being increased again till 1680^{th} minute. These are the consequence of diesel fingering in the first port. Components concentration results after rainfall simulation is shown in Figure (6-6(b)) which is related to the first experiment. The concentration of all components was increased between 1500^{th} and 1560^{th} minutes in the first port. Then, they all were decreased with time between 1560^{th}, 1620^{th} and 1680^{th} minutes. This is also because of fingering phenomenon in the first port. By comparing the results of two experiments, it can be concluded that after placing water on the top of sand pack to simulate rain in the first experiment, water as a driving force, pushes down the contaminant. Therefore, the concentration of diesel components have decreased after rainfall simulation.

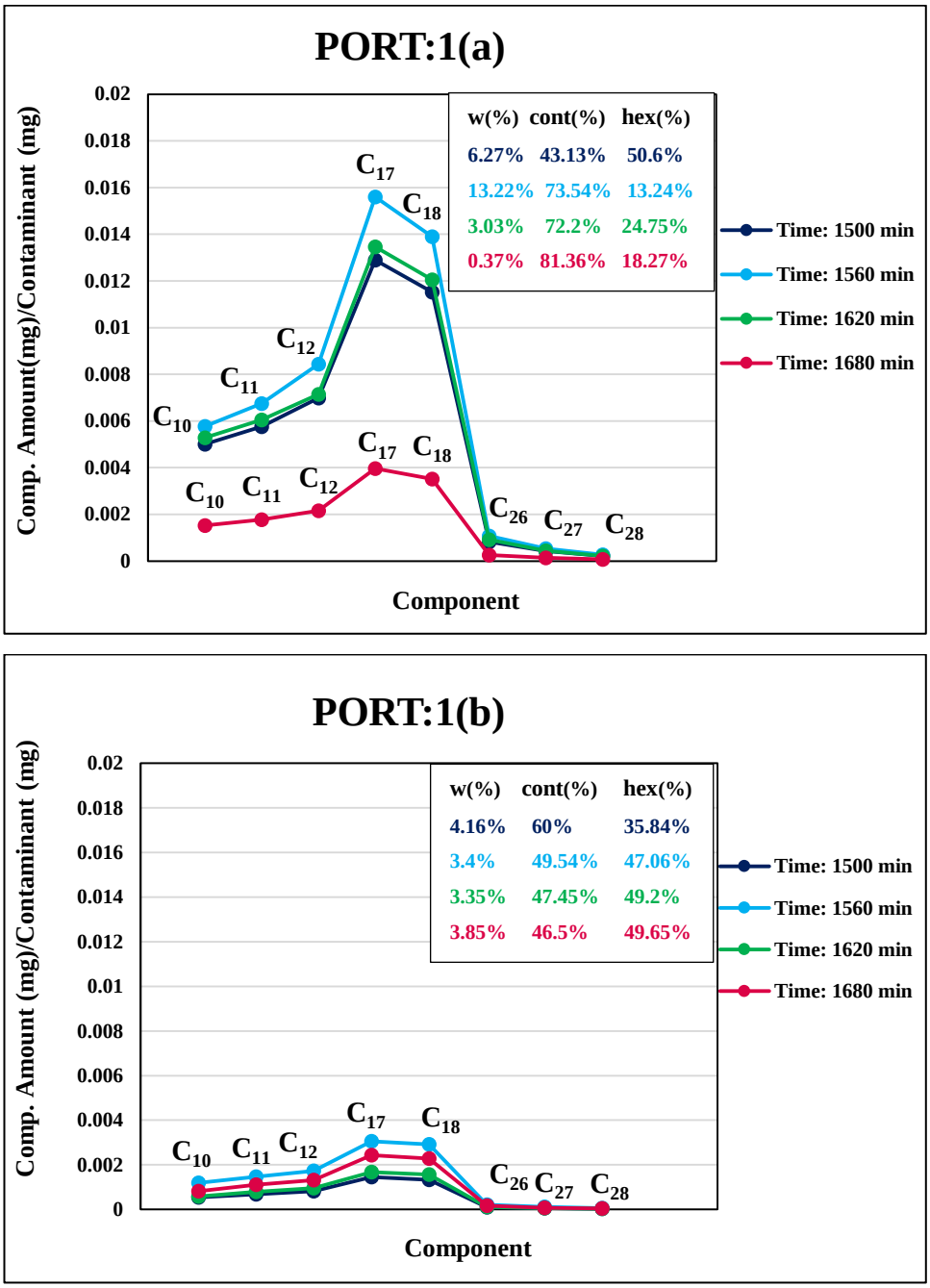

Figure 6-6: Diesel concentration in the first port without (a) and with rainfall simulation (b).

6.1.3.2 Second Port With and Without Rainfall Simulation

Impact of rainfall simulation on the concentration of components in the second port is shown in Figure (6-7(a)) and Figure (6-7(b)). In Figure (a), concentration of components are shown at different times which are related to the results of fourth experiment. There was no rainfall simulation in this experiment. Fluctuation of concentrations are obvious at 1500^{th} minute. Behavior of concentrations at different times GC results illustrated that concentration of components have not increased with time continuously. They have decreased and increased again with time in the second port like as the first port which is explainable by fingering phenomenon. Figure (6-7(b)) is related to the second port results of the first experiment at the same time steps and after placing water on the top of sand pack to simulate rainfall. As the same as the first port, concentration of components does not follow continuous increasing behavior which indicates the occurrence of the fingering phenomenon again in the second port during the experiment. Moreover, concentration of C_{12} shows a sudden drop at 1680^{th} minute and the only reason behind this is fingering. By comparing two figures, it is obvious that concentration of all the components are significantly increased after rainfall simulation. This increment is more sensible and obvious in the concentration of lighter hydrocarbons in comparison to heavier ones. Water, pushes down the components as a driving force. Therefore, it has increased in the second port.

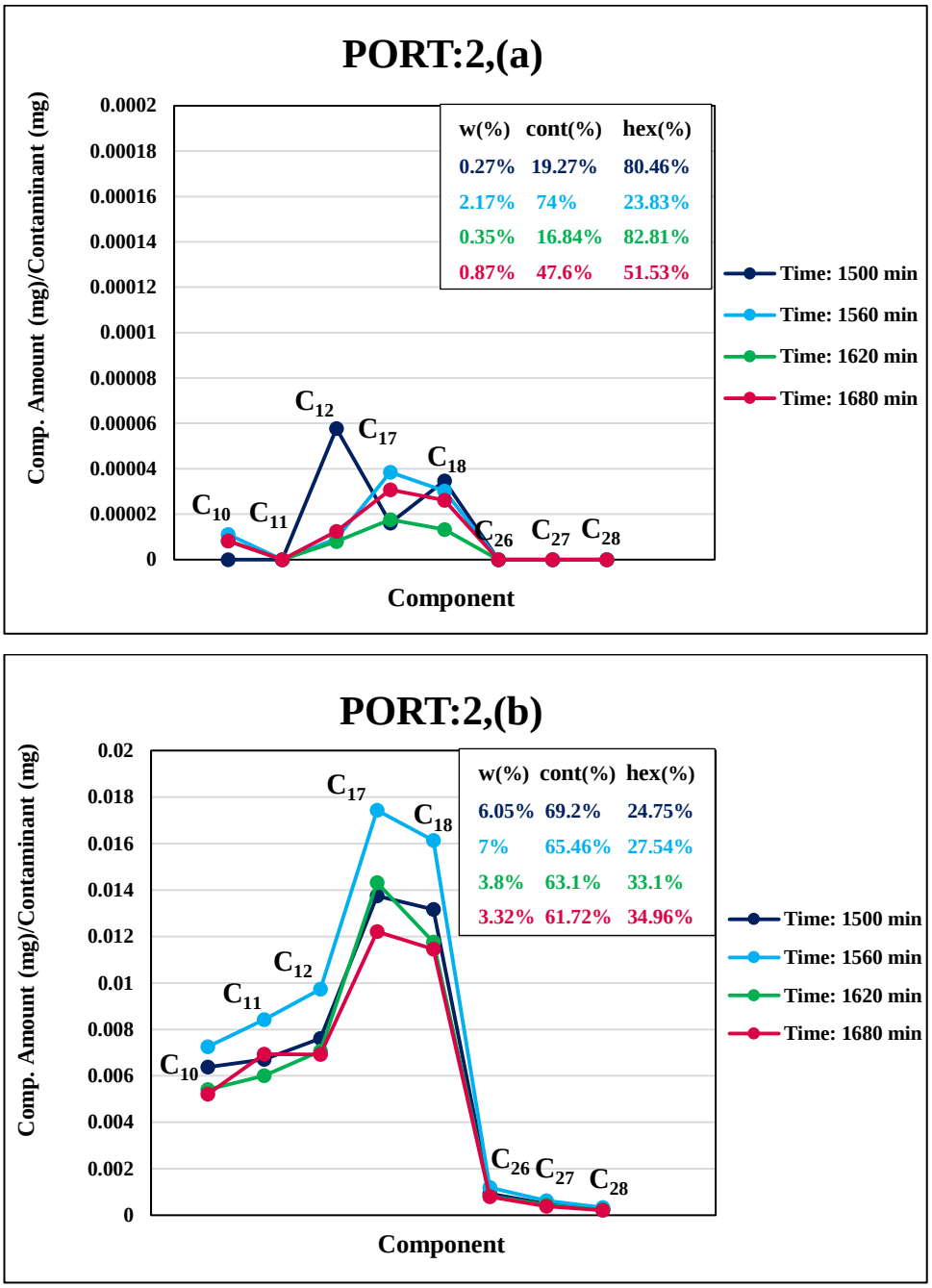

Figure 6-7: Diesel concentration in the second port without (a) and with rainfall simulation (b).

6.1.3.3 Third Port With and Without Rainfall Simulation

Figure (6-8(a)) and (6-8(b)) show the concentration of components in the third port without (fourth experiment) and with rainfall simulation (first experiment), respectively. In figure (6-8(a)), behavior of the components concentration are not the same as pure diesel. For example, C_{11} concentration shows sudden drop at all time periods. Also, C_{17} concentration at 1500^{th} minute is lower than C_{18}, unlike pure diesel. It can be concluded that viscous fingering has happened. In general, concentration of components decreased with time as a result of fingering phenomenon.

In Figure (6-8(b)), concentration of components is increased between 1500 and 1560 minutes, concentration of C_{10}, C_{11}, and C_{12}, is decreased between 1560 and 1620 minutes. Then, they all are increased until 1680^{th} minute.

In general, variation of the concentration of the lighter hydrocarbons like C_{12}, C_{17} and C_{18} are more perceptible and sensible in comparison to the heavier ones like C_{26}, C_{27} and C_{28}. It means that, the heavier the component, the less the displacement magnitude. It can be explained by viscous fingering in the other words fingering occurs in selective components.

By comparing two figures, it is obvious that concentration of all components (especially lighter hydrocarbons) increased significantly after rainfall simulation. In some cases, rainfall increases the concentration of components even 1000 times more than their concentration without rainfall simulation. This increment is more significant and obvious in the second and third ports. It shows that rainfall plays an important role in the movement of contaminant in porous medium.

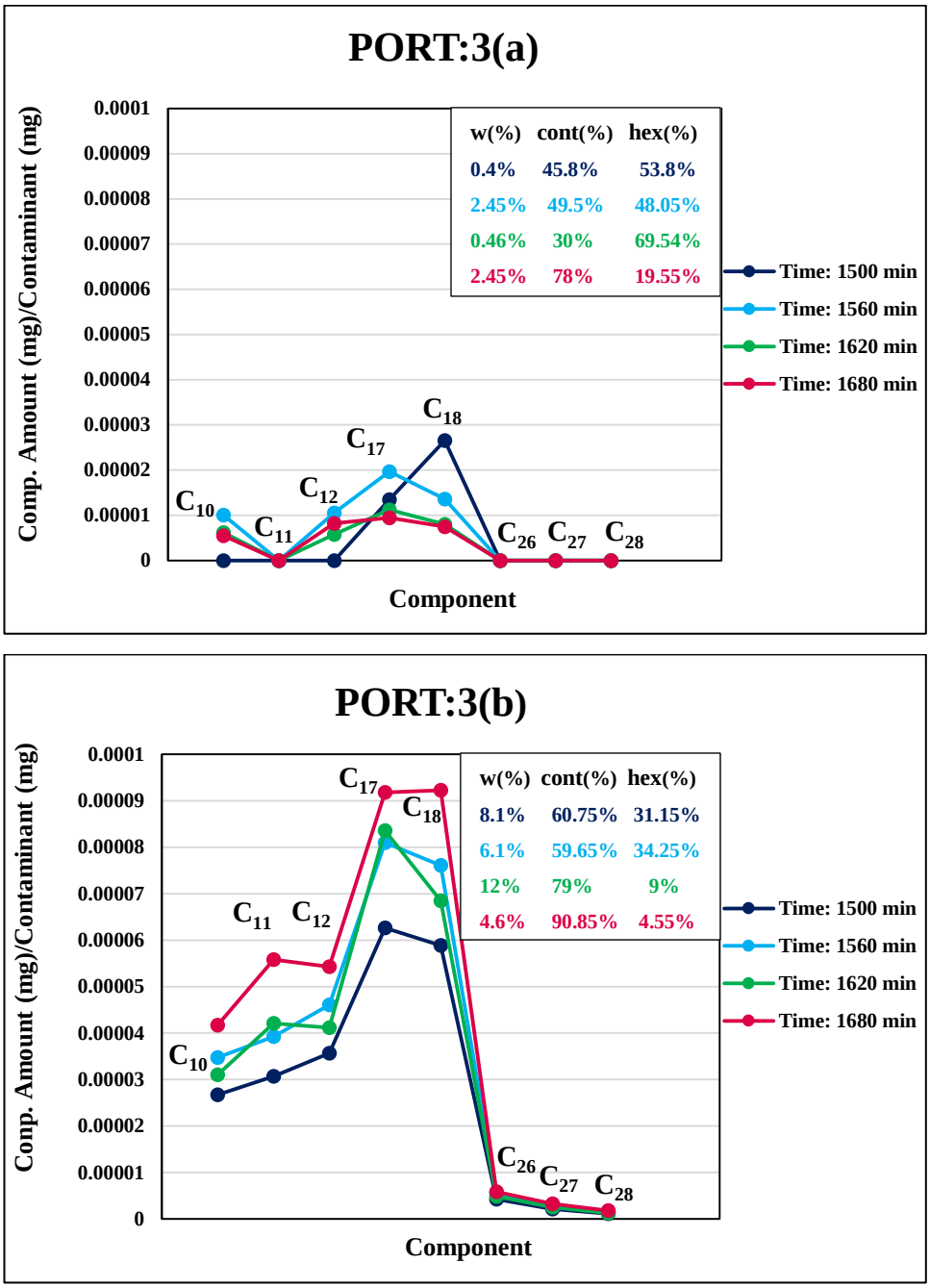

Figure 6-8: Diesel concentration in the third port without (a) and with (b) rainfall simulation.

6.1.4 Wet and Dry System

Behavior of diesel oil percolation in dry and wet porous medium were analyzed in the third and fourth experiments which lasted for 5 days. In dry system, sand pack was not saturated with water before putting contaminant. It means that there is no water in the sand pack. In the wet system, there is water in the sand pack as residual water saturation.

Figure (6-9) shows the downward movement rate of the contaminant (diesel oil) in dry and wet systems. It is obvious that generally downward movement rate of contaminant in wet system is higher than dry system.

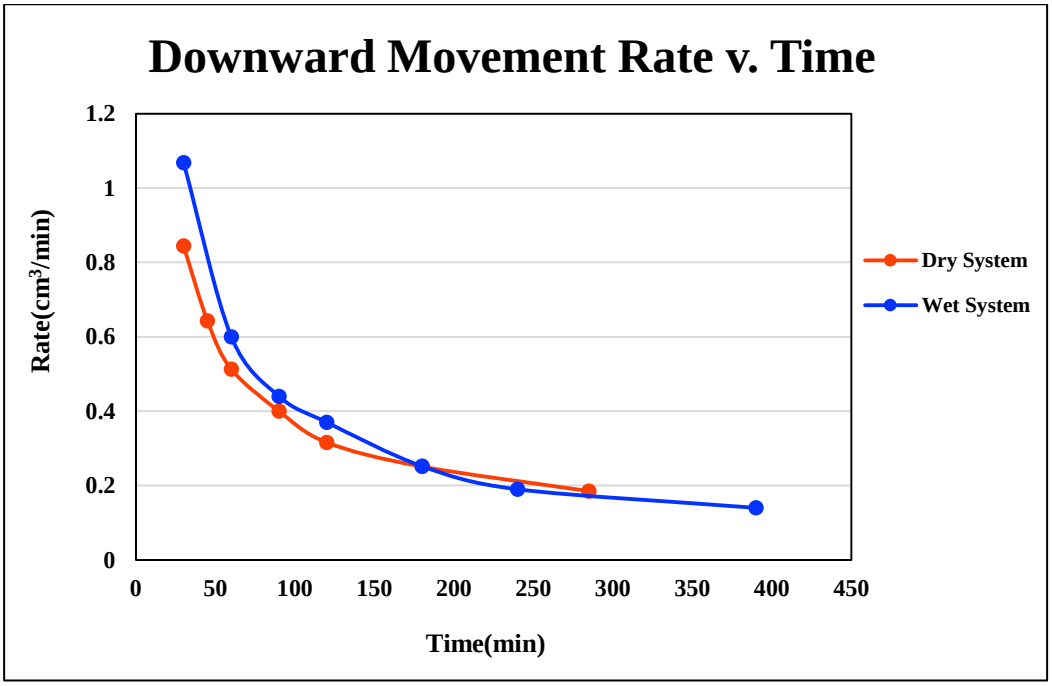

Figure 6-9: Downward movement rate of diesel oil in dry and wet systems vs. time.

Results of first and second ports analysis at different time steps are shown in Figures (6-10), (6-11) and (6-12). Concentration of the components in dry system are shown with orange series while blue series indicate concentration of components in wet systems. Front velocity of the contaminant as (cm/minute) is calculated in each system and is written at the top of each series. It was calculated by dividing downward movement rate to the area times porosity (AØ).

6.1.4.1 First Port, First Day of Experiments

Figure (6-10) shows concentration of diesel oil in the first port at different time steps in first day of third and fourth experiments.

In Figure (6-10(a)), which shows concentration of components at 60th minute of the experiments, front velocity of diesel oil in the wet system (0.082 cm/min) is higher than the dry system (0.0707 cm/min). This is because, in the porous media, contaminant has to fill up available pores prior to any migration. When there is water in the system, it occupies some of the pore spaces, as the sand is water wet, adsorption of contaminant has decreased. Therefore, downward movement rate is increased and consequently, front velocity of contaminant would be higher in the wet system. On the other hand, by comparing two series, it is obvious that concentration of components in the wet system is higher than the dry system. It is expected that concentration of the components in the dry system to be higher in comparison to the wet system, because wettability of water is higher than diesel oil. Therefore, when there is no water in the sand pack, downward movement rate of contaminant will be reduced due to the higher adsorption rate of contaminant in porous media. By comparing two series, concentration of all the components are close to each other in both dry and wet systems except for C_{17} which is very high in wet system in comparison to the dry system. Also, the concentration of C_{26} is higher in the wet system in comparison to the dry system. It can be concluded that at the 60th minute of experiment adsorption of contaminant was low.

Figure (6-10(b)) shows concentration of the selected components at 120th minute of experiment in both dry and wet systems. Front velocity in the wet system (0.05 cc/min) is higher than the dry system (0.0436 cm/min). Concentration of all the components is increased in dry system in comparison to the 60th minute (figure (6-10(a))) but they all are decreased in the wet system which shows that contaminant moves down with time in the first port. Concentration of the components at 240th minute in wet and dry system is shown in Figure (6-10(c)). Front velocity of contaminant in the wet system (0.027 cm/min)) is higher than the dry system (0.026 cm/min) but their difference is getting lower with the time. Concentration of all the components are increased in the dry system although it is more sensible for lighter hydrocarbons like C_{12}, C_{17} and C_{18} than C_{26} and C_{28} which are heavier. On the other hand, concentration of the

components continuously decreased over the time in the wet system because of fluid downward movement.

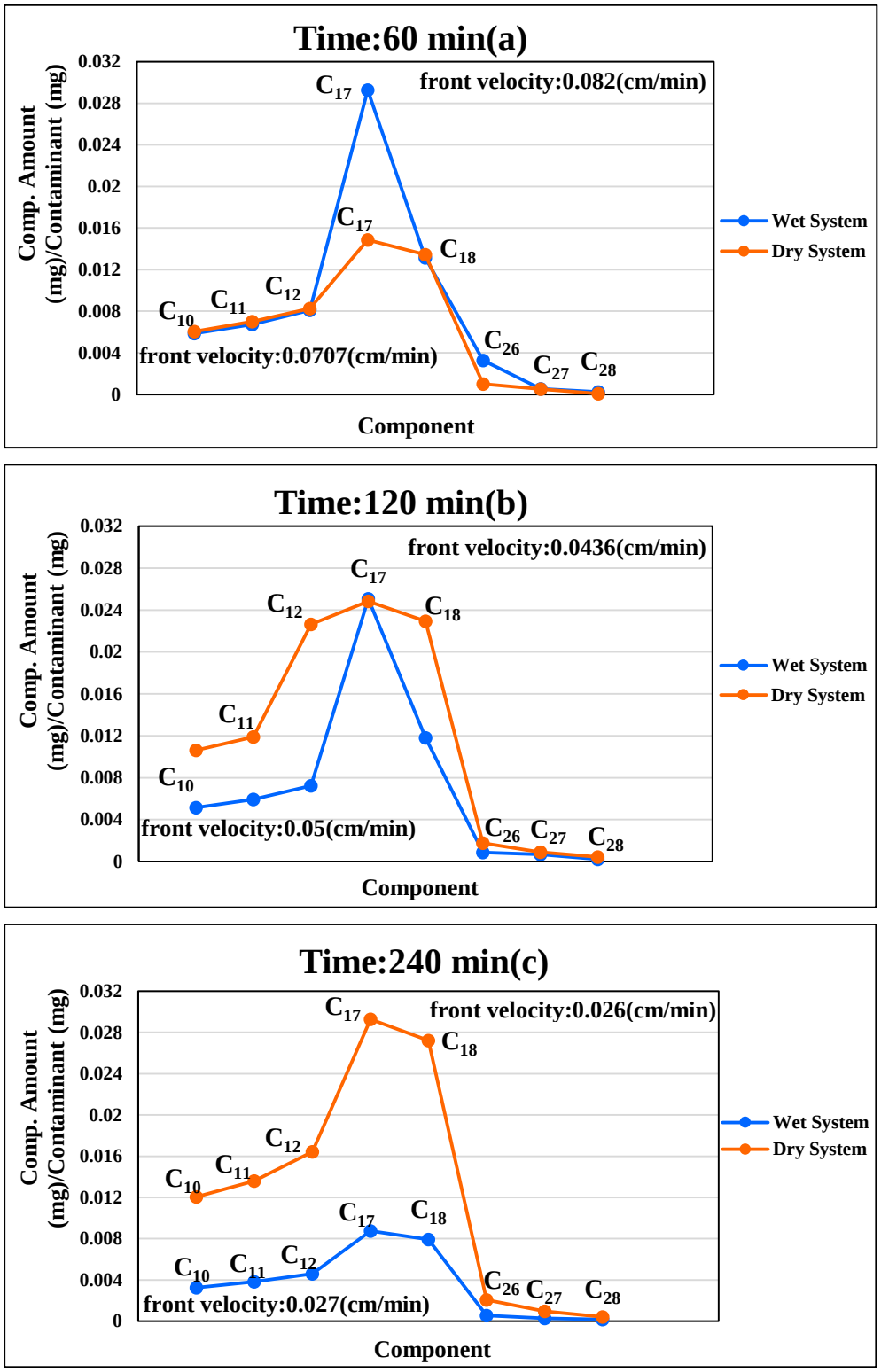

Figure 6-10: Concentration of diesel oil in dry and wet sand pack in first port at different times.

Moreover, another calculation of components concentration were done in dry and wet systems. With this calculation, ratio of each component in the collected sample to the original amount of component in pure diesel oil could be obtained. For each component this ratio was calculated as percentage for dry and wet systems. Table (6-1) shows these values for 60^{th}, 120^{th} and 240^{th} minute of the dry and wet systems. Moreover, proportion of the mass percentage of components in dry system to the wet system was calculated. It is obvious that the concentration of each component in the dry system is higher than dry system except 60^{th} minute. This is because, in dry system, contaminant continues to occupy available pores yet. Occupation the pores is prior to downward movement. Concentration of components in dry system gets higher with time in all three ports.

Concentration of all components at different time intervals were calculated for dry and wet system separately. The results are all mentioned in Appendix E.

Table 6-1: Concentration of components in dry and wet system.

Time: 60 min			
Component	**Wet System (%)**	**Dry System (%)**	**Dry/Wet**
C_{10}	29.7	14.26	0.48
C_{11}	26.35	12.73	0.48
C_{12}	33.66	16	0.47
C_{17}	56.93	13.43	0.23
C_{18}	29.78	14.13	0.47
C_{26}	106.37	15.03	0.14
C_{27}	33.54	14.6	0.43
C_{28}	27.16	3.54	0.13
Time: 120 min			
Component	**Wet System (%)**	**Dry System (%)**	**Dry/Wet**
C_{10}	25.07	27.37	1.09
C_{11}	22.28	23.64	1.06
C_{12}	29	47.87	1.65
C_{17}	46.9	24.55	0.52
C_{18}	25.71	26.37	1.02
C_{26}	27.39	28.96	1.05
C_{27}	40.57	27.42	0.67
C_{28}	22.21	24.05	1.08
Time: 240 min			
Component	**Wet System (%)**	**Dry System (%)**	**Dry/Wet**
C_{10}	16.97	21.42	1.26
C_{11}	15.37	18.60	1.21
C_{12}	19.71	23.93	1.21
C_{17}	17.50	19.91	1.13
C_{18}	18.41	21.54	1.17
C_{26}	18.94	23.43	1.23
C_{27}	18.16	20.97	1.15
C_{28}	18.95	16.77	0.88

6.1.4.2 Second Port, Third Day of Experiments

Figure (6-11) shows concentration of diesel oil in the second port at different time steps in the third day of the third and fourth experiments. Since the total amount of component is infiltrated into the sand pack in the second day of the experiments, front velocity of contaminant from the third day, is a fixed value for both dry and wet systems after third day of the experiment.

Figure (6-11(a)) shows concentration of contaminants at 2880^{th} minute of experiment for wet and dry systems. Front velocity of contaminant in both systems is 0.0026 (cm/min). As this time step, components concentration in dry sand pack are 3 to 5 times higher than the wet system.

Concentration of the components in dry and wet systems at 3000^{th} minute of experiments is shown in Figure (6-11(b)). Front velocity in both experiments is 0.0025 (cm/min). Concentration of the components in dry system is 3.5 to 11 times higher than the dry system. By comparing concentrations between 2880^{th} and 3000^{th} minutes, it can be concluded that concentrations in the dry system are increased with time while they are decreased in the wet system. This is because the downward movement rate in the wet system is higher and the adsorption rate is lower in comparison to dry system.

Concentration of the selected components at 3120^{th} minute in the dry and the wet systems is shown in Figure (6-11(c)). Front velocity in both experiments is 0.0024 (cm/min). Concentrations in the dry system are 5 to 10 times higher than the concentrations in wet system. By comparing two figures (6-11(b)) and (6-11(c)), concentration of all components in dry system decreased between 3000^{th} and 3120^{th} minutes of the experiment while in the wet system it increased at the same time intervals which is related to the fingering phenomenon in the dry system.

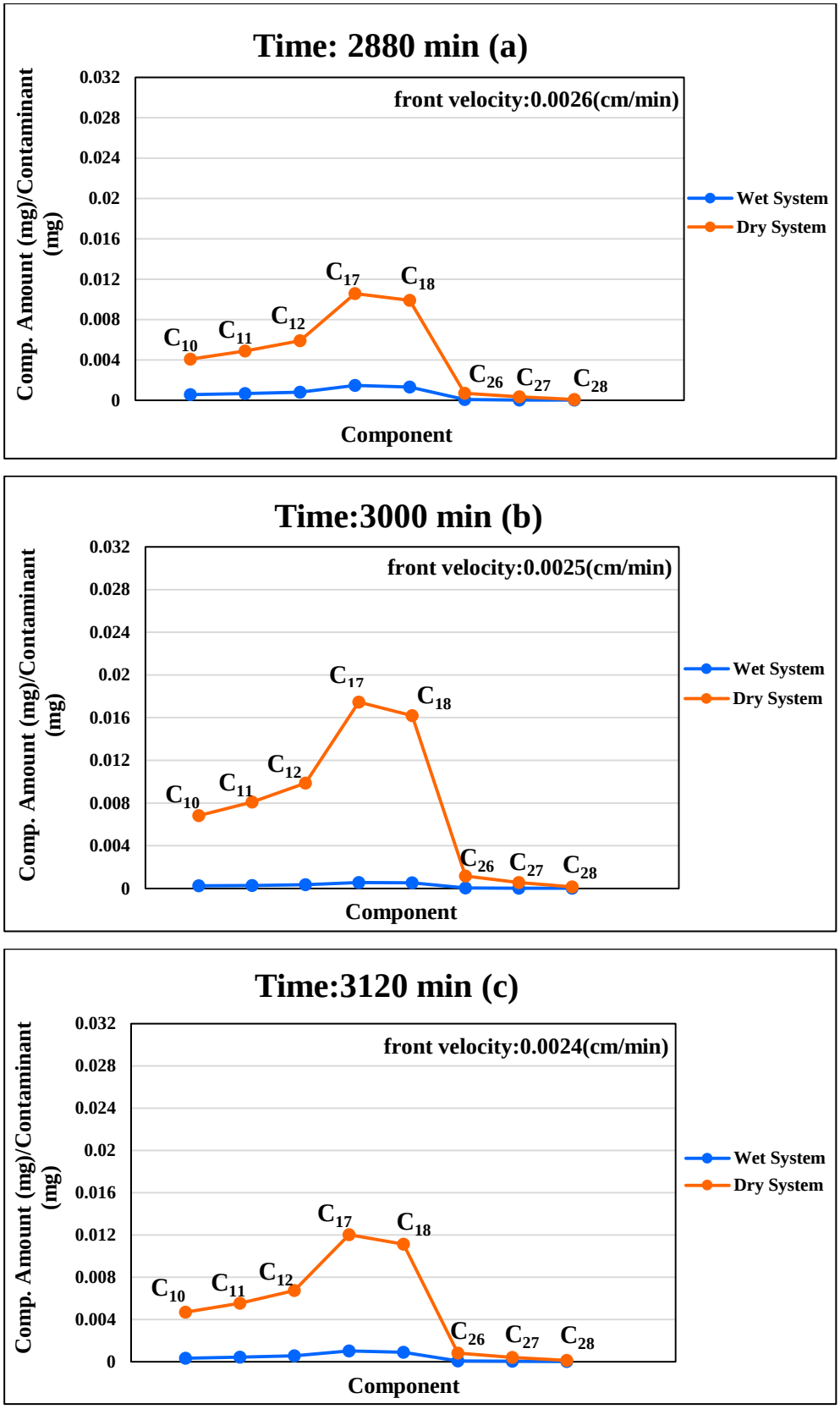

Figure 6-11: Concentration of diesel oil in dry and wet sand pack in second port at different times.

6.1.4.3 Second Port, Fourth Day of Experiments

Figure (6-12) is related to the concentration of diesel oil in the second port at different time steps in fourth day of the third and fourth experiments.

Concentration of contaminants at 4320^{th} minute of experiment for wet and dry systems are shown in Figure (6-12(a)). Front velocity of contaminant in both systems is 0.0017 (cm/min). Components concentration in the dry system are 3 to 4 times higher in comparison to the wet system.

Concentration of components in both dry and wet systems at 4440^{th} minute of experiments are shown in Figure (6-12(b)). Front velocity in both experiments is 0.00165 (cm/min). Concentration of components is 1.5 to 2.5 times higher in the dry system. Comparing concentrations between 4320^{th} and 4440^{th} minutes, it is obvious that concentrations in the dry system are increased with time while they are decreased in the wet system. This is because downward movement rate in wet system is higher and adsorption is lower in comparison to dry system.

Components concentration at 4560^{th} minute in both dry and wet systems are shown in Figure (6-12(c)). 0.00164 (cm/min) is the front velocity in both experiments. Dry system concentrations are 0.5 to 1.5 times higher in comparison to the wet system. But, comparing two (6-12(b)) and (6-12(c)) figures, concentration of all components decreased in the dry sand pack while in the wet system they increased at the same time intervals which is related to the fingering in the dry system.

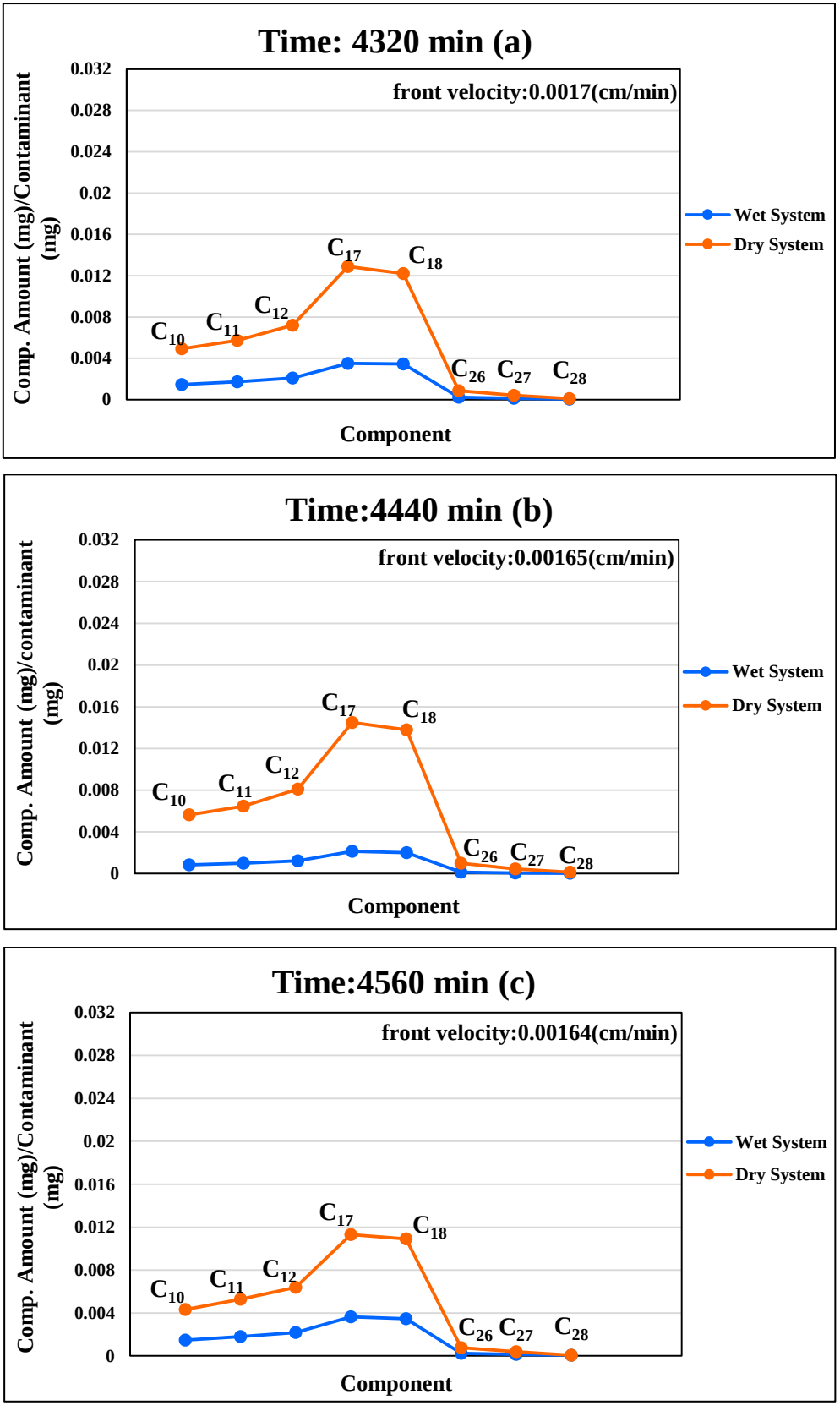

Figure 6-12: Dry and wet systems in second port.

6.1.5 Gasoline as the Contaminant

As it was discussed before, fifth experiment was done with gasoline as the contaminant. Gasoline components are tabulated in Appendix D. The same amount of gasoline as the contaminant (54.3 cm^3) was placed at the top of sand pack. All the gasoline moved into the sand pack in 40 minutes, while this time for diesel oil was 400 minutes for diesel oil Figure (6-13) shows the percolation rate of gasoline and diesel oil versus time. Downward movement rate of gasoline was 10 times more than diesel oil.

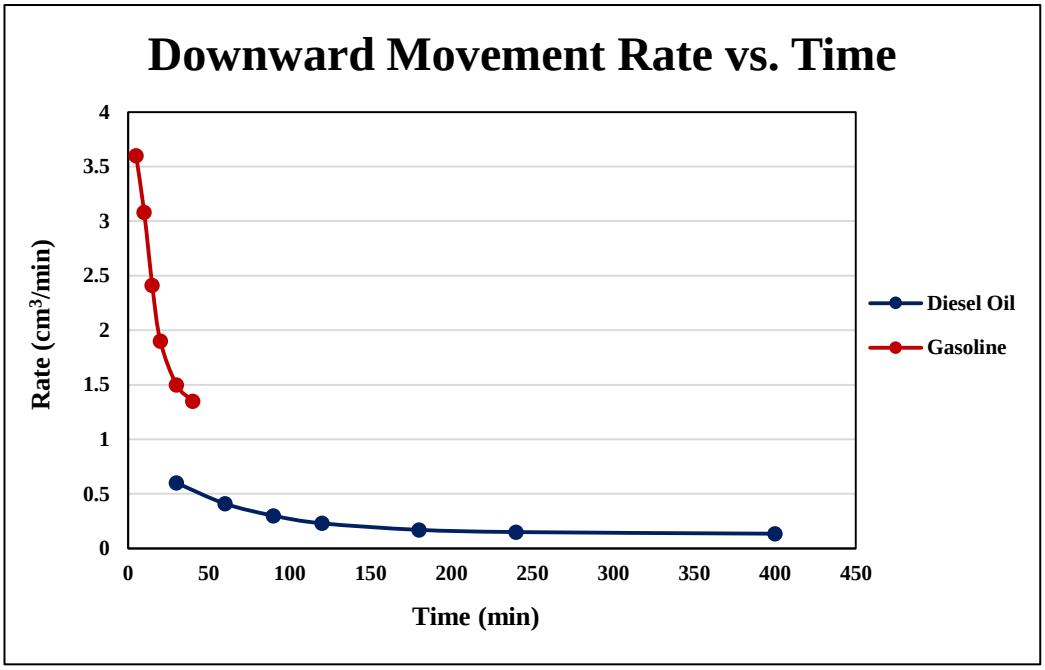

Figure 6-13: Downward movement rate of diesel oil and gasoline vs. time.

In order to investigate the impact of evaporation in this experiment, evaporation rate of gasoline was analyzed which is described in chapter four. GC gives mass percent of each component in gasoline. Samples are collected from the beaker that was open to atmosphere at 60^{th}, 120^{th} and 240^{th} minutes. Results are shown in Appendix F. Based on the gas chromatography results, there is a decrease in the mass percent of i-pentane only. When i-pentane evaporated, it does not appear in the GC results. So, mass percent of other components increased. During this study, where hexane is used as solvent in all the collected samples, contaminant movement is studied. The lighter components do not appear in the GC results. Therefore, dimethylbenzene and toluene

are used for understanding the gasoline movement in the pack. The first three data points show higher concentration than the original gasoline. The reason attributed to the mass percent calculation of the components. (Figure (6-14) and Figure (6-16)).

In all analysis of collected samples, benzene did not appear in the GC results. On the other hand, dimethylbenzene, which consists of benzene and two methyl groups is one of the components that exists in gasoline as 1,3-dimethylbenzane, 1,4-dimethylbenzane and 1,2-dimethylbenzene. These three components are isomeric forms of dimethylbenzene. Therefore, in order to have better analysis, mass percent of three isomers in each sample were added and considered as dimethylbenzene. Mass percent of two pollutants versus time is calculated and shown in this survey.

6.1.5.1 Toluene

Concentration of toluene in three ports in the first day (a) and second day (b) of experiment is shown in figure (6-14). Navy blue, green and purple series show concentration of toluene in the first, second and third port, respectively.

Figure (6-14(a)) shows concentration of toluene at 30^{th}, 60^{th}, 90^{th}, 120^{th}, 180^{th} and 240^{th} minute of the experiment. In the first port, toluene concentration is decreased with time which shows that it moves downward rapidly. Consequently, the concentration is decreased. In comparison to the second port, concentration in the first port is higher until 120^{th} minute, later it decreases. In the second port (green series), toluene concentration is significantly low until 60^{th} minute which indicates that it has not reach there yet. After 60 minutes, concentration is increased in the second port till 120^{th} minute then it is decreased again until 180^{th} minute and increased again. These concentration fluctuations are the results of fingering phenomenon. Concentrations in the third port are negligible which are expected because there is no enough time for toluene to reach to the lower part of sand pack.

In the second day of experiment (Figure (6-14(b))), concentration of toluene decreased in comparison to the first day of the experiment. It can be concluded that in the first port, the concentration in the second day is more stable than the first day. Fingering is obvious again in the port in the second day. In the second port, average amount of concentrations in second day is higher than the first day. Like as the first port, concentrations in the second port does not obey increasing or decreasing pattern, it is decreased and then increased with time which is a result of fingering. In the third port,

there is a sensible increment of concentration in the second day in comparison to the first day. Fingering occurs in this port like as the first and second ports.

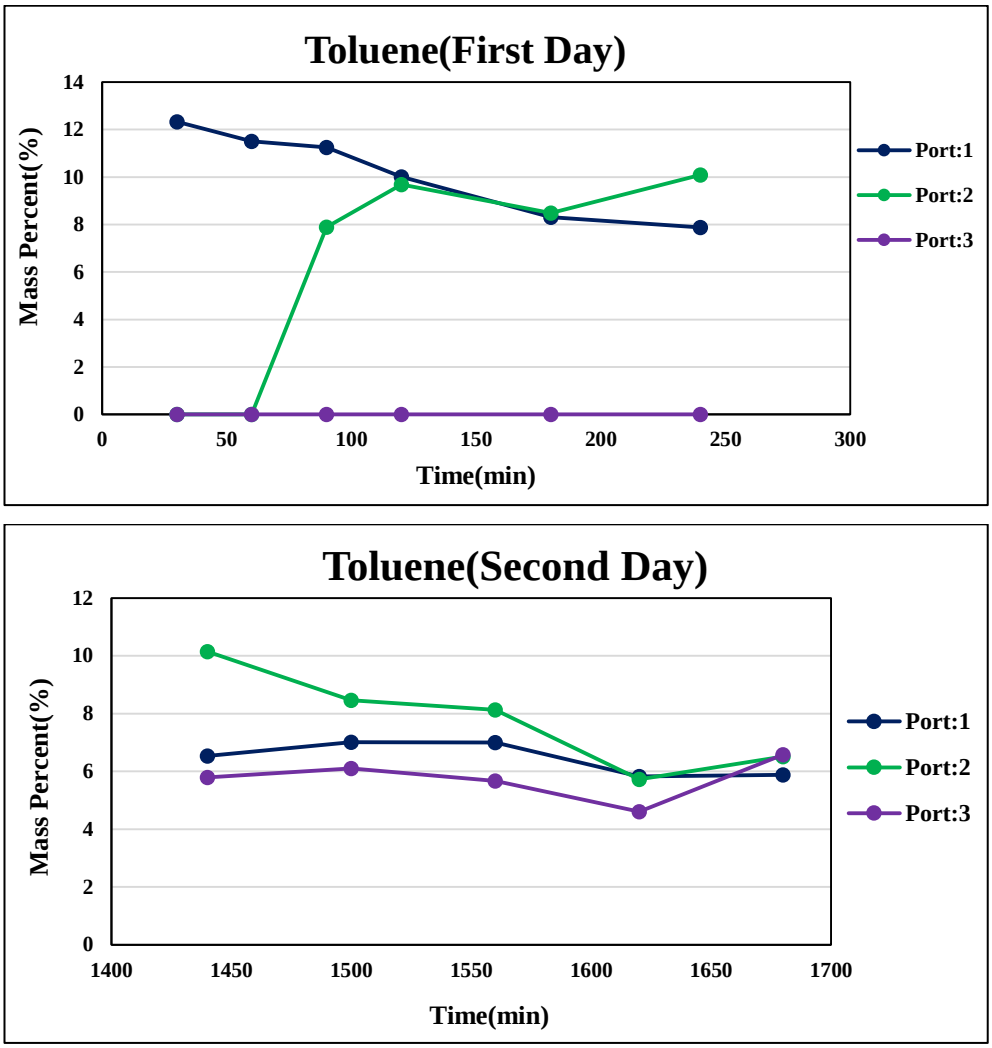

Figure 6-14: Concentration of toluene in Gasoline vs. time.

Figure (6-15) shows mass percent of toluene versus distance. As it is mentioned before, first, second and third ports were located at 7, 17 and 27 cm from the top of sand pack, respectively. Mass percent of toluene at different time intervals are shown in the figure with different series. At 60th minute, concentration of toluene in the second and the third ports are negligible. After 1 hour (120th minute), concentration of toluene in the second port increased but still it is lower than the first port concentration. In the third port, concentration is negligible which shows that toluene has not reached to the third port. Concentration of toluene decreased in the first port with time. In the

second port, it is increased from 60 to 240 minutes of experiment, then it is decreased till 1680th minute. Concentration in the third port, is negligible in the first four hours of experiment (until 240th minute). Then, it is increased with time, decreased and increased again which is believed to be due to fingering phenomenon.

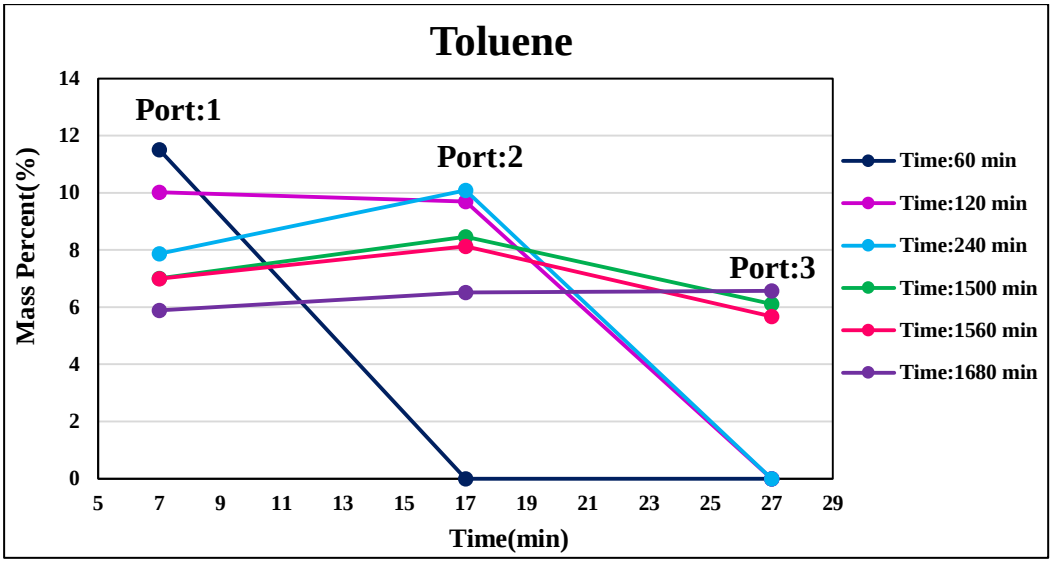

Figure 6-15: Toluene concentration in Gasoline vs. distance.

6.1.5.2 Dimethylbenzene

Figure (6-16) shows concentration of dimethylbenzene in three ports at different time steps. In figure (6-16(a)) which is related to dimethyl concentration in the first day of experiment. Concentration in the first port (navy blue series) is higher than dimethylbenzene concentration in pure gasoline until 120th minute which is due to the mass percent calculations. After that time, concentration decreased which shows movement of contaminant to the second and third port. In the second port (green series) concentration increased, decreased and again increased with time as the result of fingering. Concentration of dimethylbenzene in the third port is negligible in the first day of experiment. In the second day (Figure (6-16(b))), concentration in the first port decreased in comparison to the first day. In the second port, concentration in 1440th minute is higher than concentration of dimethylbenzene in pure gasoline which is believed to be due to a measurement error. Concentration decreased in comparison to the first day results in the second port and also fingering phenomenon is obvious in the second port. In comparison to the first day, concentration of third port in second

day of experiment is higher in which fingering is obvious like as first and the second ports.

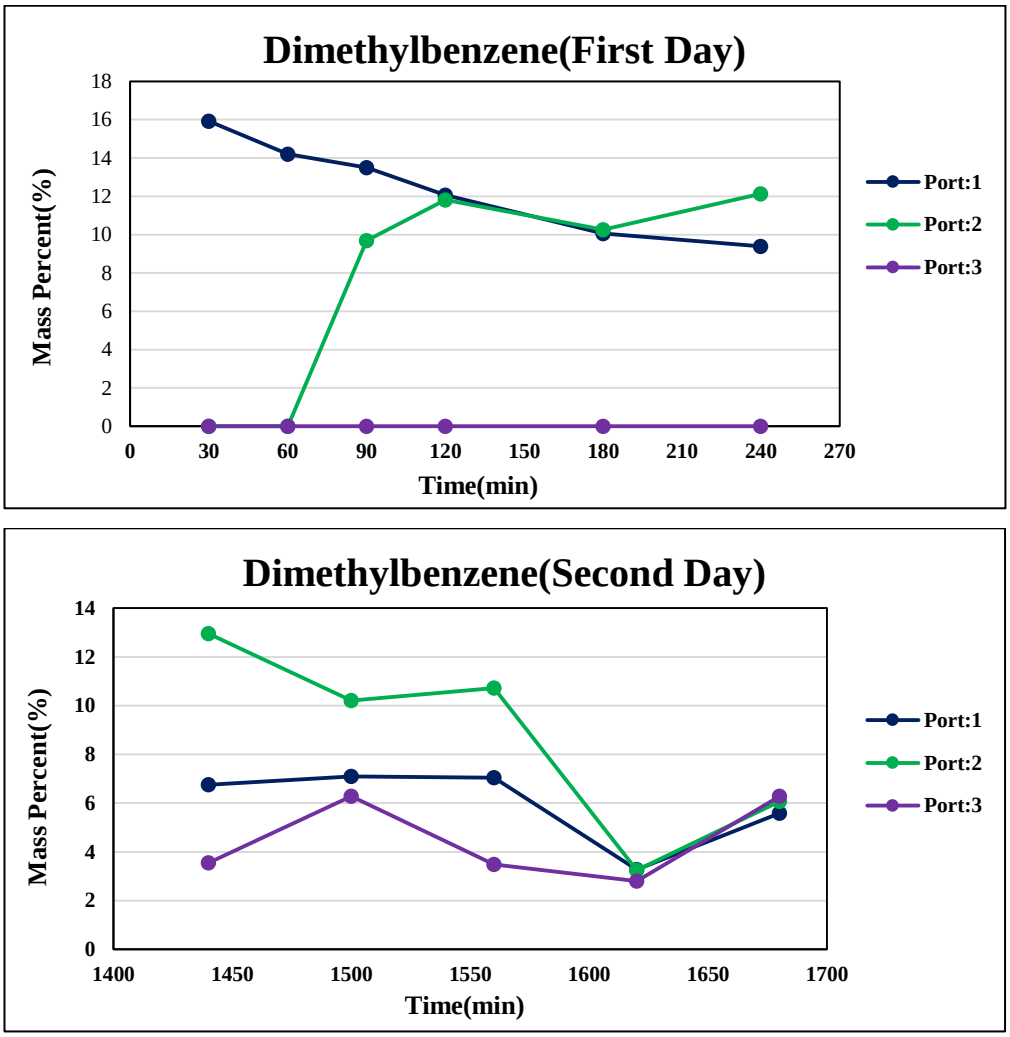

Figure 6-16: Dimethylbenzene concentration in Gasoline vs. time.

Mass percent of dimethylbenzene versus distance is shown in figure (6-17). Mass percent of dimethylbenzene at different time intervals are shown in the figure with different series. At 60th minute, concentration of dimethylbenzene in the second and third ports are negligible. After 1 hour (120th minute), concentration of dimethylbenzene in the second port increased but still it is lower than the first port concentration. In the third port, concentration is negligible which shows that dimethylbenzene has not reached to the third port. Concentration of dimethylbenzene decreased in the first port with time. In the second port, it increased from 60 to 240

minutes of experiment, then increased and decreased till 1680th minute. Concentration in the third port, is negligible in the first four hours of the experiment (until 240th minute). Then, it increased with time then decreased and increased again.

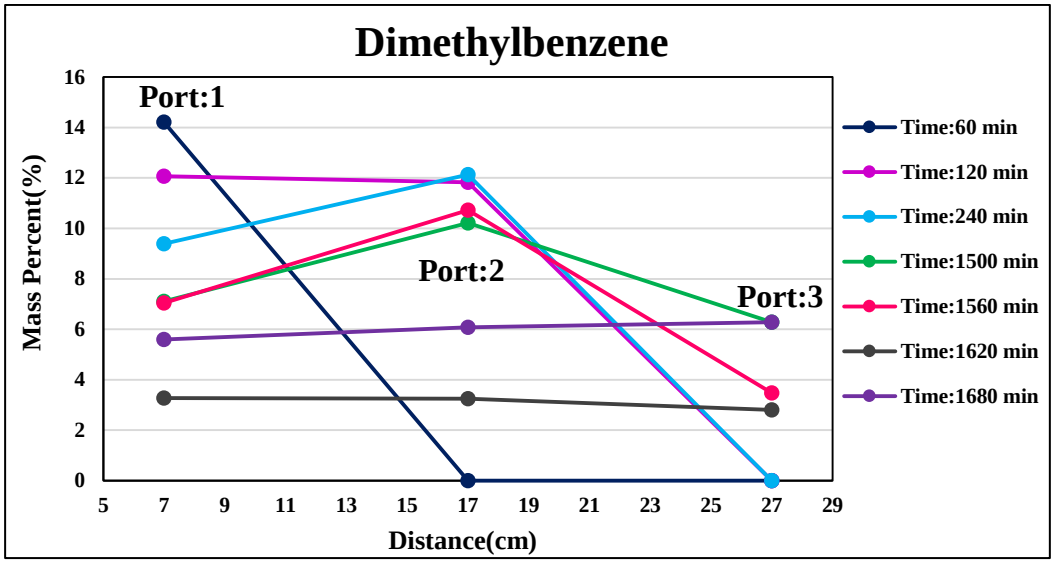

Figure 6-17: Dimethylbenzene concentration in Gasoline vs. distance.

6.2 Numerical Simulation Results

The first step was to simulate water drainage in the sand pack column. Figure (6-18) shows the saturation profile of water in different depth in the sand pack after 86400 seconds. Water saturation is between 0.22 to 1. The water saturation in the upper nodes (which are close to the top of the sand pack) is lower in comparison to the nodes which are at the bottom of the column. The average amount of water saturation which is obtained from the simulator is 51%. Average amount of water saturation which is obtained from experimental work is 53.3%. The water saturation in the higher depths are high in the simulation results to the experimental results. Although the average amount of water saturation obtained from simulator and experimental work are close to each other, there is no information about the water saturation profile at different depth in experimental work.

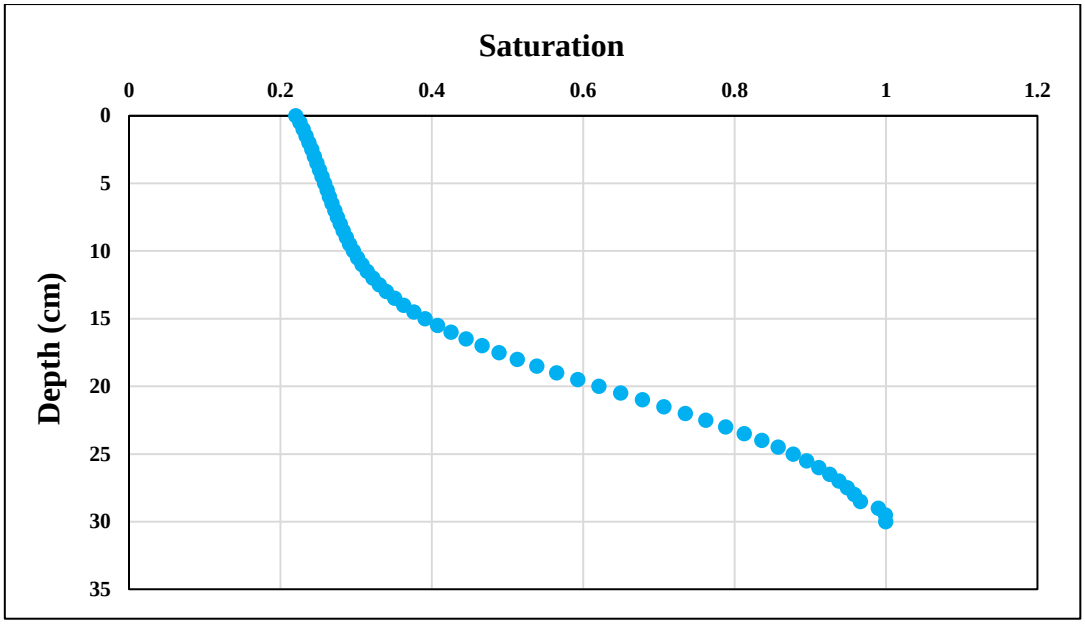

Figure 6-18:1-D water saturation profile vs. depth at the end of the first day.

As it mentioned before, three types of boundary conditions were identified for the simulator which are Drichlet, Neuman and mixed boundary conditions. In order to simulate downward movement of the contaminant and obtain the saturation profile of the contaminant, water and air there are limitations of the implementation of the boundary conditions. This is because the head of contaminant (which was placed at the top of the sand pack) is changed with time. On the other hand, the rate of contaminant downward movement also change with time, so a constant head or rate could not be defined for the simulator. Therefore, a mixed boundary condition should be defined for the simulator. As the main focus of this study was the experimental work, the numerical work could be consider as the future recommendation.

CHAPTER 7

CONCLUSIONS

In this survey, behavior of liquid hydrocarbons percolation through sand was investigated with an experimental model. Diesel oil, decane and gasoline were used as contaminant in five different experiments. Impacts of rainfall and sand moisture in the component movement were analyzed. After discussing the result, it was investigated that results could be considered as different aspects:

- **Infiltration Depth**
  - ✓ The more the Depth, The Less the Concentration. Concentration of the components in the first port (which is the nearest port to the top of the sand pack) was high in comparison to the second and the third ports (which are located at the middle and bottom of the plexiglass cylinder, respectively).

- **Time**
  - ✓ As the time passes, the concentration of the pollutant in all the ports increases.
  - ✓ In some cases, fluctuation of the components concentration occurs.These abnormalities could be attributed to the fingering phenomenon.

- **Type of Contaminant**
  - ✓ The lighter the contaminant, the faster the downward movement rate.
    - Infiltration rate of decane is 9 times more than diesel oil.
    - Infiltration rate of gasoline is 10 times more than diesel oil.

❖ **Rainfall Simulation**

- ✓ In the first port, components concentration was decreased with time which indicated that water carried pollutant downward with itself.
- ✓ Components concentration was increased after rainfall simulation in the second and third ports. In some cases, rainfall increases the concentration of components even 1000 times more than their concentration without rainfall simulation.

❖ **Soil Moisture (Wet and Dry Systems)**

- ✓ Downward movement rate in the wet system is high in comparison to the dry system which conforms the results obtained by Amro et al. (Mohammed Musa Amro et al., 2013).
- ✓ Contaminant front velocity is high in the wet system in comparison to the dry system. This is because, in the dry system, pore spaces just fill up with one phase (contaminant) while in wet system pores filled up with water and contaminant (two phases). So, in wet system, number of available pore spaces is low in comparison to the dry system in which adsorption is prior to infiltration.
- ✓ In all three ports, concentration of the contaminant components was high in the dry system in comparison to the wet system at different time steps. Comparing the results of concentration in three ports at different time steps indicates that fingering phenomenon was occurred in all three ports in both systems.
- ✓ It proves that adsorption rate in the dry system is higher than the wet system.

❖ **NAPL Simulator**

- ✓ The saturation profile of water was obtained which represents initial condition of this survey.
- ✓ The saturation profile of the contaminant, air and water after simulating contamination could not obtained because of the limitations of the implementation of the boundary conditions.

REFERENCES

Abriola, LM. PINDER, G. F. (1985). A Multophase Approach to the Mpdelling of Porous Media Contamination by Organic Compounds. *Water Resources Research*, *21*(1), 11–18. http://doi.org/10.1029/WR021i001p00011.

Amro, M. M., & Benzagouta, M. S. (2009). SPE 121768 Investigation on Crude Oil Migration in Surface and Subsurface Environment : Impact and Solution. In *Asia Pacific Health, Safety, Security and Environment Conference*. Jakarta, Indonesia: Society of petroleum engineers.

Amro, M. M., Benzagouta, M. S., & Karnanda, W. (2013). Investigation on crude oil penetration depth into soils. *Arabian Journal of Geosciences*, *6*(3), 873–880. http://doi.org/10.1007/s12517-011-0392-6.

Arya, A., Texas, U., Larson, R. G., Laboratories, T. B., Lake, L. W., & Texas, U. (1988). Dispersion and Reservoir Heterogeneity. *Society of Petroleum Engineers*, (February), 139–148.

Chen, Z., Huang, G. H., & Chakma, A. (2001). Simulation and Assessment of Subsurface Contamination Caused by Spill and Leakage of Petroleum Products — A Multiphase , Multicomponent Modelling Approach. In *Petroleum Conference of The South Saskatchewan Section* (Vol. 40). Regina: Petroleum Society of Canada.

Cherry, John(University of Waterloo, C. (1987). Groundwater Contamination By Petroleum Products. In *12th World Petroleum Congress*. Houston, Texas.

Colombo, J. C., Barreda, a., Bilos, C., Cappelletti, N., Migoya, M. C., & Skorupka,

C. (2005). Oil spill in the R??o de la Plata estuary, Argentina: 2-Hydrocarbon disappearance rates in sediments and soils. *Environmental Pollution*, *134*(2), 267–276. http://doi.org/10.1016/j.envpol.2004.07.028.

Edgett, Jane; Coon, D. (1986). *Petroleum on tap: the legacy of leaking underground storage tanks / prepared by Jane Edgett and David Coon*. Conservation Council of New Brunswick.

Fagerlund F, N. A. (2007). A partially coupled, fraction-by-fraction modelling approach to the subsurface migration of gasoline spills. *Journal of Contaminant Hydrology*, *89*(3-4), 174–198. http://doi.org/10.1016/j.jconhyd.2006.08.004.

Fingas, M. (2012). *The basics of oil spill cleanup* (Third Edi). CRC Press. http://doi.org/10.1016/S1353-2561(02)00045-2.

Ground Water Contamination by Crude Oil near Bemidji , Minnesota. (1997). *Ground Water*.

Guarnaccia, J., George, P., & Fishman, M. (1997). *NAPL Simulator Documentation*. Oklahama.

Halmemies, S., Gröndahl, S., Nenonen, K., & Tuhkanen, T. (2003). Estimation of the time periods and processes for penetration of selected spilled oils and fuels in different soils in the laboratory. *Spill Science and Technology Bulletin*, *8*(5-6), 451–465. http://doi.org/10.1016/S1353-2561(03)00002-1.

Kaluarachichi, J.J. and Parker, J. C. (1989). Modelling Multicomponent Organic Chemical Transport in Three-Fluid-Phase Porous Media. *Contaminant Hydrology*, *5*(1), 349–374.

Katyal, A.K., Kaluarachichi, J. J. (1991). *A Two-Dimentional Finite Element Program for Multiphase Flow and Multicomponent Transport*.

M.Mudge, S. (Ed.). (2008). *Methods in Environmental Forensics*. New York: CRC Press.

Milde, G., Milde, K., Friesel, P. and Kiper, M. (1983). *Basis and New Development of the Groundwater Quality Protection Concepts in Central Europe*.

Pollard S J T, Hough R L, Kim K H, Bellarby J, Paton G, Semple K T, C. F. (2008). Fugacity modelling to predict the distribution of organic contaminants in the soil:oil matrix of constructed biopiles. *Chemosphere*, *71*(8), 1432–1439. http://doi.org/10.1016/j.chemosphere.2007.12.007.

Reed, M., Brandvik, P. E. R. J., Daling, P. E. R., Lewis, A., Fiocco, R., Mackay, D. O. N., & Prentki, R. (1999). Oil Spill Modeling towards the Close of the 20th Century : Overview of the State of the Art. *Spill Science & Technology Bulletin*, *5*(1), 3–16.

Serrano, A., Gallego, M., & González, J. L. (2006). Assessment of natural attenuation of volatile aromatic hydrocarbons in agricultural soil contaminated with diesel fuel. *Environmental Pollution*, *144*, 203–209. http://doi.org/10.1016/j.envpol.2005.12.031.

Serrano, A., Tejada, M., Gallego, M., & Gonzalez, J. L. (2009). Evaluation of soil biological activity after a diesel fuel spill. *Science of The Total Environment*, *407*(13), 4056–4061. http://doi.org/10.1016/j.scitotenv.2009.03.017.

van Genuchtan M, T. (1980). A closed form equation for predicting the hydraulic conductivity of unsaturated soils. *Soil Science Society of America*, *44*(5), 892–898.

Yim, U. H., Ha, S. Y., An, J. G., Won, J. H., Han, G. M., Hong, S. H., … Shim, W. J. (2011). Fingerprint and weathering characteristics of stranded oils after the Hebei Spirit oil spill. *Journal of Hazardous Materials*, *197*, 60–9. http://doi.org/10.1016/j.jhazmat.2011.09.055.

ZHOU Jing--feng, LI Yan, XU Jun, M. K. (2014). Testing of NAPL simulator to predict migration of a light nonaqueous phase liquid (LNAPL) under water table fluctuation in a sandy medium. *Springer*, *21*, 317–325. http://doi.org/10.1007/s11771-014-1943-2.

Zoveidavianpoor, M., Oil, A., Company, G., Iranian, N., & Company, O. (2010). SPE 128373 A Huge Oil Spill Naturally Under Control in Abadan Refinery. In *Society of petroleum engineers*. Mumbai, India: Society of petroleum engineers. http://doi.org/10.2118/128373-MS.

APPENDIX A

POROSITY AND PERMEABILITY MEASUREMENTS

A.1 Porosity measurement

As the volume of cylinder was known (which is our bulk volume), we can calculate porosity of porous media:

$$\mathbf{V_w} = \frac{\mathbf{m_w}}{\boldsymbol{\rho_w}} \quad \text{(A-1)}$$

$$\mathbf{V_C} = \mathbf{A_C} \times \mathbf{L_C} \quad \text{(A-2)}$$

$$\emptyset = \frac{\mathbf{V_w}}{\mathbf{V_c}} \quad \text{(A-3)}$$

In the equations above, 'A' and 'L' are area and length of cylinder respectively. 'Ø', represents porosity of the porous media. Measured parameters are listed in the table below:

Table A-1: Core holder specifications

$m_{cylinder}$ (gr)	960
M_{sand} (gr)	514
m_{water} (gr)	150
V_{water} (cm^3)	150
V_c (cm^3)	331.17
Ø (%)	40.1

A.2 Permeability measurement

In the equation above, 'q', and 'μ' represent flow rate and viscosity of water. 'A' and 'L' are area and length of cylinder and 'ΔP' is difference between inlet and outlet pressure. Measured parameters are listed in Table (A-2):

$$\frac{q}{A} = \frac{k}{\mu} \times \frac{\Delta P}{L} \qquad \text{(A-4)}$$

Table A-2: Permeability measurement

time(sec)	q($\frac{cc}{sec}$)	ΔP(atm)	$\frac{q}{A}$	ΔP/(μ*L)
0	0	0	0	0
8.15	0.6135	2.04	0.0339	0.04165
8.6	0.5814	1.7	0.03213	0.03469
13.78	0.36284	1.36	0.02005	0.02776
24.4	0.20492	1.02	0.01132	0.02082
45.42	0.11008	0.68	0.00608	0.01388

So, by drawing $\frac{q}{A}$ vs.$\frac{\mu \Delta P}{L}$, permeability which is the slope of trend line, can easily be obtained.

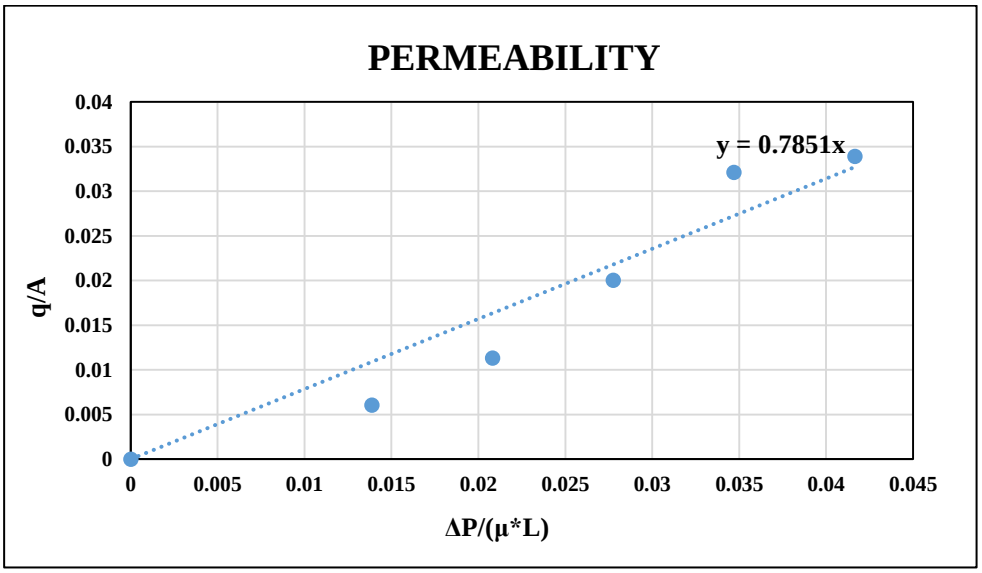

Figure A-1: Permeability measurement

APPENDIX B

DOWNWARD MOVEMENT RATE OF CONTAMINANTS IN EXPERIMENTS

For all experiments, infiltration rate of contaminants were noticed as the volume of contaminant that was percolated in sand pack at different time steps and calculated as cm^3 per minute.

B.1 First Experiment Downward Movement Rate

First experiment was lasted for 1680 minutes and diesel oil was used as contaminant.

Table B-1: Rate of diesel downward movement in sand pack

Time (min)	Amount of diesel infiltrated in sand pack (cm^3)	Rate (cm^3/min)
30	18.1	0.6
60	24.7	0.41
90	25.3	0.3
120	27.1	0.23
180	31.7	0.17
240	36.2	0.15
400	54.3	0.135

B.2 Second Experiment Downward Movement Rate

Duration of second experiment was 1680 minutes and decane was used as contaminant.

Table B-2: Rate of decane downward movement in sand pack

Time (min)	Amount of Decane infiltrated in sand pack (cm^3)	Rate (cm^3/min)
1	9.05	9.05
5	27.15	5.43
10	36.2	3.62
30	45.25	1.51
45	54.3	1.21

B.3 Third Experiment Downward Movement Rate

In the third experiment, diesel oil was used as contaminant and in was lasted for 6000 minutes. In this experiment, sand pack was not saturated with water and the system was dry.

Table B-3: Rate of diesel downward movement in sand pack (Dry System).

Time (min)	Amount of diesel infiltrated in sand pack (cm^3)	Rate (cm^3/min)
10	12.7	1.267
15	18.1	1.21
30	25.3	0.844
45	29	0.643
60	30.8	0.513
90	34.4	0.4
120	38	0.316
180	45 .25	0.251
285	54.3	0.185

B.4 Fourth Experiment Downward Movement Rate

Fourth experiment was lasted for 6000 minutes and diesel oil was used as contaminant.

Table B-4: Rate of diesel downward movement in sand pack

Time (min)	Amount of diesel infiltrated in sand pack (cm^3)	Rate (cm^3/min)
30	32.6	1.068
60	36.2	0.6
90	39.9	0.44
120	43.5	0.37
180	45.3	0.252
240	47.06	0.19
390	54.3	0.14

B.5 Fifth Experiment Downward Movement Rate

In the fifth experiment, gasoline was used as contaminant and it was lasted for 1680 minutes.

Table B-5: Rate of gasoline downward movement in sand pack

Time (min)	Amount of gasoline infiltrated in sand pack (cm^3)	Rate (cm^3/min)
5	18.1	3.6
10	30.8	3.08
15	36.2	2.41
20	38	1.9
30	45.25	1.5
40	54.3	1.35

APPENDIX C

CALCULATION OF AMOUNTS OF COMPONENTS IN SAMPLES

C.1 Diesel Oil Calculations

As it mentioned in chapter 4, gas chromatography gives information about the amount of each component as milligram per liter of solution. In order to have better analysis on the components, amount of each component as milligram was calculated by multiplying amount of each component as milligram per liter of solution by the total volume of the solution which is constant (3mL) for all samples. It should be noted that these are only the hydrocarbons which could be identified by gas chromatogram.

C.2 Gravimetric Calculations

As it was explained in chapter 4, amount of water, sand and contaminant were calculated after putting samples in oven in two steps. In the first step, samples were put in oven for 75 minutes at 50° C. The most volatile component is hexane with the boiling point of 68° C. The purpose of this step was to evaporate hexane of the samples. It is important to notice that, it was assumed that all the contaminant was solved in hexane. So, there is no contaminant in samples after gas chromatograph analysis. The temperature in oven adjusted at 50°C because it is important to keep the water of samples in them as well as possible in the first step. Then weight of each sample was measured again and the difference was milligram of hexane in each sample which was evaporated in this step. Next step was to evaporate water of samples. For this purpose, all samples were put in oven at 100° C for 60 minutes and weighted again at the end of step. The weight difference between the first and second step is related to the weight of water of samples. At last, the remaining amount of each sample at the end of second step was related to the sand weight of each sample. As the total weight of samples were known, amount of contaminant was easily calculated by

subtracting total amount of samples (after sample collecting) from the amount of water and sand.

For example for the sample that was collected from the first port at 60th minutes:

Total weight of sample after sample collection: 1.071 gr

Weight of sample after putting in oven at 50° C for 75 minutes: 0.975 gr

So the difference is the weight of hexane which is:

Weight of hexane: $1.071 - 0.975 = 0.096$ gr

Weight of sample after putting in oven at 100° C for 60 minutes: 0.963 gr

So the difference is the weight of water which is:

Weight of water in the sample: $0.963 - 0.975 = 0.012$ gr

So the weight of sample which is measured at the end of second step is related to the amount of sample sand, so:

Weight of sand: 0.895 gr

Weight of contaminant would be:

$$weight_{contaminant} = weight_{sample} - (weight_{water} + weight_{soil})$$

$$weight_{contaminant} = 1.071 - (0.012 + 0.895)$$

$$= 0.164 \text{ gr}$$

So, the total amount of contaminant in the sample that was collected from the first port at 90th minutes is 164 milligram.

So in different samples at different times, we can obtain the amount of each component as milligram to the total amount of diesel oil which is in the sample.

C.3 Gasoline Calculations

Gas chromatography analysis of gasoline samples gives information about the constitutive components of contaminant and also mass, mole and volume percent of them. As the results of diesel oil analyzed by concentration of each component as (milligram to the total amount of components in each sample), analysis of gasoline were discussed by mass percent of each component.

As it mentioned before, hexane was utilized as solvent in all experiment samples. As it is one of the constitutive components of gasoline mass percent of hexane in each sample was very high in comparison to the other components. So, in order to have more reliable sample analysis, mass percent of each component recalculated without

considering hexane as the constitutive component of samples by extracting mass percent of it. Here is the calculation method of one of the samples which was collected from the first port at 30^{th} minute:

Hexane mass percent: 95.03%

Mass percent of I15: 0.1352%

Mass percent of I20: 0.2435%

Toluene mass percent: 0.55%

Sum of the mass percent of other components was:

100-(Hexane mass percent+ Mass percent of I15+ Mass percent of I20) =

100-(95.03+0.1325+0.2435) = 4.4647 %

So, mass percent of other components can be recalculated on the basis of 4.4647%:

New mass percent of Toluene: (100*0.55/4.4647)= 12.32%

So, mass percent of toluene without considering hexane in the sample is 12.32%.

Mass percent of each component recalculated by this way and added as a new column with corrected mass percent name as a column for all samples results in Appendix D.

APPENDIX D

GAS CHROMATOGRAPHY RESULTS

D.1 Diesel Oil and Decane Results

Gas chromatogram and components of each contaminant in each sample are listed below.

It is important to note that all these results were obtained with gas chromatography in the Petroleum Research Center in the Middle East Technical University, Ankara, Turkey. Results of the first, second, third and the fourth experiments are shown below.

The first experiment was done with diesel oil as the contaminant. In total 33 samples were collected during 1680 minutes.

In the second experiment, decane was utilized as the contaminant. The experiment was lasted for 1680 minutes. 33 samples were collected during the experiment.

In the third experiment, diesel oil was used as the contaminant. It was lasted for 5 days. The experiment was conducted in the dry sand pack. 50 samples were collected during 5 days in this experiment.

In the fourth experiment, diesel oil was utilized as the contaminant. It was lasted for 5 days. There was irreducible water saturation in the sand pack in this experiment 50 samples were collected during the experiment.

The fifth experiment was done with gasoline and lasted for 1680 minutes, 33 samples were collected.

D.1.1 Experiment 1

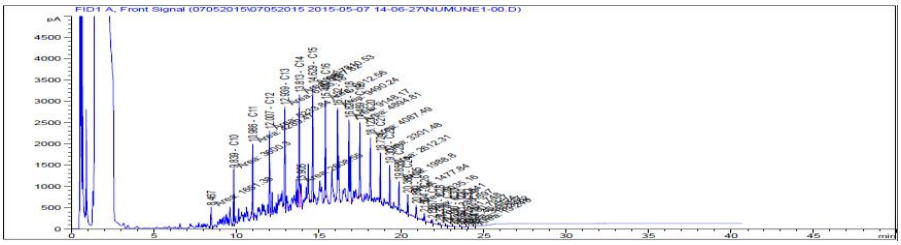

Figure D-1: Ex:1, Port:1, Time:30min, m:1.024 gr gas chromatogram.

Table D-1: Ex:1, Port:1, Time: 30min, **,** m:1.024 gr

Ret.Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.839	3600.29541	84.65083	0.25395249	C_{10}
10.986	4289.4668	111.92065	0.33576195	C_{11}
12.007	5233.83643	134.64175	0.40392525	C_{12}
12.939	6755.12793	175.63225	0.52689675	C_{13}
13.813	8587.82031	217.89202	0.65367606	C_{14}
14.629	7810.52588	197.77759	0.59333277	C_{15}
15.4	6612.56396	166.18127	0.49854381	C_{16}
16.132	9490.23535	238.32143	0.71496429	C_{17}
16.827	9148.16602	227.19346	0.68158038	C_{18}
17.489	4894.80566	122.02081	0.36606243	C_{19}
18.123	4087.49072	101.79227	0.30537681	C_{20}
18.724	3301.47803	83.72834	0.25118502	C_{21}
19.302	2612.3064	65.87187	0.19761561	C_{22}
19.856	1988.7959	50.19734	0.15059202	C_{23}
20.388	1477.83716	37.78833	0.11336499	C_{24}
20.899	1035.15649	26.05741	0.07817223	C_{25}
21.394	615.54114	16.62465	0.04987395	C_{26}
21.867	286.39743	7.56789	0.02270367	C_{27}
22.33	151.74782	4.23432	0.01270296	C_{28}
22.774	80.79269	2.30503	0.00691509	C_{29}
23.2	45.4124	0	0	C_{30}
23.621	39.50166	1.48308	0.00444924	C_{31}
24.026	18.24621	0	0	C_{32}

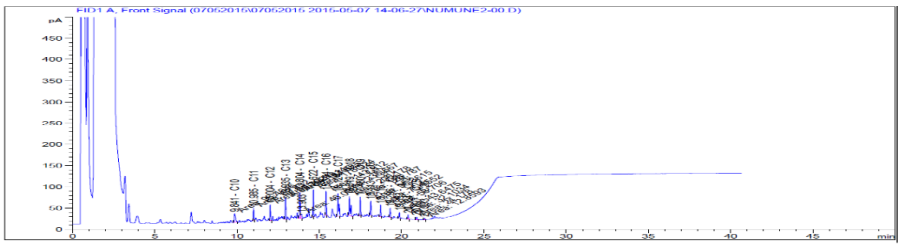

Figure D-2: Ex:1, P:2 T:30 min, m=1.294 gr, gas chromatogram.

Table D-2: Ex:1, P:2 T:30 min, m=1.294 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.841	98.40465	0	0	C_{10}
10.985	69.83201	1.82205	0.00546615	C_{11}
12.004	99.79209	3.40512	0.01021536	C_{12}
12.935	141.81421	3.68715	0.01106145	C_{13}
13.804	184.68523	5.93468	0.01780404	C_{14}
14.622	178.52361	11.1338	0.0334014	C_{15}
15.394	143.91223	5.42478	0.01627434	C_{16}
16.124	235.66655	5.91812	0.01775436	C_{17}
16.819	206.17783	5.85761	0.01757283	C_{18}
17.48	126.78706	3.16063	0.00948189	C_{19}
18.113	96.36149	2.52428	0.00757284	C_{20}
18.716	75.45518	1.91361	0.00574083	C_{21}
19.296	58.70596	1.33714	0.00401142	C_{22}
19.853	43.64754	1.10167	0.00330501	C_{23}
20.384	32.10338	1.28624	0.00385872	C_{24}
20.897	24.17798	6.09E-01	0.001825857	C_{25}
21.393	12.85933	1.66355	0.00499065	C_{26}
21.881	0	0	0	C_{27}
22.342	0	0	0	C_{28}
22.787	0	0	0	C_{29}
23.218	0	0	0	C_{30}
23.633	0	0	0	C_{31}
24.038	0	0	0	C_{32}

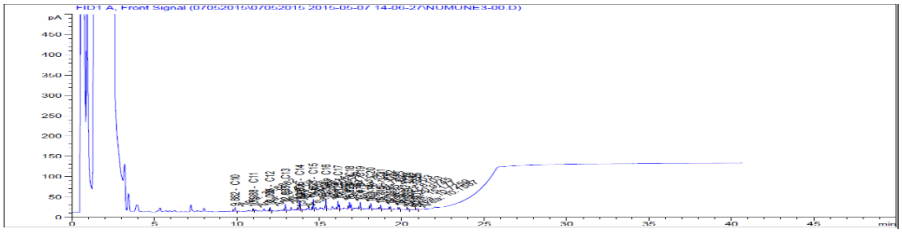

Figure D-3: EX:1, P:3 T:30 min, m=1.062 gr, gas chromatogram.

Table D-3: EX:1, P:3 T:30 min, m=1.062 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.882	39.88624	0	0	C_{10}
10.988	13.41067	3.50E-01	0.001049733	C_{11}
12.005	24.85686	1.48962	0.00446886	C_{12}
12.938	40.86136	1.06239	0.00318717	C_{13}
13.806	63.02987	2.8661	0.0085983	C_{14}
14.623	66.71003	8.39935	0.02519805	C_{15}
15.394	50.5713	3.10511	0.00931533	C_{16}
16.125	88.14729	2.21358	0.00664074	C_{17}
16.82	69.74959	2.48068	0.00744204	C_{18}
17.479	45.41352	1.1321	0.0033963	C_{19}
18.114	33.3103	9.56E-01	0.002868174	C_{20}
18.715	27.81034	7.05E-01	0.002115882	C_{21}
19.295	20.9745	3.84E-01	0.001150758	C_{22}
19.853	15.17704	3.83E-01	0.001149207	C_{23}
20.386	10.72591	7.46E-01	0.002239488	C_{24}
20.901	10.15869	2.56E-01	0.000767157	C_{25}
21.404	0	0.00E+00	0	C_{26}
21.881	0	0.00E+00	0	C_{27}
22.342	0	0.00E+00	0	C_{28}
22.787	0	0.00E+00	0	C_{29}
23.218	0	0.00E+00	0	C_{30}
23.633	0	0.00E+00	0	C_{31}
24.038	0	0.00E+00	0	C_{32}

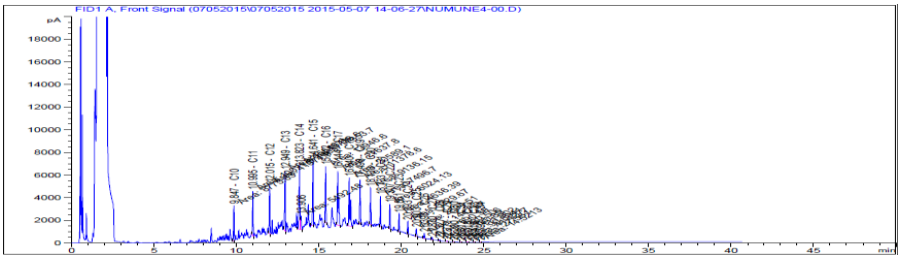

Figure D-4: EX:1, P:1 T:60 min, m=0.923 gr, gas chromatogram.

Table D-4: EX:1, P:1 T:60 min, m=0.923 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.847	8773.83398	219.60832	0.65882496	C_{10}
10.995	1.00E+04	261.48325	0.78444975	C_{11}
12.015	1.20E+04	306.95698	0.92087094	C_{12}
12.949	1.56E+04	406.81612	1.22044836	C_{13}
13.823	1.97E+04	498.49779	1.49549337	C_{14}
14.641	1.74E+04	431.16057	1.29348171	C_{15}
15.412	1.39E+04	348.44449	1.04533347	C_{16}
16.144	2.16E+04	543.37458	1.63012374	C_{17}
16.84	2.06E+04	510.38412	1.53115236	C_{18}
17.498	1.14E+04	283.65335	0.85096005	C_{19}
18.13	9136.15332	227.36339	0.68209017	C_{20}
18.733	7496.7041	190.12289	0.57036867	C_{21}
19.307	6024.12646	152.09558	0.45628674	C_{22}
19.861	4636.3916	117.02282	0.35106846	C_{23}
20.393	3329.67139	84.5437	0.2536311	C_{24}
20.903	2304.51318	58.01021	0.17403063	C_{25}
21.393	1447.66858	37.28155	0.11184465	C_{26}
21.87	690.38965	18.24315	0.05472945	C_{27}
22.327	380.50632	10.13515	0.03040545	C_{28}
22.771	180.88986	5.16081	0.01548243	C_{29}
23.2	111.90244	0	0	C_{30}
23.613	90.89415	3.41259	0.01023777	C_{31}
24.018	41.42773	0	0	C_{32}

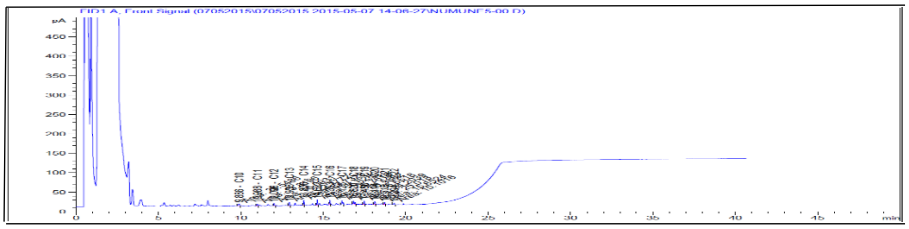

Figure D-5: EX:1, P:2 T:60 min, m=1.027 gr, gas chromatogram.

Table D-5: EX:1, P:2 T:60 min, m=1.027 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.886	23.54859	0	0	C_{10}
10.988	13.81962	3.61E-01	0.001081743	C_{11}
12.006	16.09312	1.2656	0.0037968	C_{12}
12.938	22.77722	5.92E-01	0.001776612	C_{13}
13.806	32.73285	2.1019	0.0063057	C_{14}
14.623	35.62893	7.63925	0.02291775	C_{15}
15.393	25.76165	2.48855	0.00746565	C_{16}
16.125	50.58819	1.27038	0.00381114	C_{17}
16.82	36.56176	1.6592	0.0049776	C_{18}
17.48	24.20387	6.03E-01	0.001810107	C_{19}
18.114	25.01795	7.50E-01	0.00224943	C_{20}
18.718	15.85241	4.02E-01	0.001206093	C_{21}
19.294	15.10162	2.35E-01	0.000705501	C_{22}
19.862	0	0.00E+00	0	C_{23}
20.397	0	0.00E+00	0	C_{24}
20.91	0	0.00E+00	0	C_{25}
21.404	0	0.00E+00	0	C_{26}
21.881	0	0.00E+00	0	C_{27}
22.342	0	0.00E+00	0	C_{28}
22.787	0	0.00E+00	0	C_{29}
23.218	0	0.00E+00	0	C_{30}
23.633	0	0.00E+00	0	C_{31}
24.038	0	0.00E+00	0	C_{32}

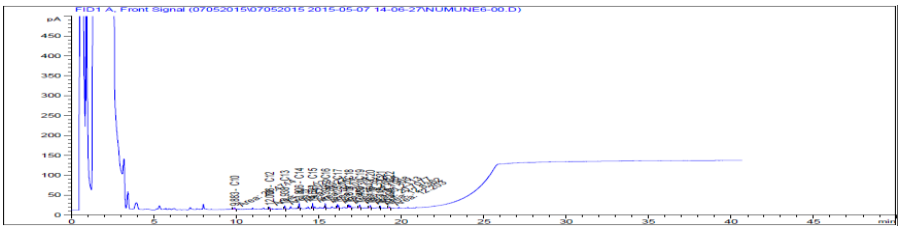

Figure D-6: EX:1, P:3 T:60 min, m=0.962 gr, gas chromatogram.

Table D-6: EX:1, P:3 T:60 min, m=0.962 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.883	20.4714	0	0	C_{10}
10.985	0	0	0	C_{11}
12.006	15.20288	1.24284	0.00372852	C_{12}
12.938	21.49218	5.59E-01	0.001676379	C_{13}
13.806	31.55403	2.07216	0.00621648	C_{14}
14.621	34.05901	7.60086	0.02280258	C_{15}
15.393	24.58415	2.45929	0.00737787	C_{16}
16.125	46.26381	1.16179	0.00348537	C_{17}
16.818	32.19675	1.55116	0.00465348	C_{18}
17.48	21.21128	5.29E-01	0.001586304	C_{19}
18.115	20.7077	6.43E-01	0.001927812	C_{20}
18.718	12.83624	3.26E-01	0.000976614	C_{21}
19.296	12.20305	1.62E-01	0.000485742	C_{22}
19.862	0	0.00E+00	0	C_{23}
20.397	0	0.00E+00	0	C_{24}
20.91	0	0.00E+00	0	C_{25}
21.404	0	0.00E+00	0	C_{26}
21.881	0	0.00E+00	0	C_{27}
22.342	0	0.00E+00	0	C_{28}
22.787	0	0.00E+00	0	C_{29}
23.218	0	0.00E+00	0	C_{30}
23.633	0	0.00E+00	0	C_{31}
24.038	0	0.00E+00	0	C_{32}

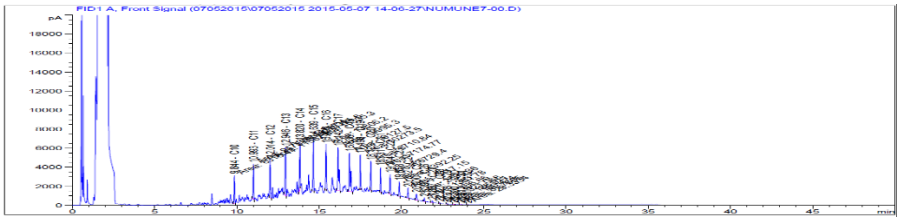

Figure D-7: EX:1, P:1 T:90 min, m=1.071 gr, gas chromatogram.

Table D-7: EX:1, P:1 T:90 min, m=1.071 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.844	8318.41406	207.72818	0.62318454	C_{10}
10.993	9475.02832	247.22218	0.74166654	C_{11}
12.014	1.14E+04	291.82268	0.87546804	C_{12}
12.946	1.48E+04	384.46987	1.15340961	C_{13}
13.82	1.53E+04	387.49534	1.16248602	C_{14}
14.639	1.63E+04	406.25474	1.21876422	C_{15}
15.409	1.38E+04	344.95555	1.03486665	C_{16}
16.142	2.00E+04	502.12732	1.50638196	C_{17}
16.836	1.91E+04	474.20575	1.42261725	C_{18}
17.498	1.03E+04	256.10309	0.76830927	C_{19}
18.129	8710.84473	216.78505	0.65035515	C_{20}
18.731	7174.77344	181.95845	0.54587535	C_{21}
19.304	5729.40137	144.64727	0.43394181	C_{22}
19.858	4392.25049	110.86068	0.33258204	C_{23}
20.392	3117.14673	79.17785	0.23753355	C_{24}
20.9	2300.35547	57.90555	0.17371665	C_{25}
21.39	1361.78162	35.14948	0.10544844	C_{26}
21.867	766.6601	20.25855	0.06077565	C_{27}
22.327	321.06772	8.60193	0.02580579	C_{28}
22.773	188.91063	5.38965	0.01616895	C_{29}
23.2	100.47388	0	0	C_{30}
23.613	81.76646	3.06989	0.00920967	C_{31}
24.016	29.33337	0	0	C_{32}

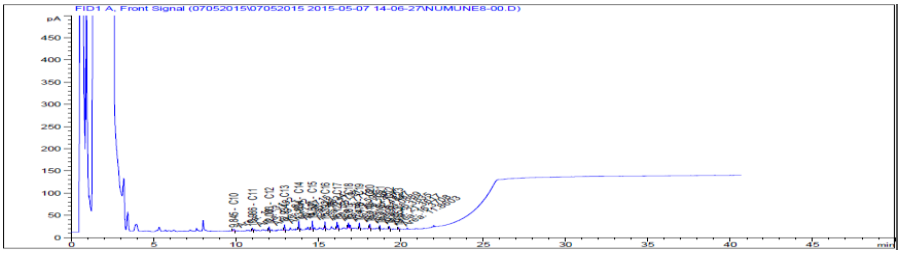

Figure D-8: EX:1, P:2 T:90 min, m=1.193 gr, gas chromatogram.

Table D-8: EX:1, P:2 T:90 min, m=1.193 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.845	18.31917	0	0	C_{10}
10.986	13.64201	3.56E-01	0.001067841	C_{11}
12.003	21.97147	1.41586	0.00424758	C_{12}
12.934	35.38336	9.20E-01	0.002759886	C_{13}
13.804	46.27914	2.44358	0.00733074	C_{14}
14.621	52.77176	8.05848	0.02417544	C_{15}
15.392	38.59082	2.80738	0.00842214	C_{16}
16.122	68.24972	1.71391	0.00514173	C_{17}
16.817	52.48468	2.05333	0.00615999	C_{18}
17.476	34.08893	8.50E-01	0.00254937	C_{19}
18.11	26.38346	7.84E-01	0.002351319	C_{20}
18.716	21.36172	5.42E-01	0.001625256	C_{21}
19.295	16.37081	2.67E-01	0.000801726	C_{22}
19.852	11.86032	2.99E-01	0.000898065	C_{23}
20.397	0	0.00E+00	0	C_{24}
20.91	0	0.00E+00	0	C_{25}
21.404	0	0.00E+00	0	C_{26}
21.881	0	0.00E+00	0	C_{27}
22.342	0	0.00E+00	0	C_{28}
22.787	0	0.00E+00	0	C_{29}
23.218	0	0.00E+00	0	C_{30}
23.633	0	0.00E+00	0	C_{31}
24.038	0	0.00E+00	0	C_{32}

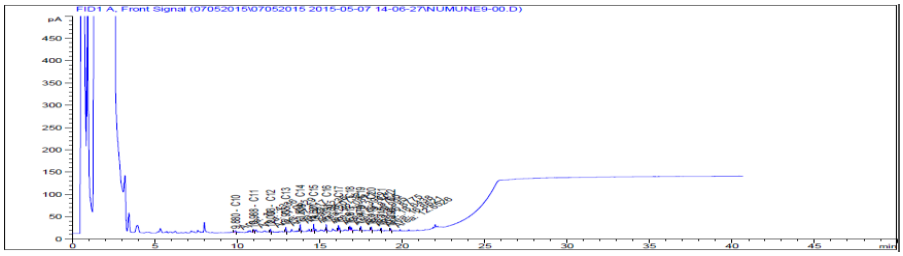

Figure D-9: EX:1, P:3 T:90 min, m=0.914 gr, gas chromatogram.

Table D-9: EX:1, P:3 T:90 min, m=0.914 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.88	19.43359	0	0	C_{10}
10.988	11.08292	2.89E-01	0.000867525	C_{11}
12.003	17.617	1.30455	0.00391365	C_{12}
12.935	28.52357	7.42E-01	0.002224824	C_{13}
13.804	38.07319	2.2366	0.0067098	C_{14}
14.621	42.08706	7.79718	0.02339154	C_{15}
15.391	30.39466	2.60369	0.00781107	C_{16}
16.123	54.87651	1.37807	0.00413421	C_{17}
16.817	39.99496	1.74418	0.00523254	C_{18}
17.479	26.87751	6.70E-01	0.00201006	C_{19}
18.113	18.64376	5.91E-01	0.00177381	C_{20}
18.715	16.8621	4.28E-01	0.001282911	C_{21}
19.296	12.65258	1.73E-01	0.000519822	C_{22}
19.862	0	0.00E+00	0	C_{23}
20.397	0	0.00E+00	0	C_{24}
20.91	0	0.00E+00	0	C_{25}
21.404	0	0.00E+00	0	C_{26}
21.881	0	0.00E+00	0	C_{27}
22.342	0	0.00E+00	0	C_{28}
22.787	0	0.00E+00	0	C_{29}
23.218	0	0.00E+00	0	C_{30}
23.633	0	0.00E+00	0	C_{31}
24.038	0	0.00E+00	0	C_{32}

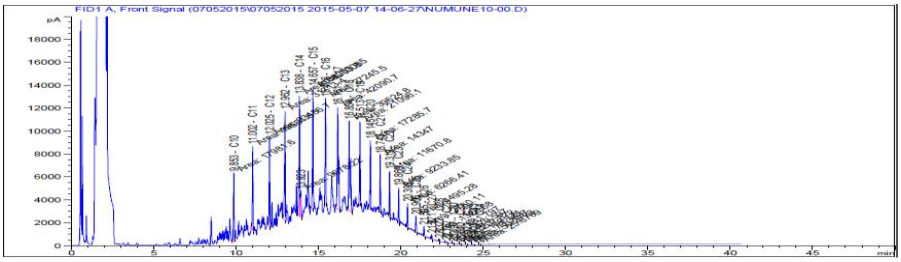

Figure D-10: EX:1, P:1 T:120 min, m=1.341 gr, gas chromatogram.

Table D-10: EX:1, P:1 T:120 min, m=1.341 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.853	1.80E+04	459.80247	1.37940741	C_{10}
11.002	1.96E+04	510.92787	1.53278361	C_{11}
12.025	2.35E+04	601.22206	1.80366618	C_{12}
12.962	3.17E+04	824.54299	2.47362897	C_{13}
13.838	3.80E+04	959.86802	2.87960406	C_{14}
14.657	3.31E+04	815.8744	2.4476232	C_{15}
15.426	2.72E+04	678.94295	2.03682885	C_{16}
16.161	4.21E+04	1056.99395	3.17098185	C_{17}
16.854	3.96E+04	981.56423	2.94469269	C_{18}
17.513	2.11E+04	525.89668	1.57769004	C_{19}
18.145	1.73E+04	430.06002	1.29018006	C_{20}
18.743	1.43E+04	363.85217	1.09155651	C_{21}
19.319	1.17E+04	294.79826	0.88439478	C_{22}
19.869	9233.85059	233.06298	0.69918894	C_{23}
20.398	6266.40918	158.69088	0.47607264	C_{24}
20.906	4495.27734	113.15709	0.33947127	C_{25}
21.395	2760.11011	69.86188	0.20958564	C_{26}
21.871	1326.68372	35.05686	0.10517058	C_{27}
22.327	681.79663	17.90694	0.05372082	C_{28}
22.767	379.59653	10.82994	0.03248982	C_{29}
23.197	207.87169	0	0	C_{30}
23.61	159.12112	5.97414	0.01792242	C_{31}
24.023	73.36368	0	0	C_{32}

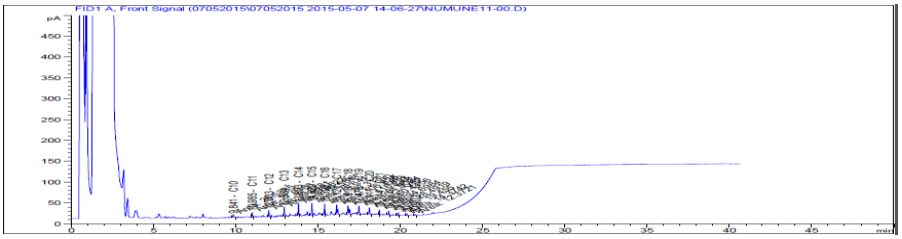

Figure D-11: EX:1, P:2 T:120 min, m=0.918 gr, gas chromatogram.

Table D-11: EX:1, P:2 T:120 min, m=0.918 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.841	26.53353	0	0	C_{10}
10.985	27.01832	7.05E-01	0.002114883	C_{11}
12.003	39.84813	1.87283	0.00561849	C_{12}
12.934	58.96224	1.53301	0.00459903	C_{13}
13.803	69.58409	3.03142	0.00909426	C_{14}
14.62	78.64104	8.69113	0.02607339	C_{15}
15.392	80.31298	3.84424	0.01153272	C_{16}
16.121	106.82632	2.68265	0.00804795	C_{17}
16.816	116.23717	3.63136	0.01089408	C_{18}
17.475	54.00238	1.34621	0.00403863	C_{19}
18.111	60.4456	1.63097	0.00489291	C_{20}
18.714	34.69844	8.80E-01	0.002639949	C_{21}
19.293	28.49192	5.74E-01	0.001720701	C_{22}
19.849	19.45498	4.91E-01	0.001473135	C_{23}
20.381	14.3742	8.39E-01	0.002515824	C_{24}
20.902	12.37208	3.11E-01	0.000934305	C_{25}
21.404	0	0.00E+00	0	C_{26}
21.881	0	0.00E+00	0	C_{27}
22.342	0	0.00E+00	0	C_{28}
22.787	0	0.00E+00	0	C_{29}
23.218	0	0.00E+00	0	C_{30}
23.633	0	0.00E+00	0	C_{31}
24.038	0	0.00E+00	0	C_{32}

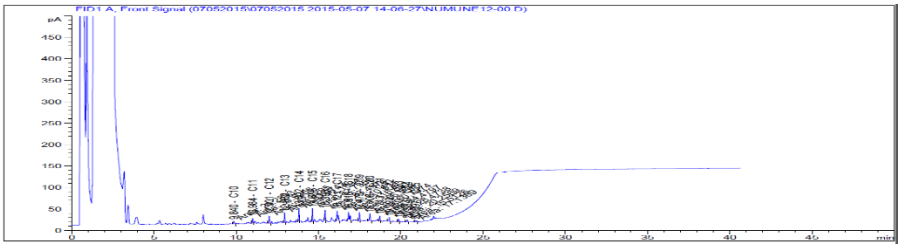

Figure D-12: EX:1, P:3 T:120 min, m=0.945 gr, gas chromatogram gas.

Table D-12: EX:1, P:3 T:120 min, m=0.945 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.84	24.2893	0	0	C_{10}
10.984	30.52664	7.97E-01	0.0023895	C_{11}
12.001	42.92948	1.95159	0.00585477	C_{12}
12.932	63.0743	1.63992	0.00491976	C_{13}
13.802	72.18944	3.09713	0.00929139	C_{14}
14.618	82.7356	8.79126	0.02637378	C_{15}
15.39	63.49743	3.42635	0.01027905	C_{16}
16.121	110.61115	2.7777	0.0083331	C_{17}
16.816	116.59143	3.64013	0.01092039	C_{18}
17.475	56.54895	1.40969	0.00422907	C_{19}
18.109	60.7974	1.63972	0.00491916	C_{20}
18.713	34.47965	8.74E-01	0.002623302	C_{21}
19.293	28.47377	5.73E-01	0.001719324	C_{22}
19.85	20.25693	5.11E-01	0.001533858	C_{23}
20.384	15.5126	8.67E-01	0.002602053	C_{24}
20.897	17.13688	4.31E-01	0.001294131	C_{25}
21.404	0	0.00E+00	0	C_{26}
21.881	0	0.00E+00	0	C_{27}
22.342	0	0.00E+00	0	C_{28}
22.787	0	0.00E+00	0	C_{29}
23.218	0	0.00E+00	0	C_{30}
23.633	0	0.00E+00	0	C_{31}
24.038	0	0.00E+00	0	C_{32}

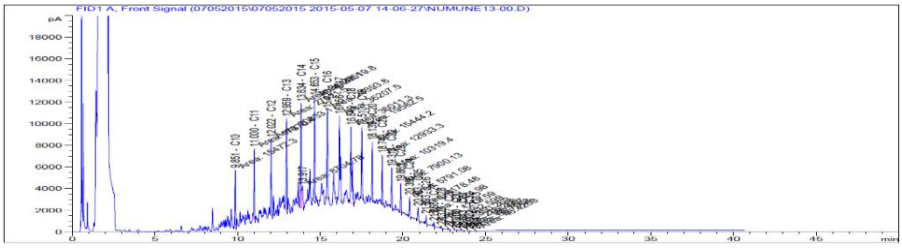

Figure D-13: EX:1, P:1 T:180 min, m=1.209 gr, gas chromatogram.

Table D-13: EX:1, P:1 T:180 min, m=1.209 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.851	1.55E+04	394.34649	1.18303947	C_{10}
11	1.74E+04	453.22827	1.35968481	C_{11}
12.022	2.08E+04	533.39165	1.60017495	C_{12}
12.959	2.70E+04	702.55357	2.10766071	C_{13}
13.834	3.44E+04	870.18077	2.61054231	C_{14}
14.653	2.95E+04	728.68612	2.18605836	C_{15}
15.423	2.44E+04	608.07452	1.82422356	C_{16}
16.156	3.62E+04	909.25312	2.72775936	C_{17}
16.849	3.60E+04	892.12068	2.67636204	C_{18}
17.51	1.96E+04	488.1651	1.4644953	C_{19}
18.139	1.54E+04	384.25921	1.15277763	C_{20}
18.742	1.29E+04	327.99963	0.98399889	C_{21}
19.313	1.03E+04	260.64581	0.78193743	C_{22}
19.863	7900.12939	199.39977	0.59819931	C_{23}
20.396	5791.07568	146.68959	0.44006877	C_{24}
20.903	4178.48389	105.18262	0.31554786	C_{25}
21.393	2434.97681	61.7907	0.1853721	C_{26}
21.868	1279.58875	33.8124	0.1014372	C_{27}
22.321	652.59912	17.15379	0.05146137	C_{28}
22.767	350.26901	9.99322	0.02997966	C_{29}
23.2	216.26605	0	0	C_{30}
23.613	165.56657	6.21614	0.01864842	C_{31}
24.02	66.70582	0	0	C_{32}

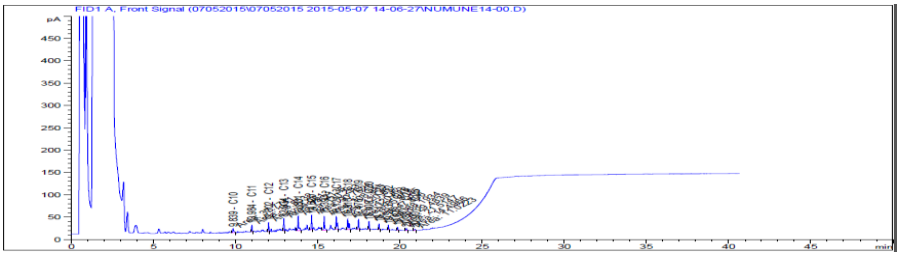

Figure D-14: EX:1, P:2 T:180 min, m=0.82 gr, gas chromatogram.

Table D-14: EX:1, P:2 T:180 min, m=0.82 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.839	37.77409	0	0	**C_{10}**
10.984	38.55321	1.00593	0.00301779	**C_{11}**
12.002	54.96132	2.25915	0.00677745	**C_{12}**
12.934	74.21361	1.92954	0.00578862	**C_{13}**
13.801	130.25313	4.56171	0.01368513	**C_{14}**
14.62	90.76283	8.98757	0.02696271	**C_{15}**
15.39	108.83521	4.55306	0.01365918	**C_{16}**
16.121	120.83014	3.03432	0.00910296	**C_{17}**
16.816	120.61771	3.73979	0.01121937	**C_{18}**
17.476	65.80154	1.64034	0.00492102	**C_{19}**
18.108	47.80602	1.3166	0.0039498	**C_{20}**
18.712	38.19342	9.69E-01	0.002905854	**C_{21}**
19.293	29.48388	5.99E-01	0.001795908	**C_{22}**
19.848	21.51473	5.43E-01	0.001629099	**C_{23}**
20.384	14.49663	8.42E-01	0.002525097	**C_{24}**
20.901	11.0223	2.77E-01	0.000832374	**C_{25}**
21.404	0	0.00E+00	0	**C_{26}**
21.881	0	0.00E+00	0	**C_{27}**
22.342	0	0.00E+00	0	**C_{28}**
22.787	0	0.00E+00	0	**C_{29}**
23.218	0	0.00E+00	0	**C_{30}**
23.633	0	0.00E+00	0	**C_{31}**
24.038	0	0.00E+00	0	**C_{32}**

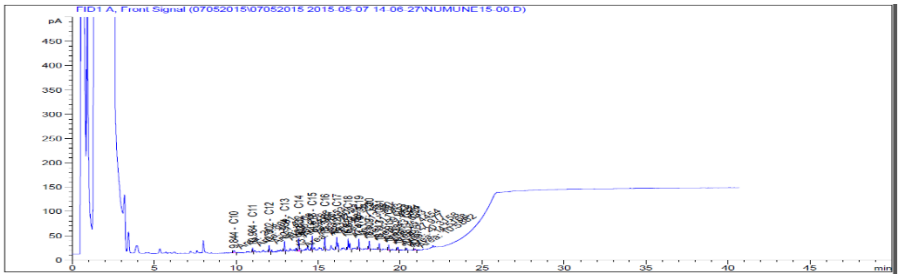

Figure D-15: EX:1, P:3 T:180 min, m=1.215 gr, gas chromatogram.

Table D-15: EX:1, P:3 T:180 min, m=1.215 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.844	24.8081	0	0	C_{10}
10.984	21.45676	5.60E-01	0.001679547	C_{11}
12.002	36.7206	1.79288	0.00537864	C_{12}
12.934	54.56527	1.41869	0.00425607	C_{13}
13.802	79.90519	3.29175	0.00987525	C_{14}
14.618	77.59949	8.66566	0.02599698	C_{15}
15.39	69.71939	3.58097	0.01074291	C_{16}
16.12	113.38042	2.84724	0.00854172	C_{17}
16.815	111.32273	3.50972	0.01052916	C_{18}
17.474	59.4524	1.48207	0.00444621	C_{19}
18.109	43.68298	1.21405	0.00364215	C_{20}
18.713	35.4454	8.99E-01	0.002696778	C_{21}
19.291	27.97699	5.61E-01	0.001681662	C_{22}
19.848	20.31577	5.13E-01	0.001538313	C_{23}
20.381	14.5168	8.42E-01	0.002526627	C_{24}
20.897	10.58825	2.67E-01	0.000799596	C_{25}
21.404	0	0.00E+00	0	C_{26}
21.881	0	0.00E+00	0	C_{27}
22.342	0	0.00E+00	0	C_{28}
22.787	0	0.00E+00	0	C_{29}
23.218	0	0.00E+00	0	C_{30}
23.633	0	0.00E+00	0	C_{31}
24.038	0	0.00E+00	0	C_{32}

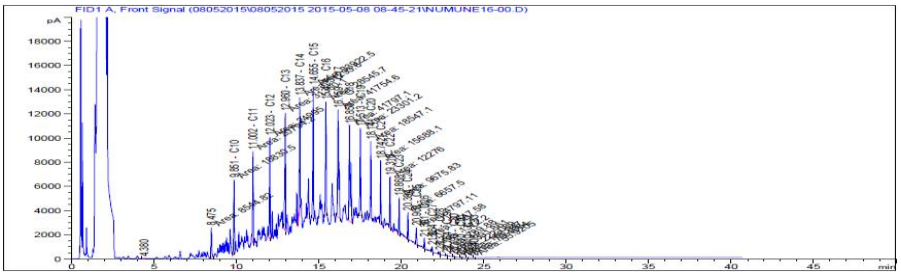

Figure D-16: EX:1, P:1 T:240 min, m=1.399 gr, gas chromatogram.

Table D-16: EX:1, P:1 T:240 min, m=1.399 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.851	1.88E+04	481.9484	1.4458452	C_{10}
11.002	2.08E+04	542.56245	1.62768735	C_{11}
12.023	2.50E+04	639.77656	1.91932968	C_{12}
12.96	3.14E+04	815.35855	2.44607565	C_{13}
13.837	3.13E+04	790.61479	2.37184437	C_{14}
14.655	3.39E+04	836.35572	2.50906716	C_{15}
15.424	2.85E+04	711.25467	2.13376401	C_{16}
16.159	4.18E+04	1048.5524	3.1456572	C_{17}
16.85	4.18E+04	1035.33316	3.10599948	C_{18}
17.513	2.33E+04	580.86758	1.74260274	C_{19}
18.141	1.85E+04	461.43304	1.38429912	C_{20}
18.742	1.57E+04	397.86366	1.19359098	C_{21}
19.316	1.23E+04	310.09321	0.93027963	C_{22}
19.868	9675.83301	244.21865	0.73265595	C_{23}
20.394	6657.49561	168.56508	0.50569524	C_{24}
20.903	4797.10645	120.75486	0.36226458	C_{25}
21.391	2647.5769	67.06833	0.20120499	C_{26}
21.864	1372.19861	36.25956	0.10877868	C_{27}
22.327	789.88049	20.69497	0.06208491	C_{28}
22.764	391.86063	11.17984	0.03353952	C_{29}
23.193	222.08904	0	0	C_{30}
23.61	168.94684	6.34305	0.01902915	C_{31}
24.01	79.48637	0	0	C_{32}

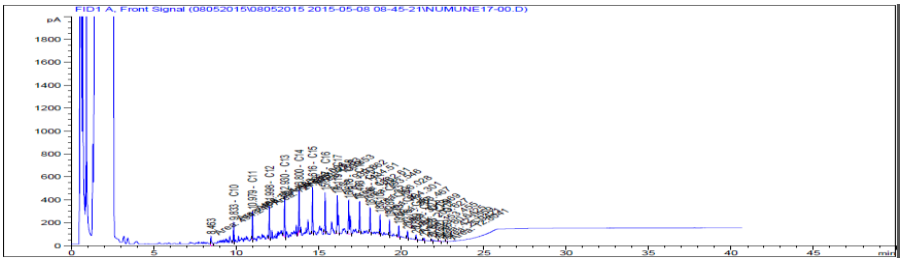

Figure D-17: EX:1, P:2 T:240 min, m=0.925 gr, gas chromatogram.

Table D-17: EX:1, P:2 T:240 min, m=0.925 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.833	486.37967	3.42089	0.01026267	C_{10}
10.979	594.48492	15.51128	0.04653384	C_{11}
11.998	727.6153	19.45356	0.05836068	C_{12}
12.93	963.00647	25.03801	0.07511403	C_{13}
13.8	1021.83258	27.05055	0.08115165	C_{14}
14.616	1099.53345	33.65748	0.10097244	C_{15}
15.387	930.86243	24.98177	0.07494531	C_{16}
16.119	1434.5144	36.02393	0.10807179	C_{17}
16.813	1382.61096	34.97718	0.10493154	C_{18}
17.473	793.54584	19.78201	0.05934603	C_{19}
18.106	596.02759	14.95205	0.04485615	C_{20}
18.71	504.30136	12.78952	0.03836856	C_{21}
19.287	383.46719	9.54452	0.02863356	C_{22}
19.843	301.96909	7.62172	0.02286516	C_{23}
20.375	203.62706	5.61689	0.01685067	C_{24}
20.889	153.45474	3.86283	0.01158849	C_{25}
21.382	80.64251	3.34621	0.01003863	C_{26}
21.863	42.35592	1.11923	0.00335769	C_{27}
22.321	25.94209	9.89E-01	0.00296748	C_{28}
22.769	12.80407	3.65E-01	0.001095906	C_{29}
23.218	0	0	0	C_{30}
23.633	0	0	0	C_{31}
24.038	0	0	0	C_{32}

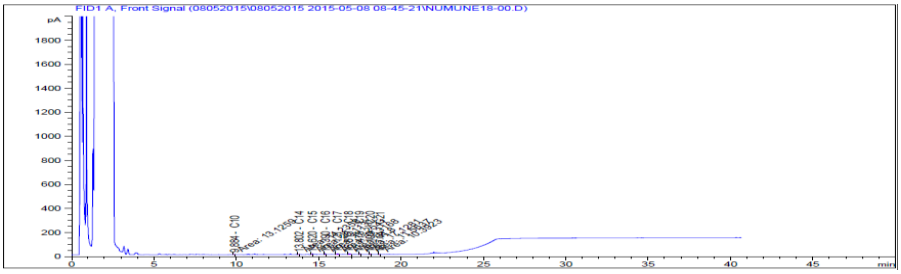

Figure D-18: EX:1, P:3 T:240 min, m=1.757 gr, gas chromatogram.

Table D-18: EX:1, P:3 T:240 min, m=1.757 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.884	13.12594	0	0	C_{10}
10.985	0	0	0	C_{11}
12.002	0	0	0	C_{12}
12.937	0	0	0	C_{13}
13.802	14.23577	1.63533	0.00490599	C_{14}
14.62	20.11315	7.2598	0.0217794	C_{15}
15.39	17.25409	2.27712	0.00683136	C_{16}
16.121	37.3168	9.37E-01	0.00281133	C_{17}
16.815	34.79996	1.61559	0.00484677	C_{18}
17.475	17.12814	4.27E-01	0.001280943	C_{19}
18.109	11.56369	4.15E-01	0.001245519	C_{20}
18.714	10.39232	2.64E-01	0.000790674	C_{21}
19.306	0	0.00E+00	0	C_{22}
19.862	0	0.00E+00	0	C_{23}
20.397	0	0.00E+00	0	C_{24}
20.91	0	0.00E+00	0	C_{25}
21.404	0	0.00E+00	0	C_{26}
21.881	0	0.00E+00	0	C_{27}
22.342	0	0.00E+00	0	C_{28}
22.787	0	0.00E+00	0	C_{29}
23.218	0	0.00E+00	0	C_{30}
23.633	0	0.00E+00	0	C_{31}
24.038	0	0.00E+00	0	C_{32}

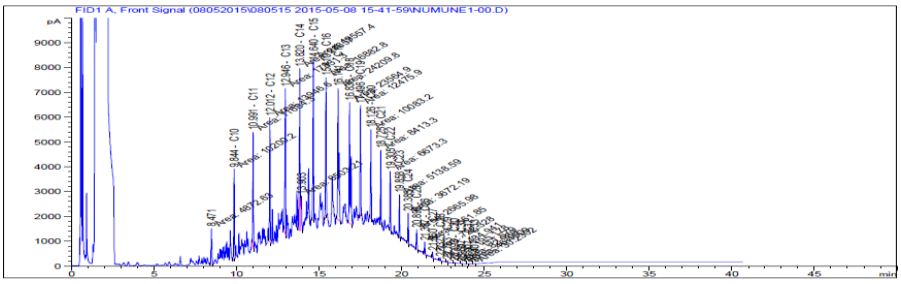

Figure D-19:EX:1, P:1 T:1440 min, m=1.125 gr, gas chromatogram.

Table D-19:EX:1, P:1 T:1440 min, m=1.125 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.844	1.02E+04	256.81735	0.77045205	C_{10}
10.991	1.17E+04	304.86725	0.91460175	C_{11}
12.012	1.39E+04	357.35721	1.07207163	C_{12}
12.946	1.78E+04	463.61178	1.39083534	C_{13}
13.82	2.19E+04	552.58744	1.65776232	C_{14}
14.64	1.96E+04	485.0519	1.4551557	C_{15}
15.41	1.69E+04	421.41234	1.26423702	C_{16}
16.141	2.42E+04	607.96326	1.82388978	C_{17}
16.836	2.36E+04	584.04253	1.75212759	C_{18}
17.496	1.25E+04	311.00678	0.93302034	C_{19}
18.126	1.01E+04	250.91868	0.75275604	C_{20}
18.725	8413.30371	213.36865	0.64010595	C_{21}
19.305	6673.30225	168.50159	0.50550477	C_{22}
19.858	5138.59033	129.69835	0.38909505	C_{23}
20.385	3672.19336	93.19175	0.27957525	C_{24}
20.896	2665.97729	67.10915	0.20132745	C_{25}
21.387	1561.85168	40.11606	0.12034818	C_{26}
21.86	722.32788	19.0871	0.0572613	C_{27}
22.323	404.94122	10.76545	0.03229635	C_{28}
22.763	195.17792	5.56845	0.01670535	C_{29}
23.193	111.57903	0	0	C_{30}
23.607	82.98897	3.11579	0.00934737	C_{31}
24.007	46.45087	0	0	C_{32}

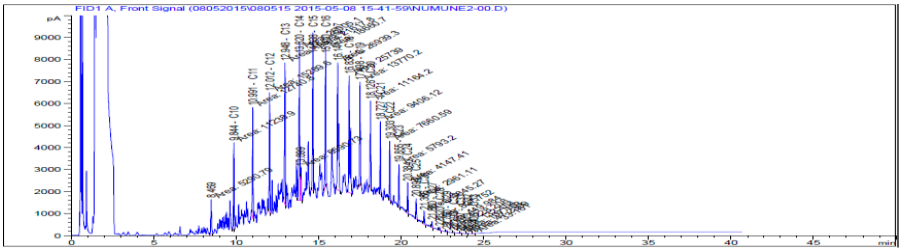

Figure D-20: EX:1, P:2 T:1440 min, m=1.315 gr, gas chromatogram.

Table D-20: EX:1, P:2 T:1440 min, m=1.315 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.844	1.12E+04	283.91154	0.85173462	C_{10}
10.991	1.27E+04	332.43357	0.99730071	C_{11}
12.012	1.53E+04	391.68785	1.17506355	C_{12}
12.948	1.96E+04	508.91382	1.52674146	C_{13}
13.82	2.50E+04	631.99405	1.89598215	C_{14}
14.638	2.16E+04	535.43999	1.60631997	C_{15}
15.41	1.87E+04	465.59615	1.39678845	C_{16}
16.141	2.69E+04	676.50605	2.02951815	C_{17}
16.836	2.57E+04	637.85744	1.91357232	C_{18}
17.498	1.38E+04	343.27161	1.02981483	C_{19}
18.126	1.12E+04	277.80604	0.83341812	C_{20}
18.727	9406.11816	238.54728	0.71564184	C_{21}
19.303	7660.58984	193.45238	0.58035714	C_{22}
19.855	5793.2041	146.22084	0.43866252	C_{23}
20.384	4147.41455	105.1902	0.3155706	C_{24}
20.894	2961.11133	74.53839	0.22361517	C_{25}
21.386	1845.26648	47.15161	0.14145483	C_{26}
21.86	827.75232	21.87288	0.06561864	C_{27}
22.32	449.98367	11.92732	0.03578196	C_{28}
22.76	228.2085	6.51082	0.01953246	C_{29}
23.19	132.45366	0	0	C_{30}
23.607	107.15276	4.02301	0.01206903	C_{31}
24.013	47.2309	0	0	C_{32}

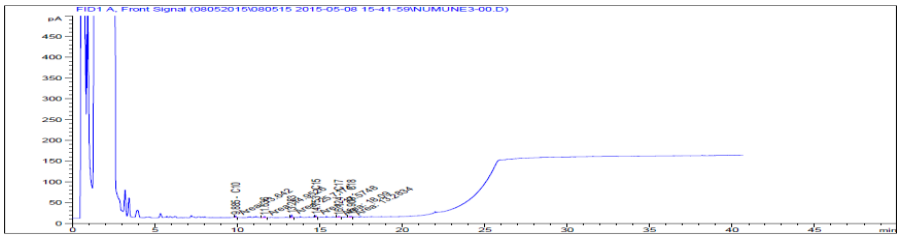

Figure D-21: EX:1, P:3 T:1440 min, m=1.046 gr, gas chromatogram.

Table D-21: EX:1, P:3 T:1440 min, m=1.046 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.885	13.64196	0	0	**C_{10}**
10.985	0	0	0	**C_{11}**
12.002	0	0	0	**C_{12}**
12.937	0	0	0	**C_{13}**
13.808	0	0	0	**C_{14}**
14.753	17.57478	7.19773	0.02159319	**C_{15}**
15.398	0	0	0	**C_{16}**
16.124	18.09	4.54E-01	0.001362843	**C_{17}**
16.909	13.28342	1.08301	0.00324903	**C_{18}**
17.489	0	0	0	**C_{19}**
18.121	0	0	0	**C_{20}**
18.725	0	0	0	**C_{21}**
19.306	0	0	0	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.91	0	0	0	**C_{25}**
21.404	0	0	0	**C_{26}**
21.881	0	0	0	**C_{27}**
22.342	0	0	0	**C_{28}**
22.787	0	0	0	**C_{29}**
23.218	0	0	0	**C_{30}**
23.633	0	0	0	**C_{31}**
24.038	0	0	0	**C_{32}**

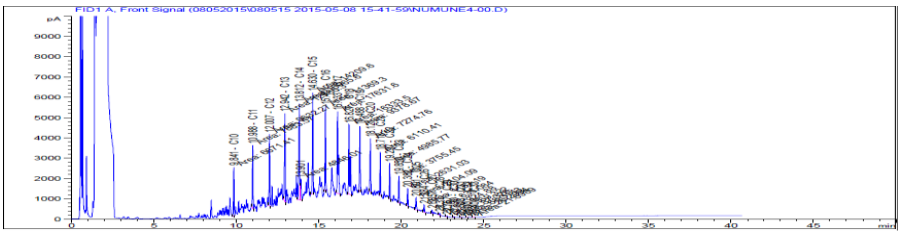

Figure D-22: EX:1, Port:1 T:1500 min, m=3.591 gr, gas chromatogram.

Table D-22: EX:1, Port:1 T:1500 min, m=3.591 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.841	6671.40918	164.76424	0.49429272	C_{10}
10.988	7883.56738	205.69783	0.61709349	C_{11}
12.007	9632.26758	247.07461	0.74122383	C_{12}
12.942	1.28E+04	332.44079	0.99732237	C_{13}
13.812	1.61E+04	406.50904	1.21952712	C_{14}
14.63	1.42E+04	354.26859	1.06280577	C_{15}
15.401	1.14E+04	284.3928	0.8531784	C_{16}
16.133	1.76E+04	442.76841	1.32830523	C_{17}
16.827	1.63E+04	405.04867	1.21514601	C_{18}
17.488	9378.66895	233.79739	0.70139217	C_{19}
18.121	7274.76172	181.06657	0.54319971	C_{20}
18.718	6110.40674	154.96519	0.46489557	C_{21}
19.297	4985.76855	125.85414	0.37756242	C_{22}
19.85	3755.44702	94.78772	0.28436316	C_{23}
20.382	2631.02905	66.90428	0.20071284	C_{24}
20.891	2104.09473	52.96519	0.15889557	C_{25}
21.384	1157.18628	30.07056	0.09021168	C_{26}
21.857	635.08405	16.78173	0.05034519	C_{27}
22.317	324.87988	8.70027	0.02610081	C_{28}
22.767	169.32249	4.83079	0.01449237	C_{29}
23.19	87.32596	0	0	C_{30}
23.608	68.31434	2.56484	0.00769452	C_{31}
24.007	26.29942	0	0	C_{32}

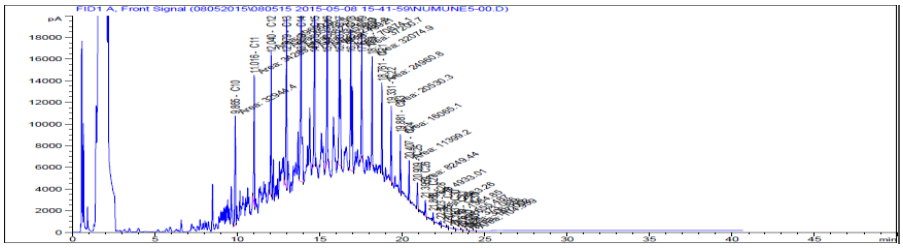

Figure D-23: EX:1, P:2 T:1500 min, m=1.551 gr, gas chromatogram.

Table D-23: EX:1, P:2 T:1500 min, m=1.551 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.865	3.29E+04	850.12436	2.55037308	C_{10}
11.016	3.43E+04	894.57664	2.68372992	C_{11}
12.04	3.97E+04	1015.42687	3.04628061	C_{12}
12.979	5.59E+04	1454.00227	4.36200681	C_{13}
13.859	8.83E+04	2228.00501	6.68401503	C_{14}
14.678	5.86E+04	1438.76129	4.31628387	C_{15}
15.448	5.23E+04	1301.23412	3.90370236	C_{16}
16.183	7.30E+04	1833.72251	5.50116753	C_{17}
16.875	7.09E+04	1755.06074	5.26518222	C_{18}
17.535	3.72E+04	927.36316	2.78208948	C_{19}
18.163	3.21E+04	797.90041	2.39370123	C_{20}
18.761	2.50E+04	633.02817	1.89908451	C_{21}
19.331	2.05E+04	518.69767	1.55609301	C_{22}
19.881	1.61E+04	405.48523	1.21645569	C_{23}
20.407	1.14E+04	288.28525	0.86485575	C_{24}
20.909	8249.43652	207.65842	0.62297526	C_{25}
21.395	4933.01416	123.8025	0.3714075	C_{26}
21.868	2463.26123	65.09027	0.19527081	C_{27}
22.323	1384.85413	36.04233	0.10812699	C_{28}
22.765	655.48682	18.70113	0.05610339	C_{29}
23.193	373.08633	3.19061	0.00957183	C_{30}
23.61	306.84555	11.5204	0.0345612	C_{31}
24.01	147.00218	0	0	C_{32}

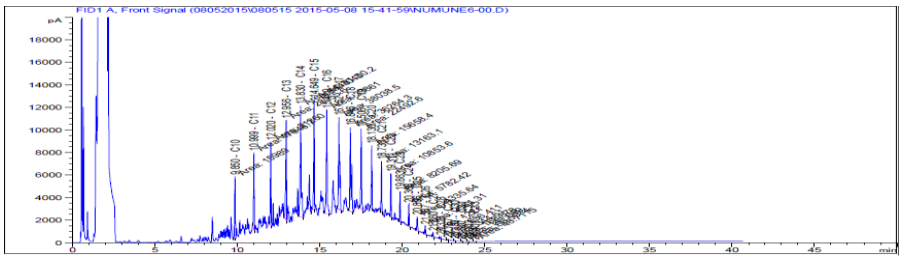

Figure D-24: EX:1, Port:3 T:1500 min, m=1.401 gr, gas chromatogram.

Table D-24: EX:1, Port:3 T:1500 min, m=1.401 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.85	1.60E+04	407.82427	1.22347281	C_{10}
10.999	1.79E+04	468.31779	1.40495337	C_{11}
12.02	2.13E+04	544.30434	1.63291302	C_{12}
12.956	2.81E+04	729.44187	2.18832561	C_{13}
13.83	4.45E+04	1122.74953	3.36824859	C_{14}
14.649	3.04E+04	750.21639	2.25064917	C_{15}
15.419	3.39E+04	843.34978	2.53004934	C_{16}
16.152	3.80E+04	955.23292	2.86569876	C_{17}
16.846	3.63E+04	898.38392	2.69515176	C_{18}
17.506	2.25E+04	560.70917	1.68212751	C_{19}
18.136	1.57E+04	389.58452	1.16875356	C_{20}
18.736	1.32E+04	333.82701	1.00148103	C_{21}
19.311	1.09E+04	274.14697	0.82244091	C_{22}
19.863	8205.6875	207.11208	0.62133624	C_{23}
20.388	5782.4165	146.47096	0.43941288	C_{24}
20.896	4335.64258	109.13869	0.32741607	C_{25}
21.387	2561.30542	64.92671	0.19478013	C_{26}
21.86	1220.99731	32.26415	0.09679245	C_{27}
22.323	656.41071	17.25211	0.05175633	C_{28}
22.767	344.61008	9.83177	0.02949531	C_{29}
23.187	168.87845	0	0	C_{30}
23.607	141.09879	5.2975	0.0158925	C_{31}
24.003	66.50138	0	0	C_{32}

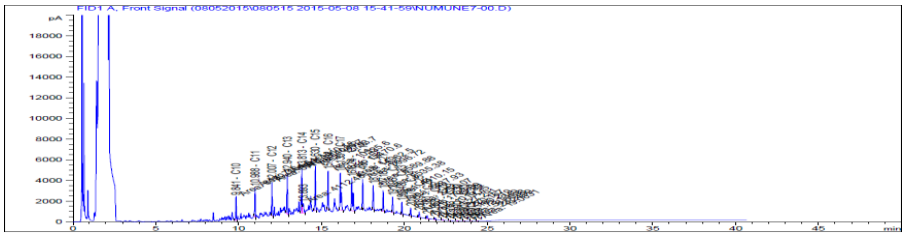

Figure D-25: EX:1, Port:1 T:1560 min, m=2.151 gr, gas chromatogram.

Table D-25: EX:1, Port:1 T:1560 min, m=2.151 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.841	6130.29932	150.64879	0.45194637	C_{10}
10.988	7164.63623	186.93949	0.56081847	C_{11}
12.007	8570.07715	219.92286	0.65976858	C_{12}
12.94	1.13E+04	294.06015	0.88218045	C_{13}
13.813	1.41E+04	356.56919	1.06970757	C_{14}
14.63	1.28E+04	318.66552	0.95599656	C_{15}
15.401	1.03E+04	258.45693	0.77537079	C_{16}
16.133	1.55E+04	388.50323	1.16550969	C_{17}
16.824	1.50E+04	371.11339	1.11334017	C_{18}
17.485	7996.7168	199.34722	0.59804166	C_{19}
18.118	6589.88037	164.03209	0.49209627	C_{20}
18.718	5535.37549	140.3819	0.4211457	C_{21}
19.296	4410.15039	111.30709	0.33392127	C_{22}
19.848	3437.92725	86.7735	0.2603205	C_{23}
20.378	2250.07153	57.28581	0.17185743	C_{24}
20.892	1708.68726	43.01182	0.12903546	C_{25}
21.381	1019.35114	26.64891	0.07994673	C_{26}
21.858	527.29144	13.93337	0.04180011	C_{27}
22.32	270.16675	7.28894	0.02186682	C_{28}
22.763	160.2191	4.57107	0.01371321	C_{29}
23.19	73.13493	0	0	C_{30}
23.607	58.65981	2.20236	0.00660708	C_{31}
24.013	23.24991	0	0	C_{32}

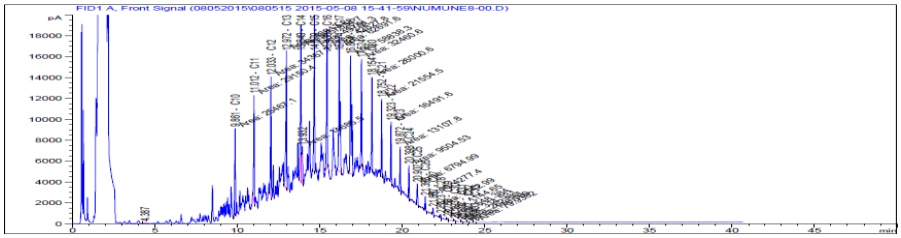

Figure D-26: EX:1, Port:2 T:1560 min, m=1.502 gr, gas chromatogram.

Table D-26:EX:1, Port:2 T:1560 min, m=1.502 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.861	2.55E+04	655.07115	1.96521345	C_{10}
11.012	2.92E+04	760.59156	2.28177468	C_{11}
12.033	3.44E+04	879.36324	2.63808972	C_{12}
12.972	4.86E+04	1263.93643	3.79180929	C_{13}
13.849	5.78E+04	1460.07678	4.38023034	C_{14}
14.67	4.98E+04	1223.45677	3.67037031	C_{15}
15.438	4.28E+04	1066.18825	3.19856475	C_{16}
16.174	6.27E+04	1574.32984	4.72298952	C_{17}
16.864	5.88E+04	1457.14351	4.37143053	C_{18}
17.524	3.25E+04	809.1972	2.4275916	C_{19}
18.154	2.60E+04	646.81906	1.94045718	C_{20}
18.752	2.16E+04	546.6396	1.6399188	C_{21}
19.323	1.65E+04	416.63114	1.24989342	C_{22}
19.872	1.31E+04	330.84203	0.99252609	C_{23}
20.398	9504.52539	240.4473	0.7213419	C_{24}
20.907	6794.99316	171.04654	0.51313962	C_{25}
21.393	4277.40088	107.52742	0.32258226	C_{26}
21.867	2142.98755	56.62722	0.16988166	C_{27}
22.323	1144.65125	29.84629	0.08953887	C_{28}
22.76	548.38446	15.64548	0.04693644	C_{29}
23.193	314.53131	1.33151	0.00399453	C_{30}
23.607	262.84061	9.86825	0.02960475	C_{31}
24.007	116.16904	0	0	C_{32}

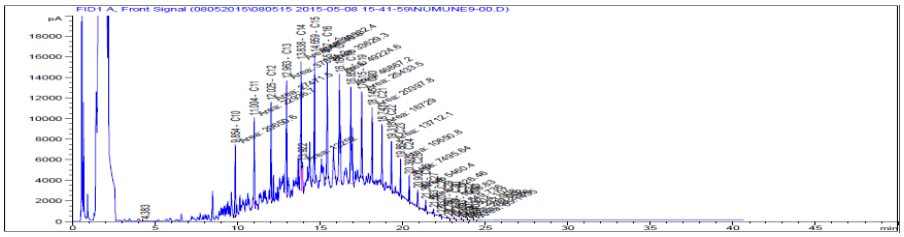

Figure D-27:EX:1, Port:3 T:1560 min, m=1.568 gr, gas chromatogram.

Table D-27:EX:1, Port:3 T:1560 min, m=1.568 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.854	2.07E+04	529.42756	1.58828268	C_{10}
11.004	2.29E+04	598.46348	1.79539044	C_{11}
12.025	2.75E+04	703.08124	2.10924372	C_{12}
12.963	3.79E+04	984.12595	2.95237785	C_{13}
13.838	4.60E+04	1162.74529	3.48823587	C_{14}
14.659	3.95E+04	973.54869	2.92064607	C_{15}
15.427	3.36E+04	837.58993	2.51276979	C_{16}
16.16	4.92E+04	1236.14132	3.70842396	C_{17}
16.853	4.69E+04	1160.83035	3.48249105	C_{18}
17.515	2.54E+04	634.02165	1.90206495	C_{19}
18.145	2.04E+04	507.46484	1.52239452	C_{20}
18.743	1.67E+04	424.26249	1.27278747	C_{21}
19.316	1.37E+04	346.38605	1.03915815	C_{22}
19.864	1.07E+04	268.82684	0.80648052	C_{23}
20.392	7495.64355	189.72676	0.56918028	C_{24}
20.9	5460.40186	137.45162	0.41235486	C_{25}
21.389	3426.45703	86.40341	0.25921023	C_{26}
21.863	1596.8252	42.19519	0.12658557	C_{27}
22.32	849.73572	22.23894	0.06671682	C_{28}
22.76	504.10687	14.38224	0.04314672	C_{29}
23.19	233.90826	0	0	C_{30}
23.603	211.0016	7.92198	0.02376594	C_{31}
24.007	68.23561	0	0	C_{32}

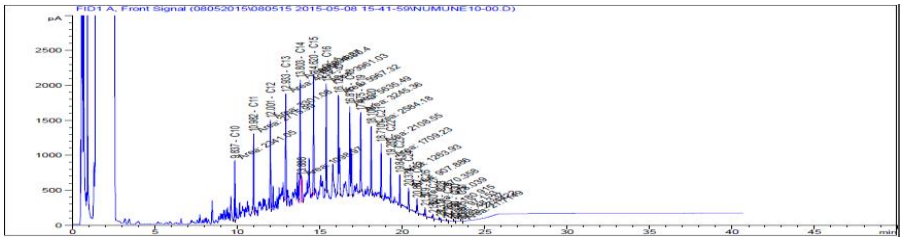

Figure D-28: EX:1, Port:1 T:1620 min, m=1.564 gr, gas chromatogram.

Table D-28: EX:1, Port:1 T:1620 min, m=1.564 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.837	2341.05151	51.80206	0.15540618	C_{10}
10.982	2715.98853	70.8655	0.2125965	C_{11}
12.001	3301.07959	85.23655	0.25570965	C_{12}
12.933	4012.50366	104.32445	0.31297335	C_{13}
13.803	6094.26514	154.99557	0.46498671	C_{14}
14.62	4800.40234	124.16376	0.37249128	C_{15}
15.389	3961.02539	100.28624	0.30085872	C_{16}
16.122	5967.32471	149.85312	0.44955936	C_{17}
16.815	5635.4917	140.24627	0.42073881	C_{18}
17.475	3245.36377	80.90248	0.24270744	C_{19}
18.108	2584.18359	64.40178	0.19320534	C_{20}
18.71	2108.55469	53.47477	0.16042431	C_{21}
19.287	1709.22815	43.04923	0.12914769	C_{22}
19.843	1263.92712	31.9016	0.0957048	C_{23}
20.374	907.88635	23.39813	0.07019439	C_{24}
20.887	670.35834	16.87455	0.05062365	C_{25}
21.379	378.03906	10.72885	0.03218655	C_{26}
21.86	180.91451	4.78056	0.01434168	C_{27}
22.317	97.15295	2.82605	0.00847815	C_{28}
22.76	48.33704	1.37906	0.00413718	C_{29}
23.19	27.44224	0	0	C_{30}
23.605	21.71488	8.15E-01	0.002445831	C_{31}
24.038	0	0	0	C_{32}

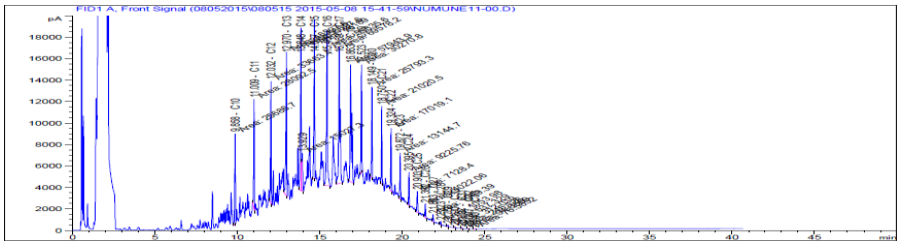

Figure D-29: EX:1, Port:2 T:1620 min, m=1.77 gr, gas chromatogram.

Table D-29: EX:1, Port:2 T:1620 min, m=1.77 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.858	2.57E+04	660.80031	1.98240093	C_{10}
11.009	2.81E+04	732.98773	2.19896319	C_{11}
12.032	3.37E+04	861.35858	2.58407574	C_{12}
12.97	4.66E+04	1211.53101	3.63459303	C_{13}
13.848	5.66E+04	1429.12397	4.28737191	C_{14}
14.667	4.82E+04	1185.2489	3.5557467	C_{15}
15.436	5.58E+04	1389.45407	4.16836221	C_{16}
16.169	6.96E+04	1747.26761	5.24180283	C_{17}
16.863	5.79E+04	1435.00692	4.30502076	C_{18}
17.523	3.03E+04	754.6089	2.2638267	C_{19}
18.149	2.58E+04	641.66251	1.92498753	C_{20}
18.75	2.10E+04	533.09834	1.59929502	C_{21}
19.324	1.70E+04	429.96186	1.28988558	C_{22}
19.872	1.31E+04	331.77288	0.99531864	C_{23}
20.395	9225.76465	233.40911	0.70022733	C_{24}
20.903	7128.39746	179.43914	0.53831742	C_{25}
21.392	4022.05518	101.18866	0.30356598	C_{26}
21.863	1999.3938	52.83284	0.15849852	C_{27}
22.323	1053.98242	27.50749	0.08252247	C_{28}
22.76	537.32892	15.33007	0.04599021	C_{29}
23.19	312.01862	1.25174	0.00375522	C_{30}
23.607	245.12614	9.20317	0.02760951	C_{31}
24.007	94.85694	0	0	C_{32}

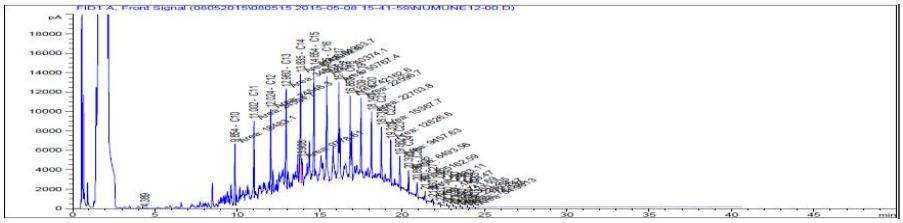

Figure D-30: EX:1, Port:3 T:1620 min, m=1.227 gr, gas chromatogram.

Table D-30: EX:1, Port:3 T:1620 min, m=1.227 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.854	1.85E+04	472.88572	1.41865716	C_{10}
11.002	2.46E+04	641.72417	1.92517251	C_{11}
12.024	2.45E+04	628.30709	1.88492127	C_{12}
12.96	3.45E+04	897.19832	2.69159496	C_{13}
13.835	4.21E+04	1062.25466	3.18676398	C_{14}
14.654	3.49E+04	860.35345	2.58106035	C_{15}
15.425	4.04E+04	1005.20965	3.01562895	C_{16}
16.156	5.08E+04	1274.88407	3.82465221	C_{17}
16.85	4.22E+04	1044.38094	3.13314282	C_{18}
17.509	2.26E+04	563.3054	1.6899162	C_{19}
18.14	2.27E+04	564.82101	1.69446303	C_{20}
18.738	1.54E+04	389.73872	1.16921616	C_{21}
19.313	1.26E+04	318.95487	0.95686461	C_{22}
19.862	9457.63086	238.71121	0.71613363	C_{23}
20.39	6493.56348	164.4261	0.4932783	C_{24}
20.899	5162.59229	129.95503	0.38986509	C_{25}
21.39	2933.11304	74.15654	0.22246962	C_{26}
21.86	1450.47058	38.32785	0.11498355	C_{27}
22.317	743.68988	19.50348	0.05851044	C_{28}
22.76	360.20493	10.2767	0.0308301	C_{29}
23.193	235.54045	0	0	C_{30}
23.603	179.74716	6.74854	0.02024562	C_{31}
24.004	74.03304	0	0	C_{32}

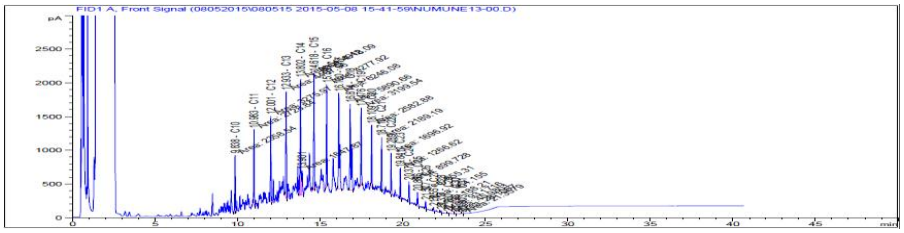

Figure D-31: EX:1, Port:1 T:1680 min, m=1.27 gr, gas chromatogram.

Table D-31: EX:1, Port:1 T:1680 min, m=1.27 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.838	2358.54004	52.25827	0.15677481	C_{10}
10.983	2728.84473	71.20094	0.21360282	C_{11}
12.001	3275.97314	84.59478	0.25378434	C_{12}
12.933	4407.95654	114.60617	0.34381851	C_{13}
13.802	5454.42236	138.85643	0.41656929	C_{14}
14.618	4918.08594	127.04176	0.38112528	C_{15}
15.389	4277.91943	108.16157	0.32448471	C_{16}
16.12	6246.0752	156.85318	0.47055954	C_{17}
16.814	5890.65674	146.56222	0.43968666	C_{18}
17.476	3199.54443	79.76027	0.23928081	C_{19}
18.109	2582.88281	64.36942	0.19310826	C_{20}
18.71	2189.19067	55.51977	0.16655931	C_{21}
19.289	1696.91589	42.73807	0.12821421	C_{22}
19.841	1266.62317	31.96965	0.09590895	C_{23}
20.373	899.72766	23.19214	0.06957642	C_{24}
20.886	655.31006	16.49575	0.04948725	C_{25}
21.377	364.15549	10.3842	0.0311526	C_{26}
21.855	188.21013	4.97334	0.01492002	C_{27}
22.317	93.17159	2.72335	0.00817005	C_{28}
22.76	45.98011	1.31182	0.00393546	C_{29}
23.193	28.10567	0	0	C_{30}
23.603	21.35789	8.02E-01	0.002405622	C_{31}
24.038	0	0	0	C_{32}

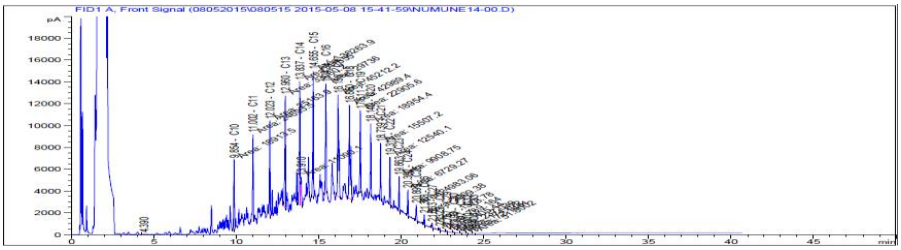

Figure D-32: EX1, Port:2 T:1680 min, m=1.406 gr, gas chromatogram.

Table D-32: EX1, Port:2 T:1680 min, m=1.406 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.854	1.89E+04	484.11238	1.45233714	C_{10}
11.002	2.47E+04	644.35391	1.93306173	C_{11}
12.023	2.52E+04	644.09519	1.93228557	C_{12}
12.96	3.31E+04	859.56081	2.57868243	C_{13}
13.837	4.17E+04	1051.96432	3.15589296	C_{14}
14.655	3.63E+04	893.61769	2.68085307	C_{15}
15.424	2.97E+04	740.83543	2.22250629	C_{16}
16.158	4.52E+04	1135.38232	3.40614696	C_{17}
16.85	4.30E+04	1064.84568	3.19453704	C_{18}
17.511	2.29E+04	571.0064	1.7130192	C_{19}
18.14	1.90E+04	471.56393	1.41469179	C_{20}
18.739	1.55E+04	393.27622	1.17982866	C_{21}
19.313	1.25E+04	316.76777	0.95030331	C_{22}
19.863	9908.74512	250.09736	0.75029208	C_{23}
20.392	6729.26514	170.37713	0.51113139	C_{24}
20.899	4983.05859	125.43573	0.37630719	C_{25}
21.388	2909.38086	73.5674	0.2207022	C_{26}
21.863	1378.77539	36.43335	0.10930005	C_{27}
22.323	769.16376	20.16058	0.06048174	C_{28}
22.757	405.44046	11.56727	0.03470181	C_{29}
23.193	237.03914	0	0	C_{30}
23.607	174.67188	6.55799	0.01967397	C_{31}
24.01	72.14011	0	0	C_{32}

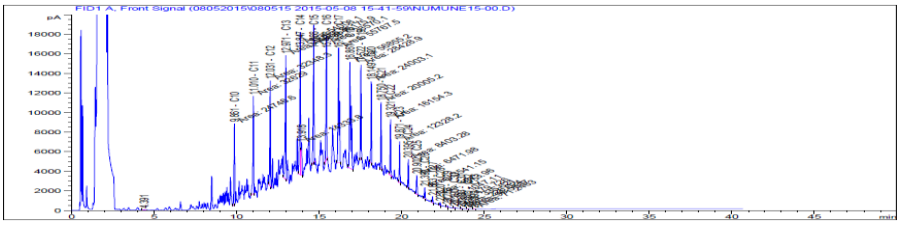

Figure D-33: EX:1, Port:3 T:1680 min, m=1.678 gr, gas chromatogram.

Table D-33: EX:1, Port:3 T:1680 min, m=1.678 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.861	2.47E+04	636.27545	1.90882635	C_{10}
11.01	3.26E+04	851.35437	2.55406311	C_{11}
12.031	3.23E+04	827.74146	2.48322438	C_{12}
12.971	4.50E+04	1168.87106	3.50661318	C_{13}
13.847	5.40E+04	1363.55433	4.09066299	C_{14}
14.666	4.52E+04	1111.56225	3.33468675	C_{15}
15.436	3.86E+04	960.37869	2.88113607	C_{16}
16.168	5.58E+04	1400.45007	4.20135021	C_{17}
16.861	5.69E+04	1408.05801	4.22417403	C_{18}
17.522	2.84E+04	708.6926	2.1260778	C_{19}
18.149	2.40E+04	597.13606	1.79140818	C_{20}
18.75	2.00E+04	507.34864	1.52204592	C_{21}
19.321	1.62E+04	408.10619	1.22431857	C_{22}
19.871	1.23E+04	311.164	0.933492	C_{23}
20.395	8403.27832	212.64286	0.63792858	C_{24}
20.902	6471.97949	162.9155	0.4887465	C_{25}
21.393	3541.14575	89.25047	0.26775141	C_{26}
21.863	1873.96228	49.51838	0.14855514	C_{27}
22.32	1047.10876	27.33018	0.08199054	C_{28}
22.763	479.72601	13.68665	0.04105995	C_{29}
23.19	335.62061	2.00109	0.00600327	C_{30}
23.603	226.02356	8.48597	0.02545791	C_{31}
24.01	96.55173	0	0	C_{32}

D.1.2 Experiment 2

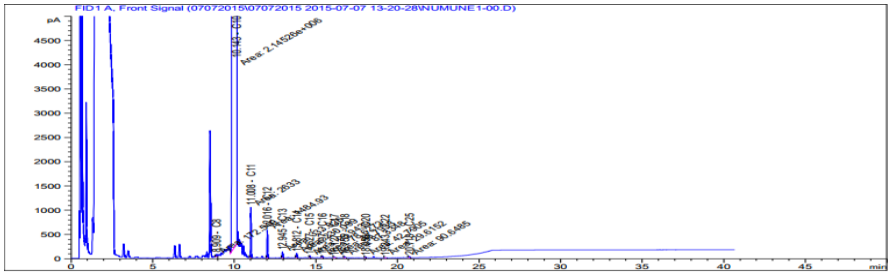

Figure D-34: EX:2, Port:1 T:30 min, m=1.625 gr, decane gas chromatogram.

Table D-34: EX:2, Port:1 T:30 min, m=1.625 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.909	172.54901	4.40877	0.01322631	C_8
10.143	2.15E+06	5.60E+04	167.8569	C_{10}
11.008	2632.99829	68.70012	0.20610036	C_{11}
12.016	1484.9281	38.81202	0.11643606	C_{12}
12.945	333.62561	8.67421	0.02602263	C_{13}
13.812	230.0992	7.08019	0.02124057	C_{14}
14.627	93.94395	9.06537	0.02719611	C_{15}
15.397	78.62717	3.80235	0.01140705	C_{16}
16.127	48.79333	1.22531	0.00367593	C_{17}
16.755	87.33485	2.91596	0.00874788	C_{18}
17.489	0	0	0	C_{19}
18.056	42.79049	1.19185	0.00357555	C_{20}
18.725	0	0	0	C_{21}
19.243	29.61521	6.02E-01	0.001805865	C_{22}
19.862	0	0	0	C_{23}
20.397	0	0	0	C_{24}
20.718	90.64846	2.28184	0.00684552	C_{25}

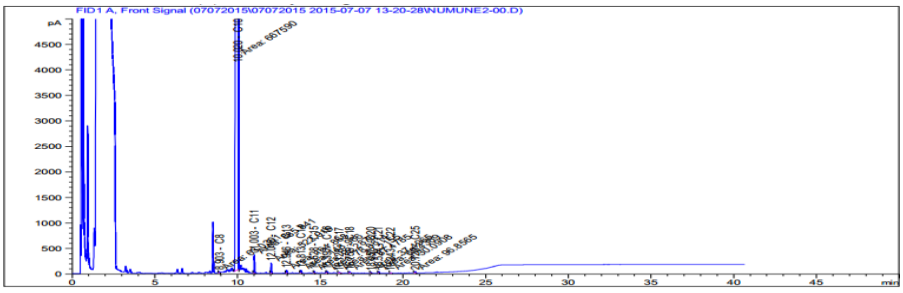

Figure D-35: EX:2, Port:2 T:30 min, m=1.314 gr, decane gas chromatogram.

Table D-35: EX:2, Port:2 T:30 min, m=1.314 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.903	63.03008	1.61047	0.00483141	C_8
10.02	6.68E+05	1.74E+04	52.2168	C_{10}
11.003	885.84149	23.11335	0.06934005	C_{11}
12.016	522.91595	14.22103	0.04266309	C_{12}
12.946	164.86298	4.28641	0.01285923	C_{13}
13.813	148.96613	5.03372	0.01510116	C_{14}
14.628	92.28759	9.02486	0.02707458	C_{15}
15.397	78.88143	3.80866	0.01142598	C_{16}
16.126	43.21552	1.08524	0.00325572	C_{17}
16.755	87.47852	2.91952	0.00875856	C_{18}
17.489	-		0	C_{19}
18.057	37.49653	1.06018	0.00318054	C_{20}
18.524	69.43685	1.76098	0.00528294	C_{21}
19.243	30.09077	6.14E-01	0.001841919	C_{22}
19.862	0	0	0	C_{23}
20.397	0	0	0	C_{24}
20.72	96.85648	2.43811	0.00731433	C_{25}

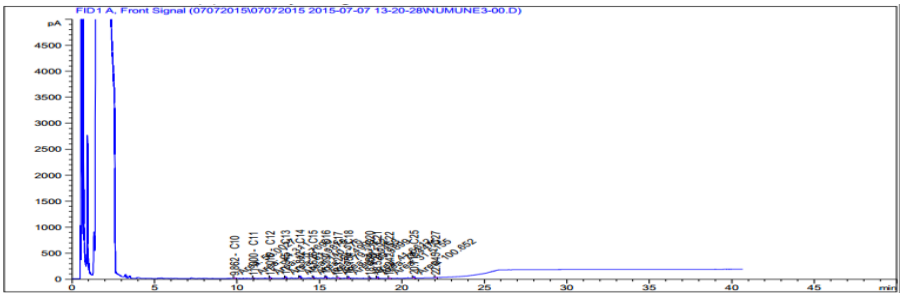

Figure D-36: EX:2, Port:3 T:30 min, m=1.171 gr, decane gas chromatogram.

Table D-36: EX:2, Port:3 T:30 min, m=1.171 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.958	0	0	0	**C_8**
9.862	50.00272	0	0	**C_{10}**
11	24.31099	6.34E-01	0.001902966	**C_{11}**
12.016	45.76957	2.02419	0.00607257	**C_{12}**
12.945	81.98763	2.13167	0.00639501	**C_{13}**
13.812	110.57639	4.06539	0.01219617	**C_{14}**
14.626	94.49983	9.07896	0.02723688	**C_{15}**
15.397	79.32516	3.81969	0.01145907	**C_{16}**
16.123	40.94526	1.02823	0.00308469	**C_{17}**
16.754	89.98994	2.98168	0.00894504	**C_{18}**
17.489	0	0	0	**C_{19}**
18.054	41.66124	1.16376	0.00349128	**C_{20}**
18.524	77.44751	1.96414	0.00589242	**C_{21}**
19.242	31.51551	6.50E-01	0.001949937	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.719	100.65182	2.53365	0.00760095	**C_{25}**

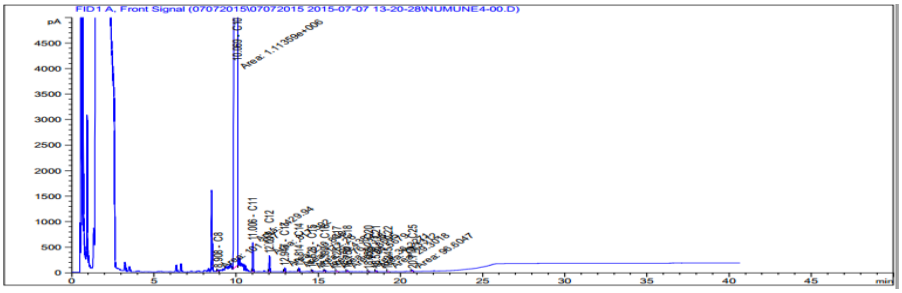

Figure D-37: EX:2, Port:1 T:60 min, m=1.091 gr, decane gas chromatogram.

Table D-37: EX:2, Port:1 T:60 min, m=1.091 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.908	101.19713	2.58567	0.00775701	**C_8**
10.069	1.11E+06	2.90E+04	87.12	**C_{10}**
11.006	1429.94202	37.31001	0.11193003	**C_{11}**
12.017	817.39197	21.74843	0.06524529	**C_{12}**
12.947	216.84784	5.63801	0.01691403	**C_{13}**
13.814	172.25958	5.62126	0.01686378	**C_{14}**
14.628	90.43818	8.97963	0.02693889	**C_{15}**
15.399	76.03384	3.7379	0.0112137	**C_{16}**
16.128	40.86052	1.0261	0.0030783	**C_{17}**
16.754	84.56793	2.84747	0.00854241	**C_{18}**
17.489	0	0	0	**C_{19}**
18.055	36.22711	1.02861	0.00308583	**C_{20}**
18.526	73.33118	1.85974	0.00557922	**C_{21}**
19.245	29.30182	5.94E-01	0.001782105	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.719	96.6047	2.43178	0.00729534	**C_{25}**

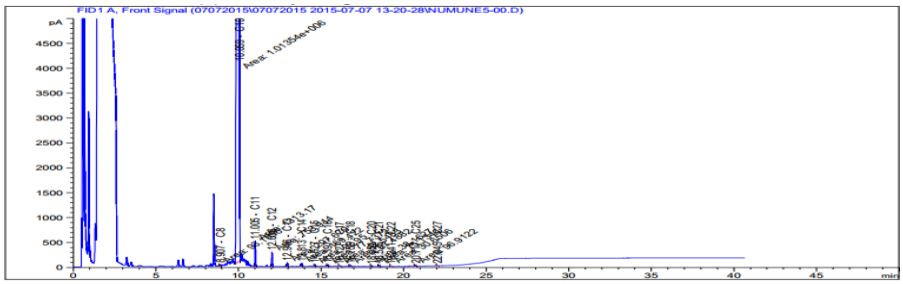

Figure D-38: EX:2, Port:2 T:60 min, m=0.989 gr, decane gas chromatogram.

Table D-38: EX:2, Port:2 T:60 min, m=0.989 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.907	93.10555	2.37893	0.00713679	**C_8**
10.059	1.01E+06	2.64E+04	79.2903	**C_{10}**
11.005	1313.17395	34.2633	0.1027899	**C_{11}**
12.016	753.91443	20.12582	0.06037746	**C_{12}**
12.946	207.67947	5.39963	0.01619889	**C_{13}**
13.813	169.42171	5.54968	0.01664904	**C_{14}**
14.627	92.94995	9.04106	0.02712318	**C_{15}**
15.397	77.73724	3.78023	0.01134069	**C_{16}**
16.127	42.54827	1.06848	0.00320544	**C_{17}**
16.755	87.48815	2.91975	0.00875925	**C_{18}**
17.489	0	0	0	**C_{19}**
18.054	38.16273	1.07675	0.00323025	**C_{20}**
18.525	75.13441	1.90547	0.00571641	**C_{21}**
19.241	30.65062	6.28E-01	0.001884366	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.717	96.91223	2.43952	0.00731856	**C_{25}**

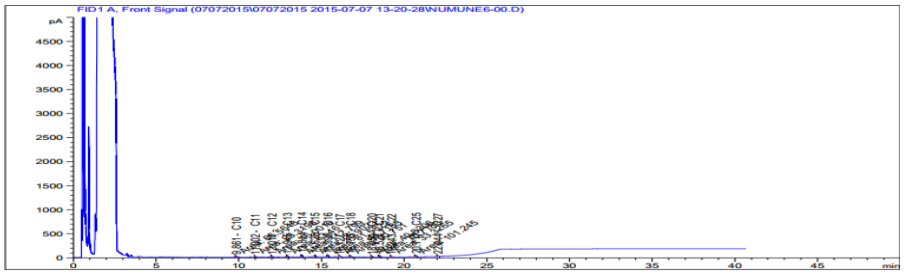

Figure D-39: EX:2, Port:3 T:60 min, m=1.147 gr, decane gas chromatogram.

Table D-39: EX:2, Port:3 T:60 min, m=1.147 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.958	0	0	0	**C_8**
9.861	66.56485	0	0	**C_{10}**
11.002	25.31977	6.61E-01	0.001981929	**C_{11}**
12.017	46.00159	2.03012	0.00609036	**C_{12}**
12.945	83.46002	2.16995	0.00650985	**C_{13}**
13.814	112.7986	4.12144	0.01236432	**C_{14}**
14.628	95.90232	9.11326	0.02733978	**C_{15}**
15.398	81.58221	3.87578	0.01162734	**C_{16}**
16.127	44.7183	1.12298	0.00336894	**C_{17}**
16.755	90.751	3.00052	0.00900156	**C_{18}**
17.489	0	0	0	**C_{19}**
18.054	40.83059	1.1431	0.0034293	**C_{20}**
18.524	76.71831	1.94564	0.00583692	**C_{21}**
19.243	33.32654	6.96E-01	0.002087244	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.717	101.24458	2.54857	0.00764571	**C_{25}**

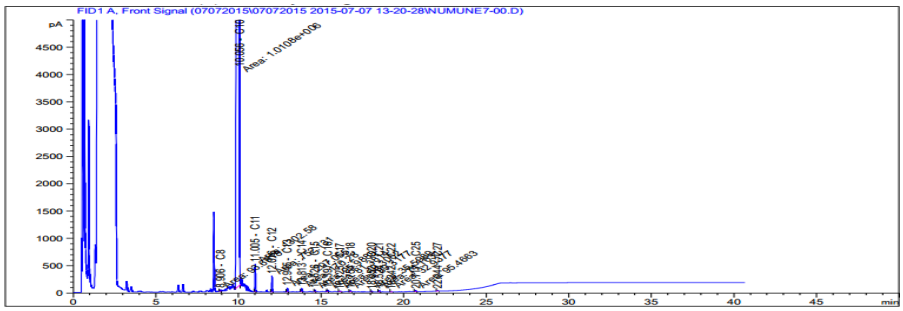

Figure D-40: EX:2, Port:1 T:90 min, m=1.096 gr, decane gas chromatogram.

Table D-40: EX:2, Port:1 T:90 min, m=1.096 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.906	93.66181	2.39314	0.00717942	**C_8**
10.056	1.01E+06	2.64E+04	79.0758	**C_{10}**
11.005	1302.57629	33.98679	0.10196037	**C_{11}**
12.016	752.13098	20.08023	0.06024069	**C_{12}**
12.945	207.05495	5.3834	0.0161502	**C_{13}**
13.813	170.28009	5.57133	0.01671399	**C_{14}**
14.626	95.98875	9.11537	0.02734611	**C_{15}**
15.397	81.38145	3.87079	0.01161237	**C_{16}**
16.125	49.30617	1.23819	0.00371457	**C_{17}**
16.754	89.31769	2.96504	0.00889512	**C_{18}**
17.489	0	0	0	**C_{19}**
18.052	35.59886	1.01298	0.00303894	**C_{20}**
18.524	74.16314	1.88084	0.00564252	**C_{21}**
19.242	32.93767	6.86E-01	0.00205776	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.717	95.46627	2.40312	0.00720936	**C_{25}**

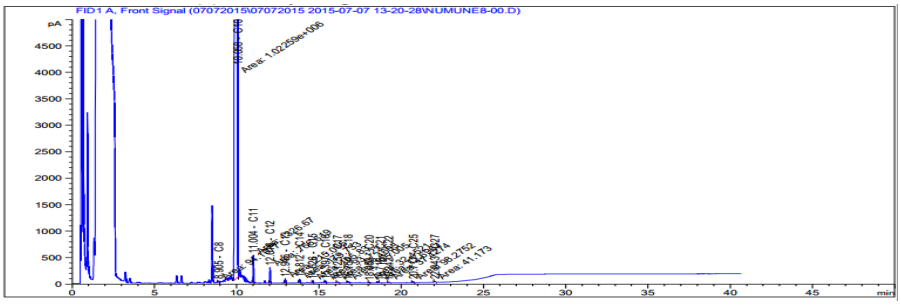

Figure D-41: EX:2, Port:2 T:90 min, m=0.821 gr, decane gas chromatogram.

Table D-41: EX:2, Port:2 T:90 min, m=0.821 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.905	94.10767	2.40453	0.00721359	**C_8**
10.058	1.02E+06	2.67E+04	79.9989	**C_{10}**
11.004	1326.66699	34.61536	0.10384608	**C_{11}**
12.016	766.61945	20.45058	0.06135174	**C_{12}**
12.945	215.06482	5.59165	0.01677495	**C_{13}**
13.812	179.73335	5.80978	0.01742934	**C_{14}**
14.626	105.82985	9.35604	0.02806812	**C_{15}**
15.397	93.12203	4.16257	0.01248771	**C_{16}**
16.125	66.46031	1.66897	0.00500691	**C_{17}**
16.754	105.0051	3.35334	0.01006002	**C_{18}**
17.489	0	0	0	**C_{19}**
18.053	32.45209	9.35E-01	0.002804139	**C_{20}**
18.716	12.69667	3.22E-01	0.000965997	**C_{21}**
19.242	37.42737	7.99E-01	0.002398152	**C_{22}**
19.862	0	0.00E+00	0	**C_{23}**
20.397	0	0.00E+00	0	**C_{24}**
20.717	98.27522	2.47383	0.00742149	**C_{25}**

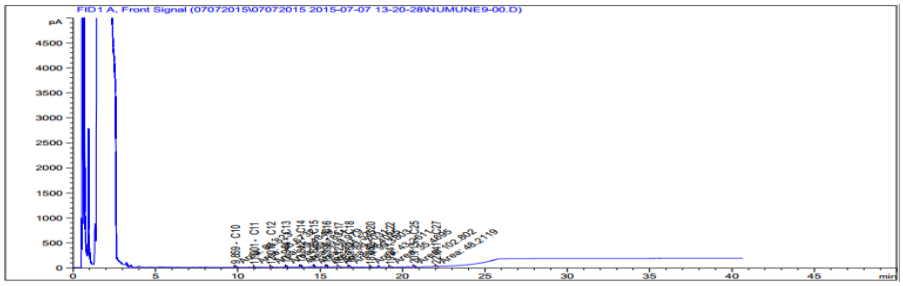

Figure D-42: EX:2, Port:3 T:90 min, m=1.125 gr, decane gas chromatogram.

Table D-42: EX:2, Port:3 T:90 min, m=1.125 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.958	0	0	0	**C_8**
9.859	81.82298	0	0	**C_{10}**
11.001	26.67322	6.96E-01	0.002087871	**C_{11}**
12.016	49.48483	2.11916	0.00635748	**C_{12}**
12.944	89.18314	2.31875	0.00695625	**C_{13}**
13.812	119.97852	4.30255	0.01290765	**C_{14}**
14.626	104.52458	9.32412	0.02797236	**C_{15}**
15.396	88.70308	4.05275	0.01215825	**C_{16}**
16.123	49.40253	1.24061	0.00372183	**C_{17}**
16.752	99.38033	3.21411	0.00964233	**C_{18}**
17.489	0	0	0	**C_{19}**
18.052	43.26111	1.20356	0.00361068	**C_{20}**
18.725	0	0	0	**C_{21}**
19.241	35.46946	7.50E-01	0.002249712	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.715	102.80188	2.58777	0.00776331	**C_{25}**

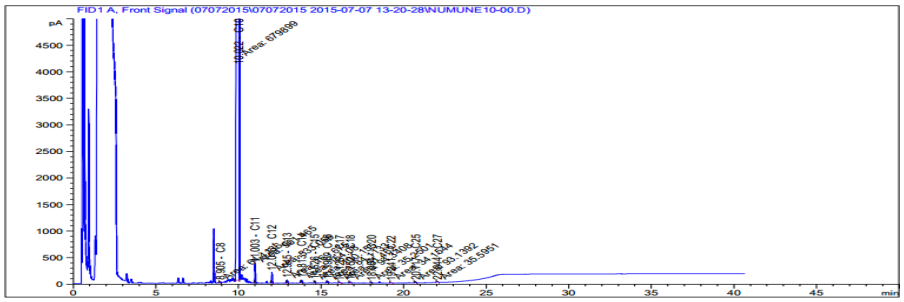

Figure D-43: EX:2, Port:1 T:120 min, m=0.935 gr, decane gas chromatogram.

Table D-43: EX:2, Port:1 T:120 min, m=0.935 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.905	64.41364	1.64582	0.00493746	**C_8**
10.022	6.80E+05	1.77E+04	53.1798	**C_{10}**
11.003	901.46527	23.52101	0.07056303	**C_{11}**
12.016	533.0556	14.48022	0.04344066	**C_{12}**
12.945	169.67468	4.41151	0.01323453	**C_{13}**
13.813	154.08049	5.16272	0.01548816	**C_{14}**
14.626	100.15508	9.21726	0.02765178	**C_{15}**
15.396	84.11329	3.93868	0.01181604	**C_{16}**
16.126	51.46201	1.29233	0.00387699	**C_{17}**
16.752	94.34082	3.08937	0.00926811	**C_{18}**
17.489	0	0	0	**C_{19}**
18.054	35.25006	1.0043	0.0030129	**C_{20}**
18.725	0	0	0	**C_{21}**
19.241	34.1544	7.17E-01	0.00215001	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.717	93.13919	2.34454	0.00703362	**C_{25}**

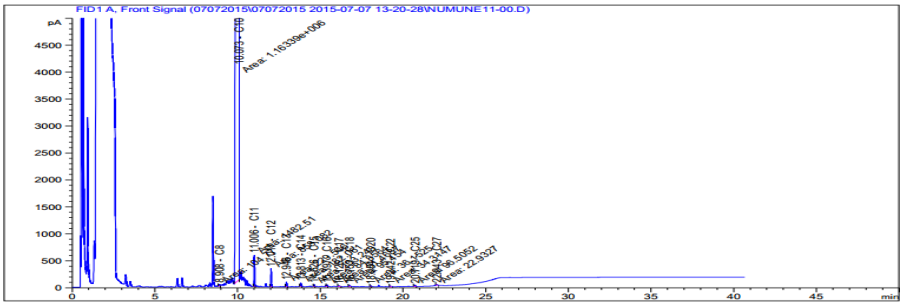

Figure D-44: EX:2, Port:2 T:120 min, m=1.003 gr, decane gas chromatogram.

Table D-44: EX:2, Port:2 T:120 min, m=1.003 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.908	104.77001	2.67696	0.00803088	**C_8**
10.073	1.16E+06	3.03E+04	91.0173	**C_{10}**
11.006	1482.50928	38.68159	0.11604477	**C_{11}**
12.017	858.08185	22.78855	0.06836565	**C_{12}**
12.946	229.5457	5.96815	0.01790445	**C_{13}**
13.813	182.06149	5.8685	0.0176055	**C_{14}**
14.626	103.24781	9.2929	0.0278787	**C_{15}**
15.397	84.85643	3.95715	0.01187145	**C_{16}**
16.126	51.4687	1.2925	0.0038775	**C_{17}**
16.753	95.45404	3.11693	0.00935079	**C_{18}**
17.489	0	0	0	**C_{19}**
18.054	36.15249	1.02675	0.00308025	**C_{20}**
18.725	0	0	0	**C_{21}**
19.242	34.31472	7.21E-01	0.002162163	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.719	96.50517	2.42927	0.00728781	**C_{25}**

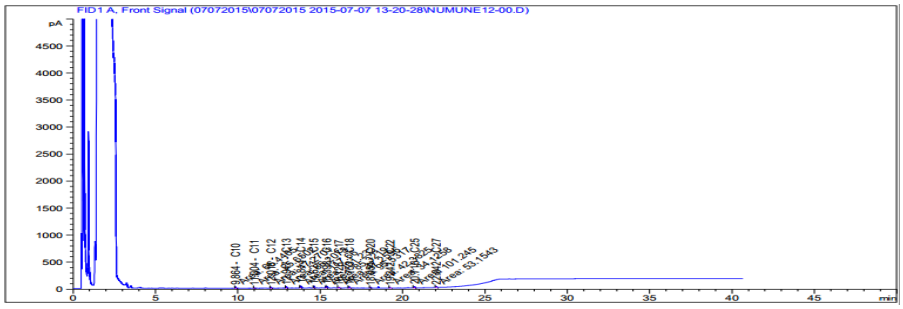

Figure D-45: EX:2, Port:3 T:120 min, m=0.795 gr, decane gas chromatogram.

Table D-45: EX:2, Port:3 T:120 min, m=0.795 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.958	0	0	0	**C_8**
9.864	66.44654	0	0	**C_{10}**
11.004	25.65019	6.69E-01	0.002007792	**C_{11}**
12.018	47.27007	2.06255	0.00618765	**C_{12}**
12.947	86.20729	2.24138	0.00672414	**C_{13}**
13.814	117.66032	4.24407	0.01273221	**C_{14}**
14.627	101.23242	9.24361	0.02773083	**C_{15}**
15.398	85.3219	3.96872	0.01190616	**C_{16}**
16.126	47.25959	1.1868	0.0035604	**C_{17}**
16.753	95.53166	3.11885	0.00935655	**C_{18}**
17.489	0	0	0	**C_{19}**
18.054	42.38249	1.1817	0.0035451	**C_{20}**
18.725	0	0	0	**C_{21}**
19.242	34.12577	7.16E-01	0.002147838	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.716	101.24506	2.54858	0.00764574	**C_{25}**

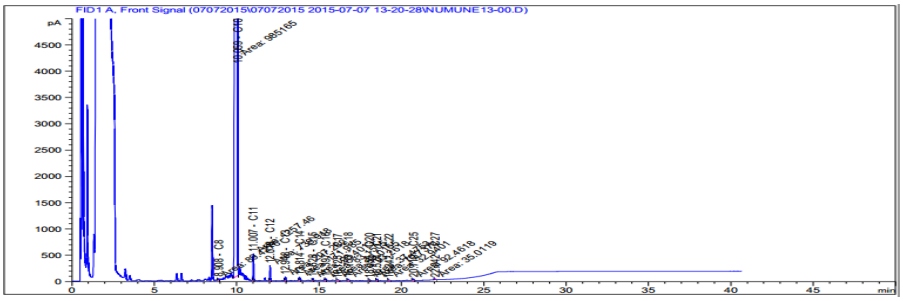

Figure D-46: EX:2, Port:1 T:180 min, m=1.246 gr, gas chromatogram.

Table D-46: EX:2, Port:1 T:180 min, m=1.246 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.908	89.42757	2.28495	0.00685485	**C_8**
10.059	9.85E+05	2.57E+04	77.0697	**C_{10}**
11.007	1257.45654	32.80952	0.09842856	**C_{11}**
12.018	739.91809	19.76804	0.05930412	**C_{12}**
12.948	207.28244	5.38931	0.01616793	**C_{13}**
13.814	171.98518	5.61434	0.01684302	**C_{14}**
14.628	98.40128	9.17437	0.02752311	**C_{15}**
15.397	83.15045	3.91476	0.01174428	**C_{16}**
16.125	49.01648	1.23092	0.00369276	**C_{17}**
16.753	93.26182	3.06267	0.00918801	**C_{18}**
17.489	0	0	0	**C_{19}**
18.055	37.47531	1.05965	0.00317895	**C_{20}**
18.524	70.73743	1.79396	0.00538188	**C_{21}**
19.242	32.94009	6.86E-01	0.002057943	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.719	92.46177	2.32749	0.00698247	**C_{25}**

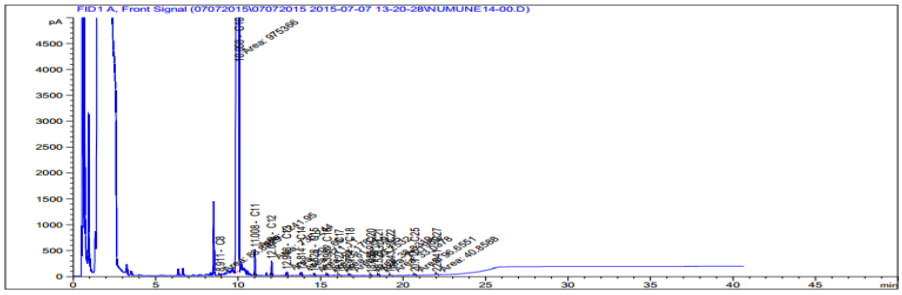

Figure D-47: EX:2, Port:2 T:180 min, m=0.940 gr, decane gas chromatogram.

Table D-47: EX:2, Port:2 T:180 min, m=0.940 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.911	88.80292	2.26899	0.00680697	C_8
10.058	9.75E+05	2.54E+04	76.3026	C_{10}
11.008	1241.95264	32.40499	0.09721497	C_{11}
12.019	735.24384	19.64856	0.05894568	C_{12}
12.948	206.65001	5.37287	0.01611861	C_{13}
13.814	171.11049	5.59228	0.01677684	C_{14}
14.628	97.17825	9.14446	0.02743338	C_{15}
15.398	81.95091	3.88495	0.01165485	C_{16}
16.127	46.23952	1.16118	0.00348354	C_{17}
16.754	93.2532	3.06245	0.00918735	C_{18}
17.489	0	0	0	C_{19}
18.055	38.83186	1.09339	0.00328017	C_{20}
18.523	71.19894	1.80567	0.00541701	C_{21}
19.243	33.03782	6.88E-01	0.002065353	C_{22}
19.862	0	0	0	C_{23}
20.397	0	0	0	C_{24}
20.715	96.6551	2.43304	0.00729912	C_{25}

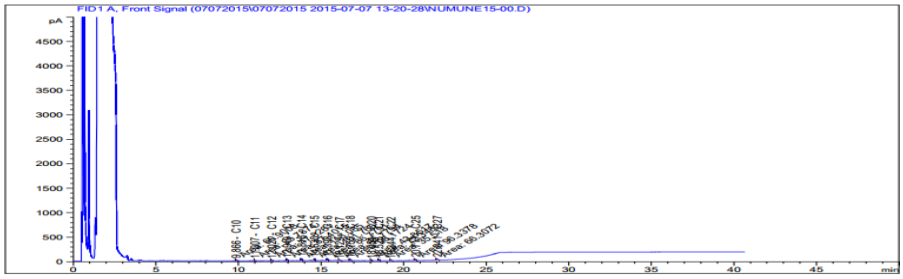

Figure D-48: EX:2, Port:3 T:180 min, m=1.062 gr, decane gas chromatogram.

Table D-48: EX:2, Port:3 T:180 min, m=1.062 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.958	-	0	0	**C_8**
9.866	60.90078	0	0	**C_{10}**
11.007	25.78745	6.73E-01	0.002018535	**C_{11}**
12.021	47.82611	2.07676	0.00623028	**C_{12}**
12.949	87.40149	2.27242	0.00681726	**C_{13}**
13.816	118.08466	4.25478	0.01276434	**C_{14}**
14.63	101.76584	9.25665	0.02776995	**C_{15}**
15.398	86.77907	4.00493	0.01201479	**C_{16}**
16.129	45.77944	1.14963	0.00344889	**C_{17}**
16.755	98.17241	3.18421	0.00955263	**C_{18}**
17.489	0	0	0	**C_{19}**
18.054	43.85173	1.21825	0.00365475	**C_{20}**
18.525	72.34816	1.83481	0.00550443	**C_{21}**
19.244	35.51805	7.51E-01	0.002253396	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.717	96.33783	2.42506	0.00727518	**C_{25}**

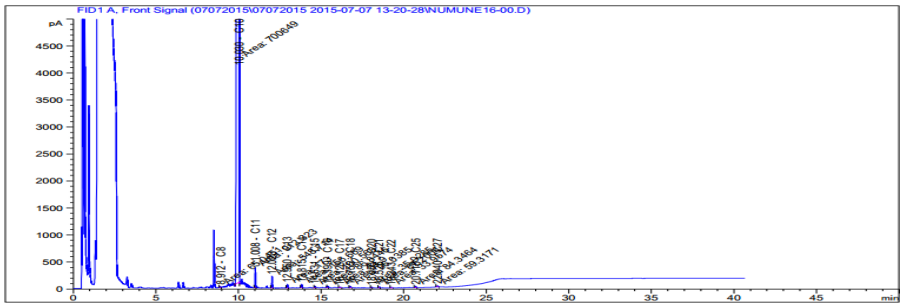

Figure D-49: EX:2, Port:1 T:240 min, m=1.025 gr, decane gas chromatogram.

Table D-49: EX:2, Port:1 T:240 min, m=1.025 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.912	65.04512	1.66196	0.00498588	**C_8**
10.03	7.01E+05	1.83E+04	54.8037	**C_{10}**
11.008	912.32288	23.8043	0.0714129	**C_{11}**
12.02	548.71417	14.88048	0.04464144	**C_{12}**
12.95	173.00002	4.49797	0.01349391	**C_{13}**
13.815	156.66902	5.22801	0.01568403	**C_{14}**
14.631	100.56802	9.22736	0.02768208	**C_{15}**
15.399	86.84457	4.00656	0.01201968	**C_{16}**
16.128	54.9	1.37866	0.00413598	**C_{17}**
16.755	96.03848	3.13139	0.00939417	**C_{18}**
17.489	0	0	0	**C_{19}**
18.055	35.92852	1.02118	0.00306354	**C_{20}**
18.526	67.20036	1.70426	0.00511278	**C_{21}**
19.243	33.95742	7.12E-01	0.002135073	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.718	84.34641	2.1232	0.0063696	**C_{25}**

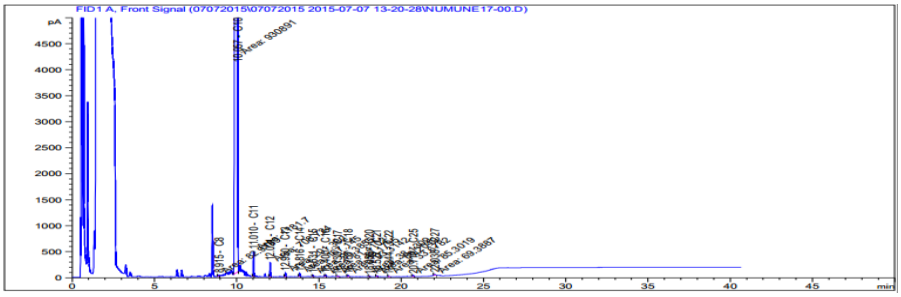

Figure D-50: EX:2, Port:2 T:240 min, m=1.092 gr, decane gas chromatogram.

Table D-50: EX:2, Port:2 T:240 min, m=1.092 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.915	82.91889	2.11865	0.00635595	**C_8**
10.057	9.31E+05	2.43E+04	72.8223	**C_{10}**
11.01	1181.70264	30.83295	0.09249885	**C_{11}**
12.021	708.72406	18.97066	0.05691198	**C_{12}**
12.95	201.38153	5.23589	0.01570767	**C_{13}**
13.816	167.14545	5.49226	0.01647678	**C_{14}**
14.631	96.38554	9.12508	0.02737524	**C_{15}**
15.4	81.41018	3.87151	0.01161453	**C_{16}**
16.13	49.17947	1.23501	0.00370503	**C_{17}**
16.757	93.31422	3.06396	0.00919188	**C_{18}**
17.489	-		0	**C_{19}**
18.056	38.13088	1.07596	0.00322788	**C_{20}**
18.527	66.20492	1.67901	0.00503703	**C_{21}**
19.244	33.67822	7.05E-01	0.002113908	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.719	85.30187	2.14726	0.00644178	**C_{25}**

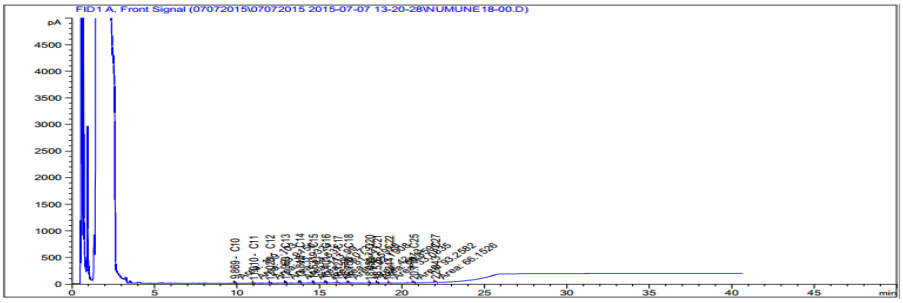

Figure D-51: EX:2, Port:3 T:240 min, m=1.161 gr, decane gas chromatogram.

Table D-51: EX:2, Port:3 T:240 min, m=1.161 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.958	0	0	0	**C_8**
9.869	109.10319	0	0	**C_{10}**
11.01	23.91561	6.24E-01	0.001872015	**C_{11}**
12.023	45.93243	2.02835	0.00608505	**C_{12}**
12.95	84.63704	2.20055	0.00660165	**C_{13}**
13.818	113.98985	4.15149	0.01245447	**C_{14}**
14.631	95.0731	9.09298	0.02727894	**C_{15}**
15.401	81.34097	3.86979	0.01160937	**C_{16}**
16.127	42.59284	1.0696	0.0032088	**C_{17}**
16.756	92.19078	3.03616	0.00910848	**C_{18}**
17.489	0	0	0	**C_{19}**
18.054	42.12995	1.17542	0.00352626	**C_{20}**
18.526	68.85905	1.74633	0.00523899	**C_{21}**
19.244	33.08345	6.90E-01	0.002068815	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.719	93.25822	2.34754	0.00704262	**C_{25}**

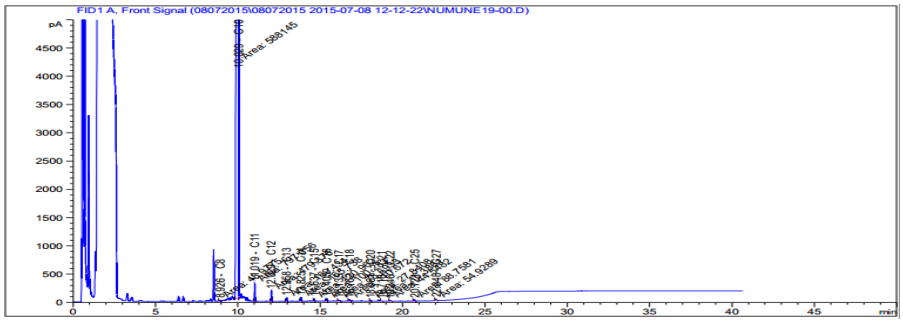

Figure D-52: EX:2, Port:1 T:1440 min, m=1.114 gr, decane gas chromatogram.

Table D-52: EX:2, Port:1 T:1440 min, m=1.114 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.926	48.97747	1.25142	0.00375426	**C_8**
10.029	5.88E+05	1.53E+04	45.9996	**C_{10}**
11.019	797.05591	20.79676	0.06239028	**C_{11}**
12.029	479.37552	13.10804	0.03932412	**C_{12}**
12.958	169.43408	4.40526	0.01321578	**C_{13}**
13.825	165.73819	5.45677	0.01637031	**C_{14}**
14.637	120.96247	9.72612	0.02917836	**C_{15}**
15.405	100.28268	4.34052	0.01302156	**C_{16}**
16.135	78.69328	1.97617	0.00592851	**C_{17}**
16.762	110.67154	3.4936	0.0104808	**C_{18}**
17.489	0	0	0	**C_{19}**
18.061	27.84083	8.20E-01	0.002460063	**C_{20}**
18.718	16.38609	4.16E-01	0.001246695	**C_{21}**
19.246	44.54822	9.79E-01	0.002938029	**C_{22}**
19.862	0	0.00E+00	0	**C_{23}**
20.397	0	0.00E+00	0	**C_{24}**
20.721	88.75812	2.23426	0.00670278	**C_{25}**

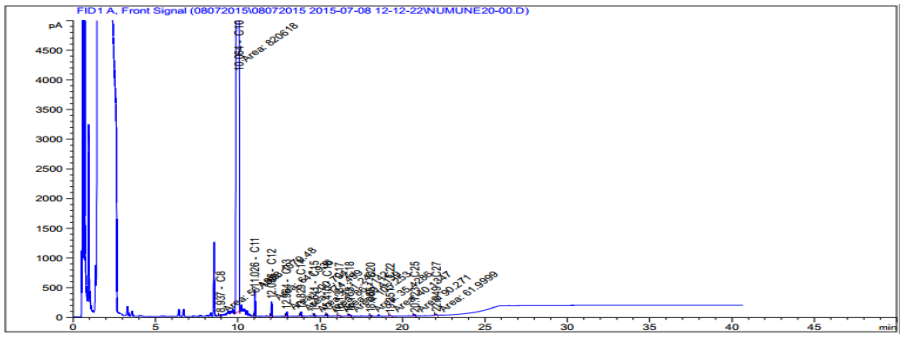

Figure D-53: EX:2, Port:2 T:1440 min, m=1.255 gr, decane gas chromatogram.

Table D-53: EX:2, Port:2 T:1440 min, m=1.255 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.937	56.13329	1.43425	0.00430275	**C_8**
10.064	8.21E+05	2.14E+04	64.1925	**C_{10}**
11.026	1079.48083	28.16578	0.08449734	**C_{11}**
12.036	641.93567	17.26341	0.05179023	**C_{12}**
12.964	200.79106	5.22054	0.01566162	**C_{13}**
13.829	174.49889	5.67775	0.01703325	**C_{14}**
14.641	111.24632	9.4885	0.0284655	**C_{15}**
15.41	86.11422	3.98841	0.01196523	**C_{16}**
16.138	60.41395	1.51713	0.00455139	**C_{17}**
16.765	105.25342	3.35949	0.01007847	**C_{18}**
17.489	0	0	0	**C_{19}**
18.065	35.42857	1.00874	0.00302622	**C_{20}**
18.725	0	0	0	**C_{21}**
19.251	40.13472	8.68E-01	0.002603415	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.723	90.27102	2.27234	0.00681702	**C_{25}**

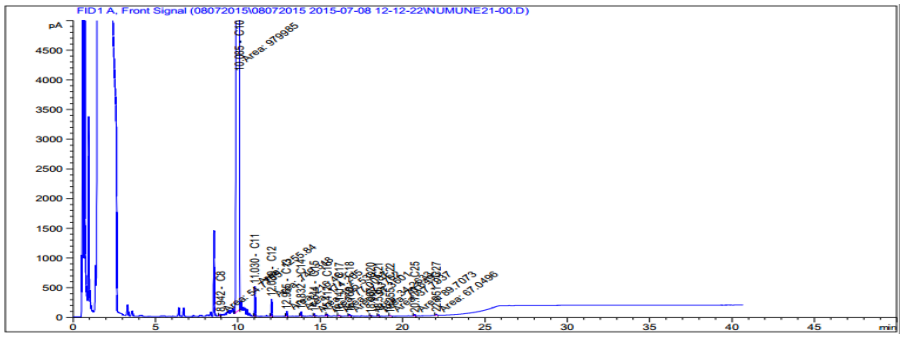

Figure D-54: EX:2, Port:3 T:1440 min, m=1.27 gr, decane gas chromatogram.

Table D-54: EX:2, Port:3 T:1440 min, m=1.27 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.942	54.77046	1.39943	0.00419829	**C_8**
10.085	9.80E+05	2.56E+04	76.6641	**C_{10}**
11.03	1255.83948	32.76733	0.09830199	**C_{11}**
12.039	749.31769	20.00831	0.06002493	**C_{12}**
12.965	216.48027	5.62845	0.01688535	**C_{13}**
13.832	174.20503	5.67033	0.01701099	**C_{14}**
14.644	105.538	9.3489	0.0280467	**C_{15}**
15.412	77.00865	3.76212	0.01128636	**C_{16}**
16.141	57.37621	1.44085	0.00432255	**C_{17}**
16.768	97.36008	3.16411	0.00949233	**C_{18}**
17.489	0	0	0	**C_{19}**
18.067	34.26326	9.80E-01	0.00293928	**C_{20}**
18.535	70.64928	1.79173	0.00537519	**C_{21}**
19.255	37.79372	8.09E-01	0.002425929	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.727	89.7073	2.25815	0.00677445	**C_{25}**

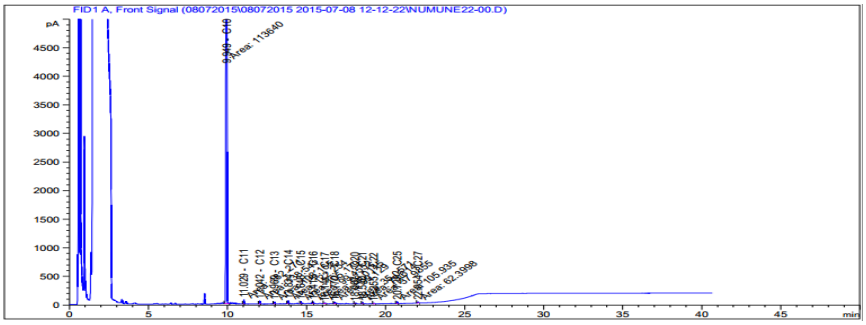

Figure D-55: EX:2, Port:1 T:1500 min, m=1.293 gr, decane gas chromatogram.

Table D-55: EX:2, Port:1 T:1500 min, m=1.293 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.958	0	0	0	**C_8**
9.949	1.14E+05	2955.1578	8.8654734	**C_{10}**
11.029	182.27122	4.75582	0.01426746	**C_{11}**
12.042	138.54123	4.39562	0.01318686	**C_{12}**
12.969	108.16491	2.81227	0.00843681	**C_{13}**
13.834	122.25385	4.35994	0.01307982	**C_{14}**
14.646	105.17893	9.34012	0.02802036	**C_{15}**
15.415	99.45523	4.31996	0.01295988	**C_{16}**
16.144	58.01446	1.45688	0.00437064	**C_{17}**
16.77	99.12897	3.20789	0.00962367	**C_{18}**
17.489	0	0	0	**C_{19}**
18.067	35.05711	1.00E+00	0.002998515	**C_{20}**
18.54	73.61401	1.86691	0.00560073	**C_{21}**
19.255	37.98552	8.13E-01	0.00244047	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0.00E+00	0	**C_{24}**
20.729	105.93474	2.66664	0.00799992	**C_{25}**

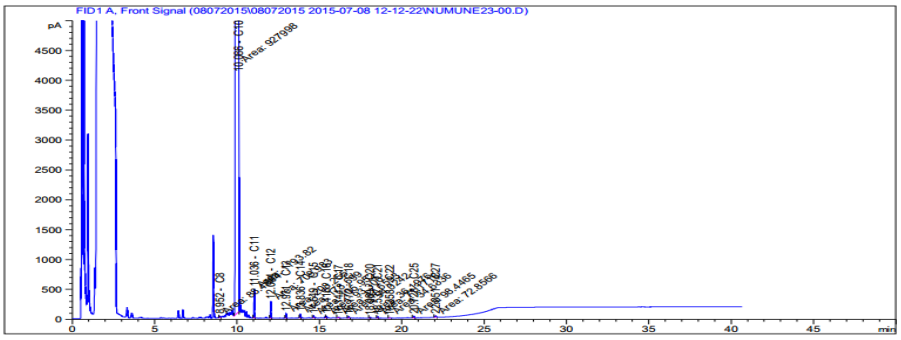

Figure D-56 :EX:2, Port:2 T:1500 min, m=1.164 gr, decane gas chromatogram.

Table D-56: EX:2, Port:2 T:1500 min, m=1.164 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.952	88.4864	2.2609	0.0067827	**C_8**
10.086	9.28E+05	2.42E+04	72.5958	**C_{10}**
11.036	1193.82312	31.1492	0.0934476	**C_{11}**
12.044	709.9826	19.00283	0.05700849	**C_{12}**
12.971	208.25514	5.4146	0.0162438	**C_{13}**
13.836	178.69911	5.78369	0.01735107	**C_{14}**
14.649	105.95216	9.35903	0.02807709	**C_{15}**
15.416	93.30598	4.16714	0.01250142	**C_{16}**
16.144	47.65935	1.19683	0.00359049	**C_{17}**
16.772	94.0242	3.08154	0.00924462	**C_{18}**
17.489	0	0	0	**C_{19}**
18.069	36.19765	1.02787	0.00308361	**C_{20}**
18.537	71.17179	1.80498	0.00541494	**C_{21}**
19.258	34.63362	7.29E-01	0.002186343	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.728	98.44652	2.47814	0.00743442	**C_{25}**

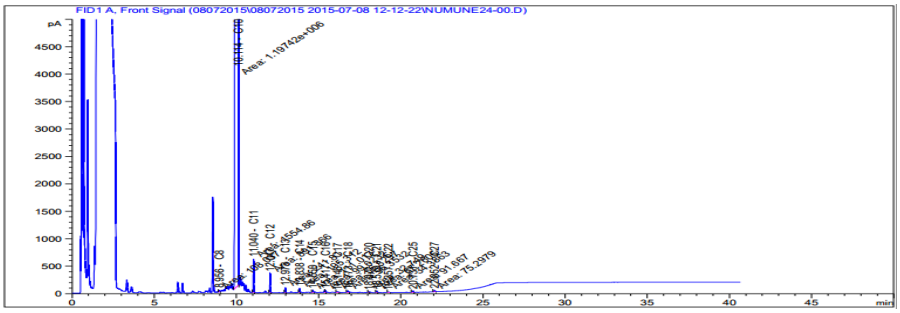

Figure D-57: EX:2, Port:3 T:1500 min, m=1.267 gr, decane gas chromatogram.

Table D-57: EX:2, Port:3 T:1500 min, m=1.267 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.956	108.03728	2.76044	0.00828132	**C_8**
10.114	1.20E+06	3.12E+04	93.6804	**C_{10}**
11.04	1554.86353	40.56946	0.12170838	**C_{11}**
12.047	891.36639	23.63937	0.07091811	**C_{12}**
12.973	241.81042	6.28703	0.01886109	**C_{13}**
13.838	195.31248	6.20274	0.01860822	**C_{14}**
14.65	111.01677	9.48289	0.02844867	**C_{15}**
15.417	99.62323	4.32413	0.01297239	**C_{16}**
16.146	56.82965	1.42712	0.00428136	**C_{17}**
16.773	96.35319	3.13918	0.00941754	**C_{18}**
17.489	0	0	0	**C_{19}**
18.071	32.74905	9.42E-01	0.002826297	**C_{20}**
18.539	67.26052	1.70578	0.00511734	**C_{21}**
19.257	34.38631	7.23E-01	0.00216759	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.731	91.66702	2.30748	0.00692244	**C_{25}**

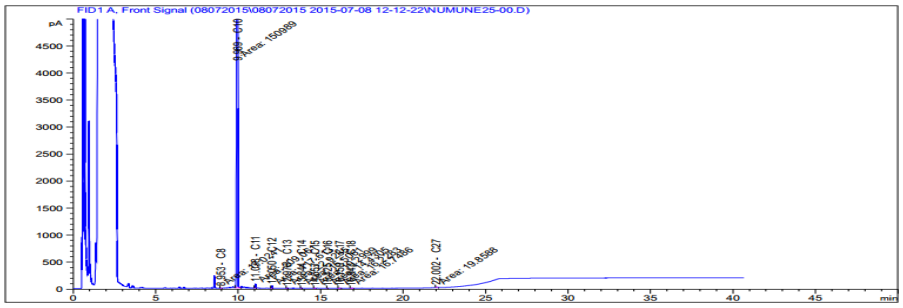

Figure D-58: EX:2, Port:1 T:1560 min, m=1.721 gr, decane gas chromatogram.

Table D-58: EX:2, Port:1 T:1560 min, m=1.721 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.953	17.02407	4.35E-01	1.30E-03	**C_8**
9.969	1.51E+05	3929.45496	1.18E+01	**C_{10}**
11.038	209.06105	5.45482	1.64E-02	**C_{11}**
12.05	117.61324	3.86066	1.16E-02	**C_{12}**
12.978	22.92854	5.96E-01	1.79E-03	**C_{13}**
13.844	15.50607	1.66737	5.00E-03	**C_{14}**
14.657	10.29993	7.01982	2.11E-02	**C_{15}**
15.425	14.43046	2.20695	6.62E-03	**C_{16}**
16.15	16.22826	4.08E-01	1.22E-03	**C_{17}**
16.843	16.74861	1.16878	3.51E-03	**C_{18}**
17.489	0	0	0	**C_{19}**
18.121	0	0	0	**C_{20}**
18.725	0	0	0	**C_{21}**
19.306	0	0	0	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.91	0	0	0	**C_{25}**

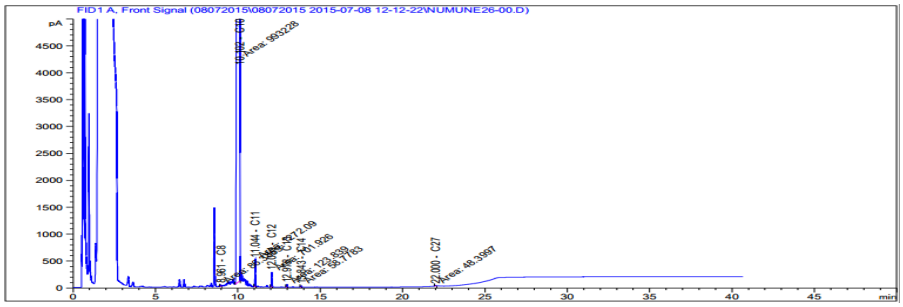

Figure D-59: EX:2, Port:2 T:1560 min, m=1.231 gr, decane gas chromatogram.

Table D-59: EX:2, Port:2 T:1560 min, m=1.231 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.961	86.38692	2.20726	0.00662178	**C_8**
10.102	9.93E+05	2.59E+04	77.7006	**C_{10}**
11.044	1272.08728	33.19127	0.09957381	**C_{11}**
12.051	701.92596	18.79689	0.05639067	**C_{12}**
12.978	123.8387	3.21979	0.00965937	**C_{13}**
13.843	58.77827	2.75885	0.00827655	**C_{14}**
14.626	0	0	0	**C_{15}**
15.398	0	0	0	**C_{16}**
16.131	0	0	0	**C_{17}**
16.826	0	0	0	**C_{18}**
17.489	0	0	0	**C_{19}**
18.121	0	0	0	**C_{20}**
18.725	0	0	0	**C_{21}**
19.306	0	0	0	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.91	0	0	0	**C_{25}**

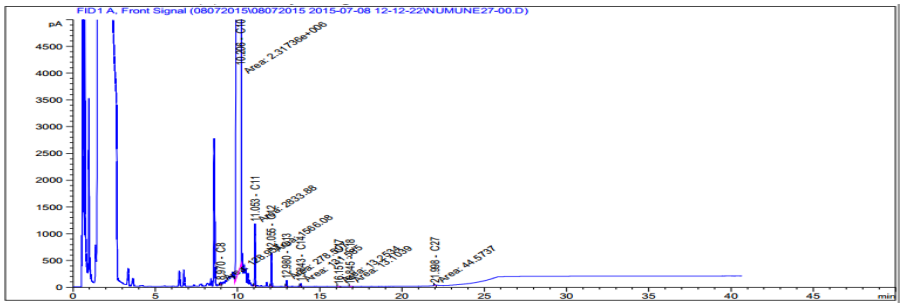

Figure D-60: EX:2, Port:3 T:1560 min, m=1.367 gr, decane gas chromatogram.

Table D-60: EX:2, Port:3 T:1560 min, m=1.367 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.97	128.95721	3.29497	0.00988491	**C_8**
10.206	2.32E+06	6.04E+04	181.3248	**C_{10}**
11.053	2833.88477	73.94164	0.22182492	**C_{11}**
12.055	1566.08203	40.88648	0.12265944	**C_{12}**
12.98	278.50742	7.24115	0.02172345	**C_{13}**
13.843	131.58488	4.5953	0.0137859	**C_{14}**
14.626	0	0	0	**C_{15}**
15.398	0	0	0	**C_{16}**
16.151	13.25344	3.33E-01	0.000998472	**C_{17}**
16.845	13.10387	1.07856	0.00323568	**C_{18}**
17.489	0	0	0	**C_{19}**
18.121	0	0	0	**C_{20}**
18.725	0	0	0	**C_{21}**
19.306	0	0	0	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.91	0	0	0	**C_{25}**

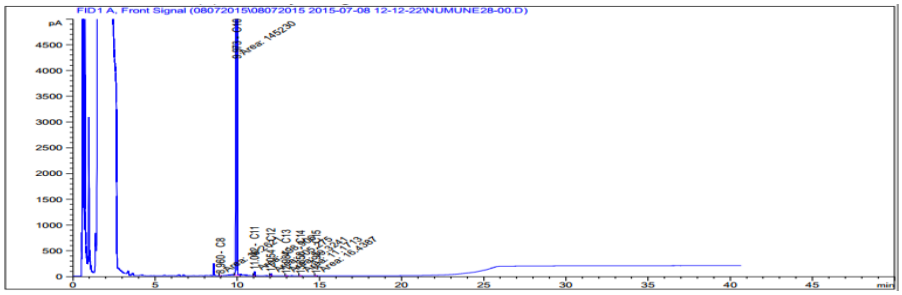

Figure D-61: EX:2, Port:1 T:1620 min, m=1.226 gr, decane gas chromatogram.

Table D-61: EX:2, Port:1 T:1620 min, m=1.226 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.96	16.26214	4.16E-01	1.25E-03	**C_8**
9.973	1.45E+05	3779.20958	1.13E+01	**C_{10}**
11.042	198.90646	5.18986	1.56E-02	**C_{11}**
12.054	105.2752	3.54528	1.06E-02	**C_{12}**
12.984	19.32412	5.02E-01	1.51E-03	**C_{13}**
13.85	11.17129	1.55804	4.67E-03	**C_{14}**
14.792	16.43868	7.16994	2.15E-02	**C_{15}**
15.398	0	0	0	**C_{16}**
16.131	0	0	0	**C_{17}**
16.826	0	0	0	**C_{18}**
17.489	0	0	0	**C_{19}**
18.121	0	0	0	**C_{20}**
18.725	0	0	0	**C_{21}**
19.306	0	0	0	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.91	0	0	0	**C_{25}**

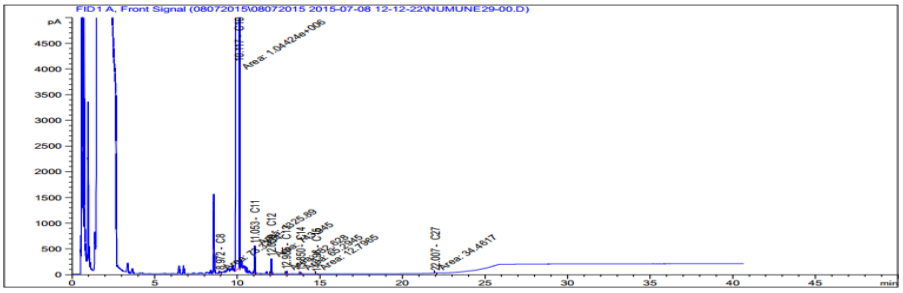

Figure D-62: EX:2, Port:2 T:1620 min, m=1.542 gr, decane gas chromatogram.

Table D-62: EX:2, Port:2 T:1620 min, m=1.542 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.972	73.33337	1.87373	0.00562119	**C_8**
10.117	1.04E+06	2.72E+04	81.6927	**C_{10}**
11.053	1325.89417	34.59519	0.10378557	**C_{11}**
12.059	743.94507	19.87098	0.05961294	**C_{12}**
12.985	132.62759	3.4483	0.0103449	**C_{13}**
13.85	65.29449	2.92322	0.00876966	**C_{14}**
14.796	12.79655	7.08087	0.02124261	**C_{15}**
15.398	0	0	0	**C_{16}**
16.131	0	0	0	**C_{17}**
16.826	0	0	0	**C_{18}**
17.489	0	0	0	**C_{19}**
18.121	0	0	0	**C_{20}**
18.725	0	0	0	**C_{21}**
19.306	0	0	0	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.91	0	0	0	**C_{25}**

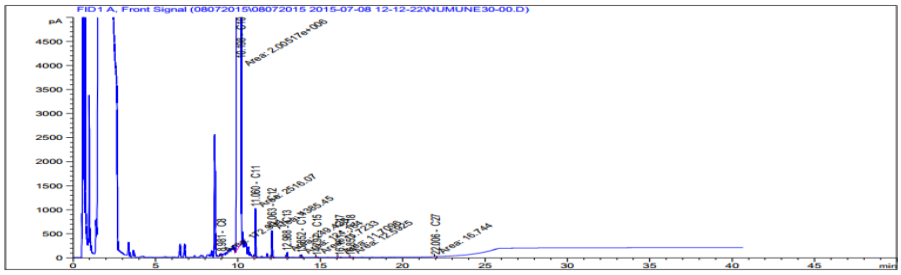

Figure D-63: EX:2, Port:3 T:1620 min, m=1.416 gr, decane gas chromatogram.

Table D-63: EX:2, Port:3 T:1620 min, m=1.416 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.981	172.99376	4.42014	0.01326042	**C_8**
10.198	2.01E+06	5.23E+04	156.8934	**C_{10}**
11.06	2516.07251	65.6493	0.1969479	**C_{11}**
12.063	1385.44629	36.26906	0.10880718	**C_{12}**
12.988	249.42772	6.48508	0.01945524	**C_{13}**
13.852	124.16371	4.40811	0.01322433	**C_{14}**
14.797	11.72326	7.05463	0.02116389	**C_{15}**
15.398	0	0	0	**C_{16}**
16.161	11.70955	2.94E-01	0.000882162	**C_{17}**
16.852	12.59254	1.06591	0.00319773	**C_{18}**
17.489	0	0	0	**C_{19}**
18.121	0	0	0	**C_{20}**
18.725	0	0	0	**C_{21}**
19.306	0	0	0	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.91	0	0	0	**C_{25}**

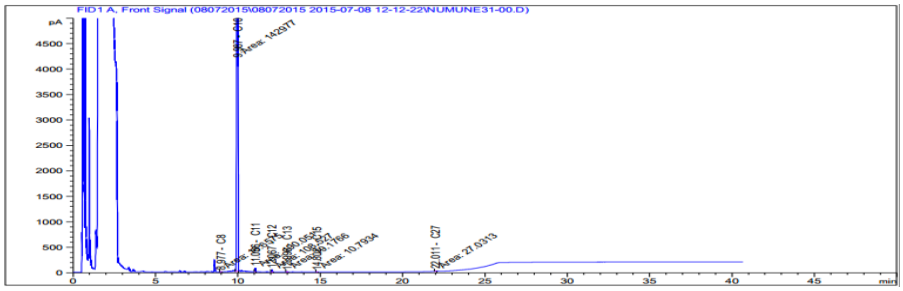

Figure D-64: EX:2, Port:1 T:1680 min, m=1.464 gr, decane gas chromatogram.

Table D-64: EX:2, Port:1 T:1680 min, m=1.464 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.977	16.65753	4.26E-01	1.28E-03	**C_8**
9.987	1.43E+05	3720.4335	1.12E+01	**C_{10}**
11.056	190.05122	4.95881	1.49E-02	**C_{11}**
12.067	108.52728	3.62841	1.09E-02	**C_{12}**
12.996	19.17664	4.99E-01	1.50E-03	**C_{13}**
13.808	0	0	0	**C_{14}**
14.802	10.79336	7.03188	2.11E-02	**C_{15}**
15.398	0	0	0	**C_{16}**
16.131	0	0	0	**C_{17}**
16.826	0	0	0	**C_{18}**
17.489	0	0	0	**C_{19}**
18.121	0	0	0	**C_{20}**
18.725	0	0	0	**C_{21}**
19.306	0	0	0	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.91	0	0	0	**C_{25}**

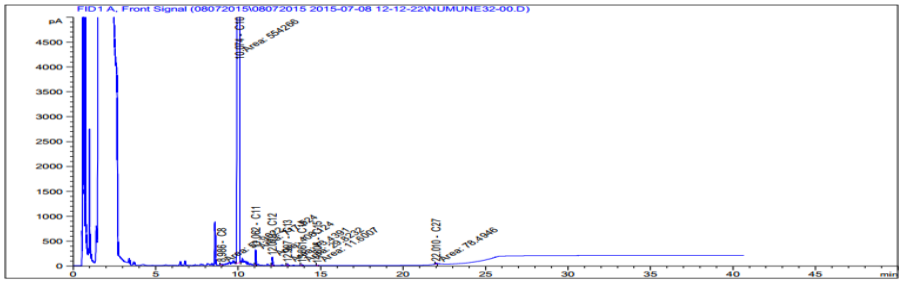

Figure D-65: EX:2, Port:2 T:1680 min, m=1.494 gr, decane gas chromatogram.

Table D-65: EX:2, Port:2 T:1680 min, m=1.494 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.986	53.90223	1.37725	0.00413175	**C_8**
10.074	5.54E+05	1.44E+04	43.3482	**C_{10}**
11.062	717.52368	18.72161	0.05616483	**C_{11}**
12.07	408.1236	11.2867	0.0338601	**C_{12}**
12.997	73.4391	1.9094	0.0057282	**C_{13}**
13.861	29.82319	2.0285	0.0060855	**C_{14}**
14.806	11.60066	7.05163	0.02115489	**C_{15}**
15.398	0	0	0	**C_{16}**
16.131	0	0	0	**C_{17}**
16.826	0	0	0	**C_{18}**
17.489	0	0	0	**C_{19}**
18.121	0	0	0	**C_{20}**
18.725	0	0	0	**C_{21}**
19.306	0	0	0	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.91	0	0	0	**C_{25}**

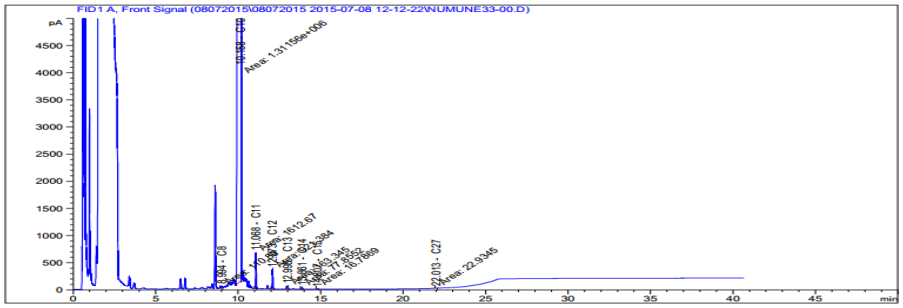

Figure D-66: EX:2, Port:3 T:1680 min, m=1.218 gr, decane gas chromatogram.

Table D-66: EX:2, Port:3 T:1680 min, m=1.218 gr.

Ret Time (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
8.994	110.89034	2.83334	0.00850002	**C_8**
10.158	1.31E+06	3.42E+04	102.6126	**C_{10}**
11.068	1612.66589	42.07763	0.12623289	**C_{11}**
12.073	921.38385	24.40668	0.07322004	**C_{12}**
12.998	163.34462	4.24693	0.01274079	**C_{13}**
13.861	77.85519	3.24004	0.00972012	**C_{14}**
14.807	16.78694	7.17846	0.02153538	**C_{15}**
15.398	0	0	0	**C_{16}**
16.131	0	0	0	**C_{17}**
16.826	0	0	0	**C_{18}**
17.489	0	0	0	**C_{19}**
18.121	0	0	0	**C_{20}**
18.725	0	0	0	**C_{21}**
19.306	0	0	0	**C_{22}**
19.862	0	0	0	**C_{23}**
20.397	0	0	0	**C_{24}**
20.91	0	0	0	**C_{25}**

D.1.3 Experiment 3

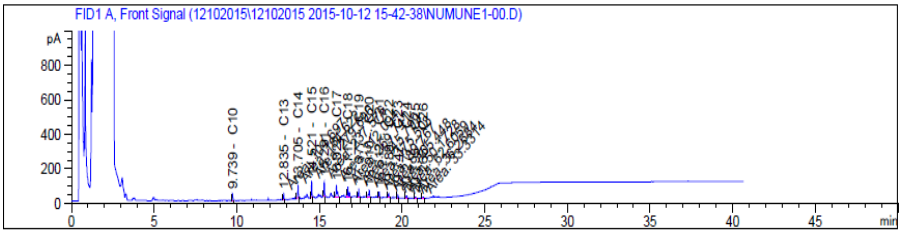

Figure D-67: EX:3, Port:1 T:30 min, m:1.324 gr, gas chromatogram.

Table D-67: EX:3, Port:1 T:30 min, m:1.324 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.739	110.59465	0	0	**C_{10}**
11.243	-	0	0	**C_{11}**
11.9	-	0	0	**C_{12}**
12.835	104.69672	2.433	0.007299	**C_{13}**
13.705	184.62192	5.64985	0.01694955	**C_{14}**
14.521	279.69644	18.18127	0.05454381	**C_{15}**
15.291	237.57568	6.47105	0.01941315	**C_{16}**
16.022	312.09402	7.08866	0.02126598	**C_{17}**
16.717	269.7413	6.73971	0.02021913	**C_{18}**
17.377	145.79854	3.44269	0.01032807	**C_{19}**
18.01	175.50273	0	0	**C_{20}**
18.612	89.76704	2.27172	0.00681516	**C_{21}**
19.189	1.05E+02	0	0	**C_{22}**
19.747	5.02E+01	1.25296	0.00375888	**C_{23}**
20.277	62.60585	2.18E-02	6.54951E-05	**C_{24}**
20.795	36.2684	8.86E-01	0.002656752	**C_{25}**
21.266	33.3314	1.1389	0.0034167	**C_{26}**
22.042	-	0	0	**C_{27}**
22.494	-	0	0	**C_{28}**
22.936	-	0	0	**C_{29}**
23.362	-	0	0	**C_{30}**
23.776	-	0	0	**C_{31}**
24.179	-	0	0	**C_{32}**

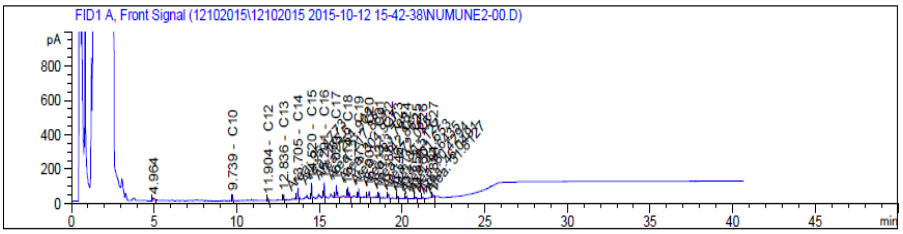

Figure D-68: EX:3, Port:2, T:30 min, m:1.11 gr, gas chromatogram.

Table D-68: EX:3, Port:2, T:30 min, m:1.11 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.739	97.23327	0	0	C_{10}
11.243	0	0	0	C_{11}
11.904	34.7446	1.97966	0.00593898	C_{12}
12.836	95.17734	2.21179	0.00663537	C_{13}
13.705	165.5997	5.21932	0.01565796	C_{14}
14.52	254.90445	17.66489	0.05299467	C_{15}
15.291	217.88947	6.0295	0.0180885	C_{16}
16.02	304.9274	6.92589	0.02077767	C_{17}
16.714	263.76801	6.60485	0.01981455	C_{18}
17.377	142.86227	3.37335	0.01012005	C_{19}
18.007	172.02547	0	0	C_{20}
18.613	80.51271	2.03753	0.00611259	C_{21}
19.188	101.65264	0	0	C_{22}
19.746	42.64349	1.06493	0.00319479	C_{23}
20.277	60.42939	0	0	C_{24}
20.853	46.04908	1.1244	0.0033732	C_{25}
21.26	31.81267	1.10235	0.00330705	C_{26}
21.884	43.03207	1.10077	0.00330231	C_{27}
22.494	-	0	0	C_{28}
22.936	-	0	0	C_{29}
23.362	-	0	0	C_{30}
23.776	-	0	0	C_{31}
24.179	-	0	0	C_{32}

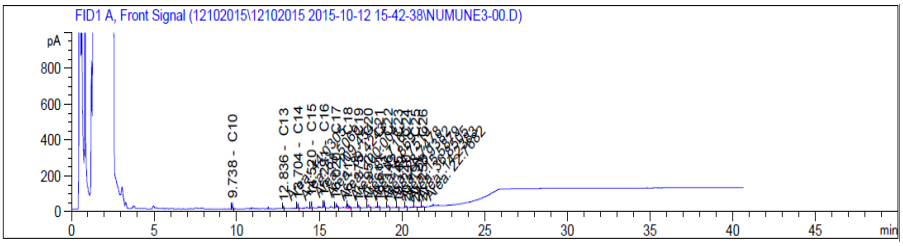

Figure D-69: EX:3, Port:3 T:30, min, m:1.453 gr, gas chromatogram.

Table D-69: EX:3, Port:3, T:30 min, m:1.453 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.738	92.76509	0	0	**C_{10}**
11.243	0	0	0	**C_{11}**
11.9	0	0	0	**C_{12}**
12.836	44.03049	1.02321	0.00306963	**C_{13}**
13.704	68.50694	3.02183	0.00906549	**C_{14}**
14.52	109.45444	14.63538	0.04390614	**C_{15}**
15.291	89.42429	3.14809	0.00944427	**C_{16}**
16.02	100.00372	2.27141	0.00681423	**C_{17}**
16.717	85.71653	2.58499	0.00775497	**C_{18}**
17.375	42.86901	1.01225	0.00303675	**C_{19}**
17.952	84.75189	0	0	**C_{20}**
18.611	28.74778	7.28E-01	0.002182548	**C_{21}**
19.146	58.93818	0	0	**C_{22}**
19.745	15.58792	3.89E-01	0.001167825	**C_{23}**
20.24	36.85049	0	0	**C_{24}**
20.791	14.23833	3.48E-01	0.001042995	**C_{25}**
21.255	22.76821	8.85E-01	0.002654043	**C_{26}**
22.042	-	0	0	**C_{27}**
22.494	-	0	0	**C_{28}**
22.936	-	0	0	**C_{29}**
23.362	-	0	0	**C_{30}**
23.776	-	0	0	**C_{31}**
24.179	-	0	0	**C_{32}**

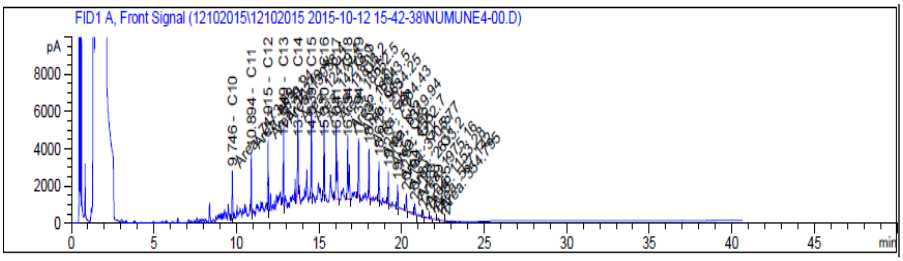

Figure D-70: EX:3, Port:1, T:60 min, m:0.989 gr, gas chromatogram.

Table D-70: EX:3, Port:1, T:60 min, m:0.989 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.746	7473.68945	171.27553	0.51382659	**C_{10}**
10.894	8539.94336	198.36045	0.59508135	**C_{11}**
11.915	1.02E+04	234.26632	0.70279896	**C_{12}**
12.849	1.30E+04	302.99272	0.90897816	**C_{13}**
13.722	1.25E+04	283.91668	0.85175004	**C_{14}**
14.539	1.43E+04	309.74765	0.92924295	**C_{15}**
15.31	1.18E+04	266.10724	0.79832172	**C_{16}**
16.041	1.86E+04	421.38694	1.26416082	**C_{17}**
16.734	1.68E+04	380.9238	1.1427714	**C_{18}**
17.394	9634.24805	227.48985	0.68246955	**C_{19}**
18.025	7804.43359	190.35183	0.57105549	**C_{20}**
18.626	6319.93994	159.93793	0.47981379	**C_{21}**
19.201	4552.70068	111.85345	0.33556035	**C_{22}**
19.756	3705.76587	92.5435	0.2776305	**C_{23}**
20.285	2613.20117	64.16049	0.19248147	**C_{24}**
20.794	1975.16089	48.22853	0.14468559	**C_{25}**
21.287	1153.28162	28.09265	0.08427795	**C_{26}**
21.761	567.14209	14.50764	0.04352292	**C_{27}**
22.665	157.59085	1.91	0.00573	**C_{28}**
22.936	-	0	0	**C_{29}**
23.362	-	0	0	**C_{30}**
23.776	-	0	0	**C_{31}**
24.179	-	0	0	**C_{32}**

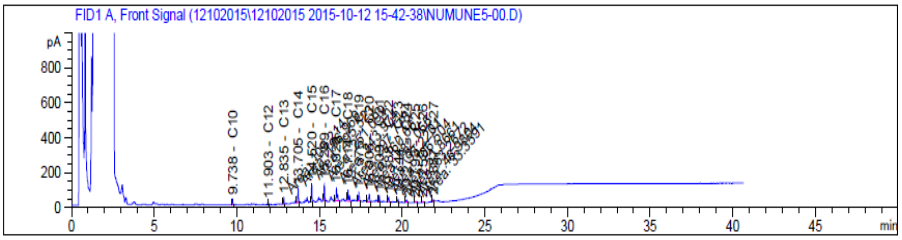

Figure D-71: EX:3, Port:2, T:60 min, m:1.023 gr, gas chromatogram.

Table D-71: EX:3, Port:2, T:60 min, m:1.023 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.738	88.42827	0	0	**C_{10}**
10.9	0	0	0	**C_{11}**
11.903	33.55784	1.95259	0.00585777	**C_{12}**
12.835	109.21437	2.53799	0.00761397	**C_{13}**
13.705	196.96942	5.92931	0.01778793	**C_{14}**
14.52	295.52313	18.51091	0.05553273	**C_{15}**
15.289	251.09947	6.77438	0.02032314	**C_{16}**
16.02	343.97424	7.81277	0.02343831	**C_{17}**
16.714	297.7782	7.3727	0.0221181	**C_{18}**
17.376	160.66005	3.7936	0.0113808	**C_{19}**
18.006	182.05464	0	0	**C_{20}**
18.609	93.2201	2.35911	0.00707733	**C_{21}**
19.188	106.50444	0	0	**C_{22}**
19.744	51.86607	1.29524	0.00388572	**C_{23}**
20.273	63.26721	3.85E-02	0.000115387	**C_{24}**
20.793	46.98043	1.14715	0.00344145	**C_{25}**
21.259	33.35911	1.13957	0.00341871	**C_{26}**
21.887	35.65474	9.12E-01	0.002736171	**C_{27}**
22.494	-	0	0	**C_{28}**
22.936	-	0	0	**C_{29}**
23.362	-	0	0	**C_{30}**
23.776	-	0	0	**C_{31}**
24.179	-	0	0	**C_{32}**

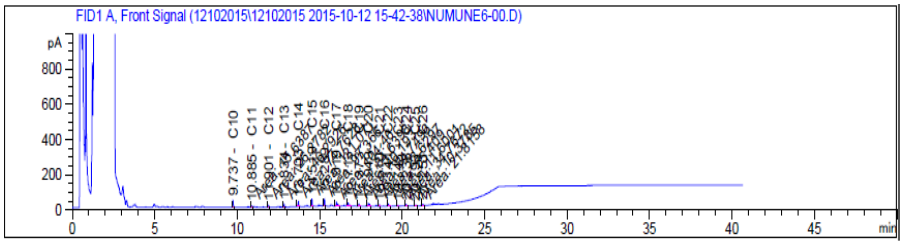

Figure D-72: EX:3, Port:3, T:60 min, m:1.797 gr, gas chromatogram.

Table D-72: EX:3, Port:3, T:60 min, m:1.797 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.737	105.44929	0	0	**C_{10}**
10.885	15.63872	3.63E-01	0.001089738	**C_{11}**
11.901	26.27823	1.78656	0.00535968	**C_{12}**
12.834	46.29256	1.07577	0.00322731	**C_{13}**
13.703	74.76278	3.16342	0.00949026	**C_{14}**
14.519	121.07085	14.87733	0.04463199	**C_{15}**
15.289	97.36596	3.32621	0.00997863	**C_{16}**
16.019	104.45998	2.37262	0.00711786	**C_{17}**
16.713	84.63982	2.56068	0.00768204	**C_{18}**
17.373	40.19301	9.49E-01	0.002847186	**C_{19}**
17.949	84.74965	0	0	**C_{20}**
18.61	23.62972	5.98E-01	0.001793982	**C_{21}**
19.141	55.40899	0	0	**C_{22}**
19.743	11.60014	2.90E-01	0.000869064	**C_{23}**
20.238	34.76721	0	0	**C_{24}**
20.793	10.37849	2.53E-01	0.000760251	**C_{25}**
21.251	21.81579	8.62E-01	0.00258528	**C_{26}**
21.8	0	0	0	**C_{27}**
22.494	0	0	0	**C_{28}**
22.936	0	0	0	**C_{29}**
23.362	0	0	0	**C_{30}**
23.776	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

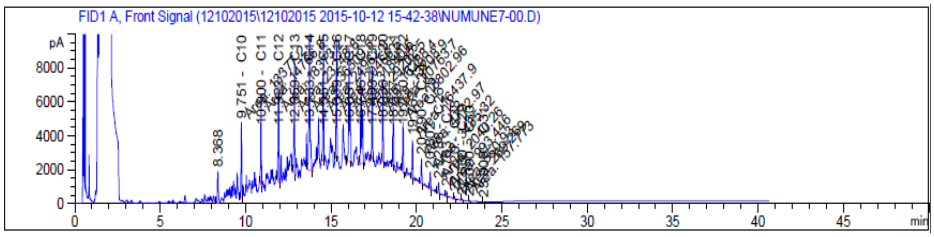

Figure D-73: EX:3, Port:1, T:90 min, m:1.167 gr, gas chromatogram.

Table D-73: EX:3, Port:1, T:90 min, m:1.167 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.751	1.34E+04	308.92521	0.92677563	**C_{10}**
10.9	1.48E+04	342.99457	1.02898371	**C_{11}**
11.922	1.84E+04	420.23574	1.26070722	**C_{12}**
12.859	2.32E+04	540.26857	1.62080571	**C_{13}**
13.733	3.63E+04	823.26241	2.46978723	**C_{14}**
14.551	2.50E+04	532.29512	1.59688536	**C_{15}**
15.319	2.05E+04	460.1967	1.3805901	**C_{16}**
16.051	3.18E+04	723.20254	2.16960762	**C_{17}**
16.746	2.92E+04	659.95287	1.97985861	**C_{18}**
17.403	1.63E+04	384.61158	1.15383474	**C_{19}**
18.036	1.32E+04	325.38029	0.97614087	**C_{20}**
18.637	1.08E+04	272.39516	0.81718548	**C_{21}**
19.21	8802.96094	219.48356	0.65845068	**C_{22}**
19.762	1.64E+04	410.50219	1.23150657	**C_{23}**
20.29	4772.96533	118.4711	0.3554133	**C_{24}**
20.802	3485.31738	85.1028	0.2553084	**C_{25}**
21.288	2040.26367	49.43957	0.14831871	**C_{26}**
21.763	993.44568	25.4126	0.0762378	**C_{27}**
22.22	550.9295	11.87138	0.03561414	**C_{28}**
22.66	269.26901	6.69204	0.02007612	**C_{29}**
23.09	157.77313	1.64821	0.00494463	**C_{30}**
23.909	42.62107	1.08251	0.00324753	**C_{31}**
24.179	0	0	0	**C_{32}**

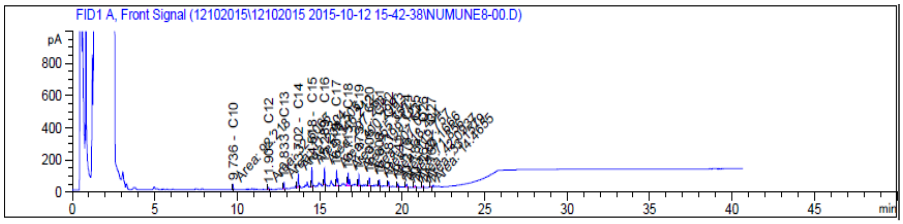

Figure D-74: EX:3, Port:2, T:90 min, m:1.2 gr, gas chromatogram.

Table D-74: EX:3, Port:2, T:90 min, m:1.2 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.736	92.21798	0	0	**C_{10}**
10.9	0	0	0	**C_{11}**
11.901	32.60652	1.93089	0.00579267	**C_{12}**
12.833	117.30418	2.72598	0.00817794	**C_{13}**
13.702	238.50473	6.86938	0.02060814	**C_{14}**
14.518	346.21249	19.5667	0.0587001	**C_{15}**
15.289	297.29288	7.81048	0.02343144	**C_{16}**
16.019	400.2995	9.09209	0.02727627	**C_{17}**
16.713	355.35745	8.67266	0.02601798	**C_{18}**
17.373	199.1227	4.70181	0.01410543	**C_{19}**
18.005	207.04953	5.35E-01	0.001605795	**C_{20}**
18.608	118.43412	2.9972	0.0089916	**C_{21}**
19.187	119.75671	0	0	**C_{22}**
19.741	67.1666	1.67734	0.00503202	**C_{23}**
20.276	71.85603	2.54E-01	0.000763326	**C_{24}**
20.786	42.0937	1.02782	0.00308346	**C_{25}**
21.267	33.15788	1.13473	0.00340419	**C_{26}**
21.766	14.46552	3.70E-01	0.001110096	**C_{27}**
22.3	-	0	0	**C_{28}**
22.7	-	0	0	**C_{29}**
23.362	-	0	0	**C_{30}**
23.776	-	0	0	**C_{31}**
24.179	-	0	0	**C_{32}**

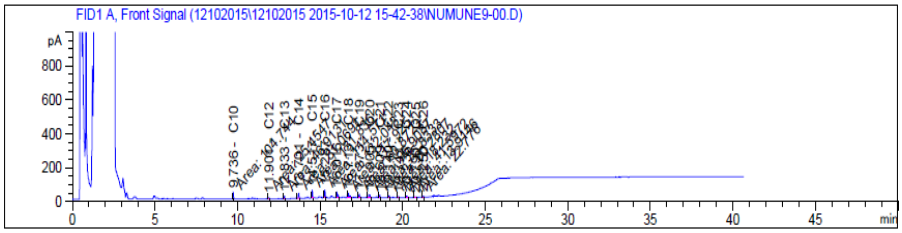

Figure D-75: EX:3, Port:3, T:90 min, m:1.803 gr, gas chromatogram.

Table D-75: EX:3, Port:3, T:90 min, m:1.803 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.736	104.74378	0	0	C_{10}
10.9	0	0	0	C_{11}
11.901	25.45473	1.76778	0.00530334	C_{12}
12.833	46.91309	1.09019	0.00327057	C_{13}
13.701	81.0691	3.30615	0.00991845	C_{14}
14.517	131.83571	15.10155	0.04530465	C_{15}
15.287	114.57121	3.71212	0.01113636	C_{16}
16.016	132.04262	2.99911	0.00899733	C_{17}
16.713	117.92514	3.31216	0.00993648	C_{18}
17.373	60.87231	1.43735	0.00431205	C_{19}
18.005	96.9087	0	0	C_{20}
18.609	35.83329	9.07E-01	0.002720484	C_{21}
19.14	60.28066	0	0	C_{22}
19.741	18.23197	4.55E-01	0.001365912	C_{23}
20.236	41.59716	0	0	C_{24}
20.79	13.91461	3.40E-01	0.00101928	C_{25}
21.25	22.77603	8.85E-01	0.002654607	C_{26}
21.8	0	0	0	C_{27}
22.3	0	0	0	C_{28}
22.7	0	0	0	C_{29}
23.362	0	0	0	C_{30}
23.776	0	0	0	C_{31}
24.179	0	0	0	C_{32}

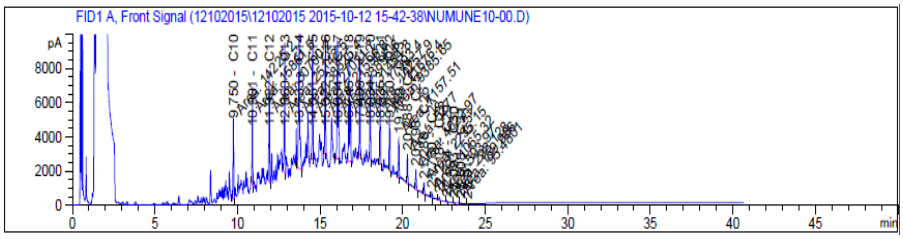

Figure D-76: EX:3, Port:1, T:120 min, m:1.352gr, gas chromatogram.

Table D-76: EX:3, Port:1, T:120 min, m:1.352gr

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.75	1.42E+04	328.6994	0.9860982	C_{10}
10.901	1.59E+04	368.4219	1.1052657	C_{11}
11.922	3.07E+04	701.38461	2.10415383	C_{12}
12.86	2.51E+04	584.27685	1.75283055	C_{13}
13.733	3.88E+04	880.20383	2.64061149	C_{14}
14.551	2.70E+04	575.17713	1.72553139	C_{15}
15.322	2.16E+04	485.5489	1.4566467	C_{16}
16.054	3.39E+04	769.90054	2.30970162	C_{17}
16.746	3.15E+04	710.80399	2.13241197	C_{18}
17.406	1.74E+04	410.7029	1.2321087	C_{19}
18.034	1.43E+04	351.58899	1.05476697	C_{20}
18.635	1.17E+04	295.49377	0.88648131	C_{21}
19.21	9385.6543	234.23921	0.70271763	C_{22}
19.759	7157.50537	178.74324	0.53622972	C_{23}
20.288	5277.00391	131.14593	0.39343779	C_{24}
20.798	4022.97021	98.23095	0.29469285	C_{25}
21.288	2235.15405	54.12998	0.16238994	C_{26}
21.76	1065.3186	27.25112	0.08175336	C_{27}
22.218	593.97046	12.9614	0.0388842	C_{28}
22.664	298.1282	7.40927	0.02222781	C_{29}
23.093	159.98578	1.70416	0.00511248	C_{30}
23.508	95.48011	2.42504	0.00727512	C_{31}
23.911	45.33072	0	0	C_{32}

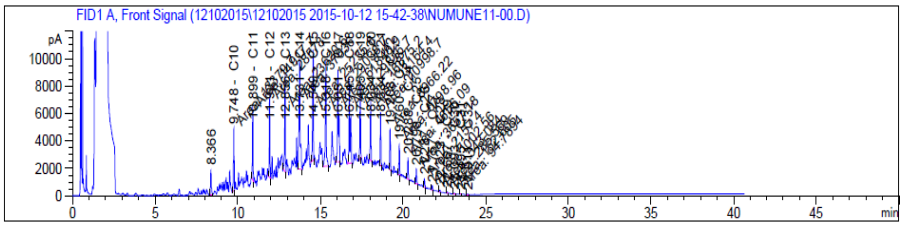

Figure D-77: EX:3, Port:1, T:180 min, m:1.257 gr, gas chromatogram.

Table D-77: EX:3, Port:1, T:180 min, m:1.257 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.748	1.34E+04	308.98571	0.92695713	C_{10}
10.899	1.49E+04	346.49803	1.03949409	C_{11}
11.921	2.86E+04	652.98194	1.95894582	C_{12}
12.856	2.36E+04	548.9081	1.6467243	C_{13}
13.731	3.76E+04	853.28591	2.55985773	C_{14}
14.549	2.52E+04	537.97565	1.61392695	C_{15}
15.318	2.90E+04	652.4667	1.9574001	C_{16}
16.051	6.18E+04	1404.7885	4.2143655	C_{17}
16.745	2.98E+04	673.81905	2.02145715	C_{18}
17.405	1.69E+04	398.46695	1.19540085	C_{19}
18.034	1.32E+04	324.26745	0.97280235	C_{20}
18.634	1.10E+04	278.34356	0.83503068	C_{21}
19.208	8966.21973	223.61779	0.67085337	C_{22}
19.76	6798.9585	169.78931	0.50936793	C_{23}
20.288	4656.09082	115.53211	0.34659633	C_{24}
20.798	3657.18115	89.29929	0.26789787	C_{25}
21.287	2157.39551	52.25857	0.15677571	C_{26}
21.757	1002.55902	25.64572	0.07693716	C_{27}
22.223	543.08417	11.67269	0.03501807	C_{28}
22.667	285.5687	7.09713	0.02129139	C_{29}
23.093	152.60474	1.51751	0.00455253	C_{30}
23.495	94.78943	2.4075	0.0072225	C_{31}
23.911	47.40651	0	0	C_{32}

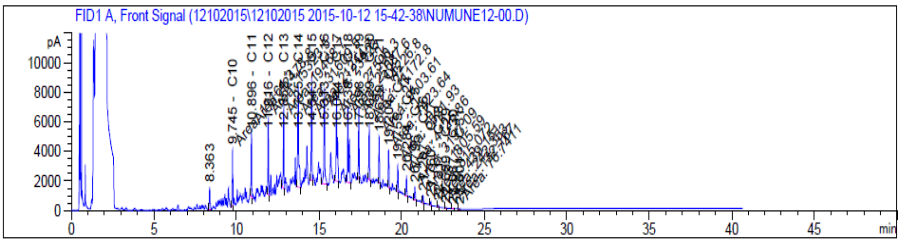

Figure D-78: EX:3, Port:1, T:240 min, m:1.001 gr, gas chromatogram.

Table D-78: EX:3, Port:1, T:240 min, m:1.001 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.745	1.12E+04	257.32832	0.77198496	C_{10}
10.896	1.25E+04	289.84973	0.86954919	C_{11}
11.916	1.53E+04	350.67842	1.05203526	C_{12}
12.853	1.95E+04	452.42553	1.35727659	C_{13}
13.725	3.16E+04	716.88674	2.15066022	C_{14}
14.543	2.12E+04	454.22545	1.36267635	C_{15}
15.313	2.39E+04	537.7238	1.6131714	C_{16}
16.044	2.75E+04	624.61972	1.87385916	C_{17}
16.738	2.57E+04	580.59751	1.74179253	C_{18}
17.398	1.42E+04	335.93194	1.00779582	C_{19}
18.029	1.12E+04	274.50902	0.82352706	C_{20}
18.629	9103.60938	230.3839	0.6911517	C_{21}
19.204	7423.64111	184.55479	0.55366437	C_{22}
19.755	5521.93066	137.8983	0.4136949	C_{23}
20.284	4125.85889	102.19861	0.30659583	C_{24}
20.796	3137.09351	76.60004	0.22980012	C_{25}
21.287	1805.58972	43.79169	0.13137507	C_{26}
21.76	815.07202	20.84975	0.06254925	C_{27}
22.217	439.15063	9.04055	0.02712165	C_{28}
22.659	242.3533	6.02312	0.01806936	C_{29}
23.087	132.16666	1.00068	0.00300204	C_{30}
23.501	76.74107	1.9491	0.0058473	C_{31}
24.179	0	0	0	C_{32}

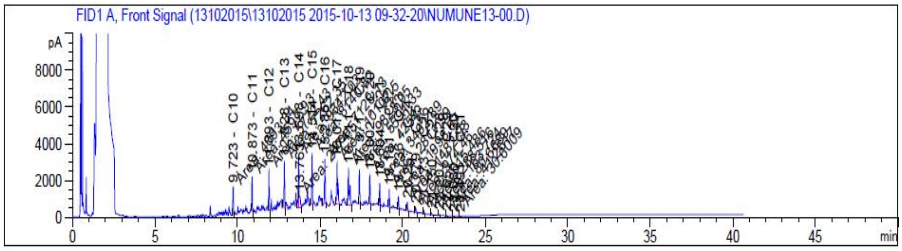

Figure D-79: EX:3, Port:1, T:1440 min, m:0.932 gr, gas chromatogram.

Table D-79: EX:3, Port:1, T:1440 min, m:0.932 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.723	4093.34399	92.45683	0.27737049	**C_{10}**
10.873	4597.92725	106.79777	0.32039331	**C_{11}**
11.893	5772.42773	132.84244	0.39852732	**C_{12}**
12.828	7262.35352	168.76675	0.50630025	**C_{13}**
13.698	9342.02539	212.90893	0.63872679	**C_{14}**
14.514	8140.82324	181.91687	0.54575061	**C_{15}**
15.285	7128.12793	161.0229	0.4830687	**C_{16}**
16.017	1.01E+04	229.45959	0.68837877	**C_{17}**
16.711	9823.04883	222.42434	0.66727302	**C_{18}**
17.371	5591.33398	132.02605	0.39607815	**C_{19}**
18.002	4254.00439	101.64626	0.30493878	**C_{20}**
18.604	3402.89038	86.11652	0.25834956	**C_{21}**
19.181	2811.99292	67.77319	0.20331957	**C_{22}**
19.736	1998.07227	49.89754	0.14969262	**C_{23}**
20.267	1482.93103	35.7381	0.1072143	**C_{24}**
20.779	974.46008	23.7939	0.0713817	**C_{25}**
21.273	615.48566	15.14956	0.04544868	**C_{26}**
21.75	288.51553	7.3803	0.0221409	**C_{27}**
22.207	163.72351	2.06531	0.00619593	**C_{28}**
22.657	80.66885	2.00483	0.00601449	**C_{29}**
23.08	41.26172	0	0	**C_{30}**
23.491	30.60092	7.77E-01	0.002331642	**C_{31}**
24.179	0	0	0	**C_{32}**

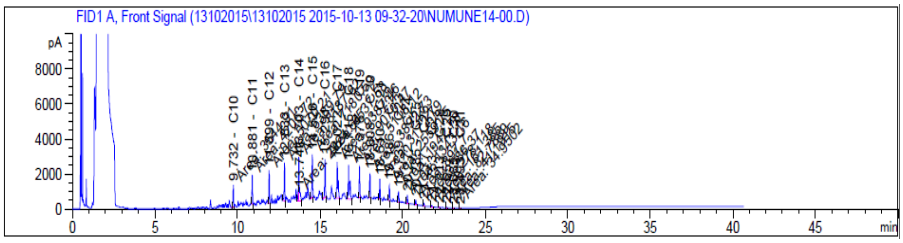

Figure D-80: EX:3, Port:2, T:1440 min, m:1.336 gr, gas chromatogram.

Table D-80: EX:3, Port:2, T:1440 min, m:1.336 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.732	3544.91016	79.66913	0.23900739	C_{10}
10.881	4205.71729	97.68776	0.29306328	C_{11}
11.899	5070.21387	116.82662	0.35047986	C_{12}
12.833	6389.78857	148.48959	0.44546877	C_{13}
13.703	8187.62256	186.78139	0.56034417	C_{14}
14.52	7180.58789	161.91659	0.48574977	C_{15}
15.291	6537.57861	147.77715	0.44333145	C_{16}
16.022	9387.46094	213.21954	0.63965862	C_{17}
16.715	9070.46582	205.4333	0.6162999	C_{18}
17.376	5118.1167	120.85215	0.36255645	C_{19}
18.008	3892.73193	92.62006	0.27786018	C_{20}
18.61	3172.78979	80.29339	0.24088017	C_{21}
19.186	2559.74731	61.38553	0.18415659	C_{22}
19.739	1942.78333	48.51682	0.14555046	C_{23}
20.272	1343.16394	32.22344	0.09667032	C_{24}
20.785	897.69971	21.9196	0.0657588	C_{25}
21.277	586.36993	14.44884	0.04334652	C_{26}
21.753	278.11758	7.11432	0.02134296	C_{27}
22.213	161.38515	2.00609	0.00601827	C_{28}
22.657	82.78891	2.05752	0.00617256	C_{29}
23.085	41.19152	0	0	C_{30}
23.493	34.95018	8.88E-01	0.002663037	C_{31}
24.179	0	0	0	C_{32}

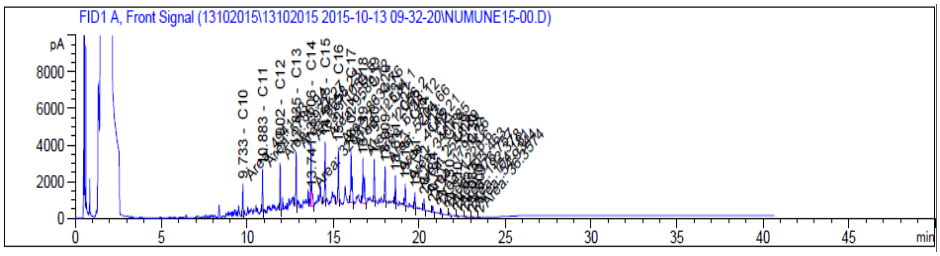

Figure D-81: EX:3, Port:1, T:1500 min, m:1.028 gr, gas chromatogram.

Table D-81: EX:3, Port:1, T:1500 min, m:1.028 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.733	4941.42578	112.23135	0.33669405	C_{10}
10.883	5786.94238	134.41547	0.40324641	C_{11}
11.902	6927.2749	159.18173	0.47754519	C_{12}
12.835	8658.23438	201.20504	0.60361512	C_{13}
13.706	1.11E+04	251.66629	0.75499887	C_{14}
14.523	9589.72266	212.09529	0.63628587	C_{15}
15.293	8634.75586	194.81585	0.58444755	C_{16}
16.024	1.25E+04	284.69097	0.85407291	C_{17}
16.719	1.21E+04	272.84279	0.81852837	C_{18}
17.38	6748.1167	159.34072	0.47802216	C_{19}
18.009	5204.66113	125.39791	0.37619373	C_{20}
18.611	4148.21191	104.97828	0.31493484	C_{21}
19.187	3407.85083	82.86221	0.24858663	C_{22}
19.741	2548.8877	63.65297	0.19095891	C_{23}
20.272	1799.75708	43.70518	0.13111554	C_{24}
20.784	1226.5968	29.95045	0.08985135	C_{25}
21.277	793.46301	19.43293	0.05829879	C_{26}
21.75	376.75659	9.63753	0.02891259	C_{27}
22.21	192.37755	2.79098	0.00837294	C_{28}
22.657	104.18066	2.58916	0.00776748	C_{29}
23.083	54.93443	0	0	C_{30}
23.5	36.35736	9.23E-01	0.002770257	C_{31}
24.179	0	0	0	C_{32}

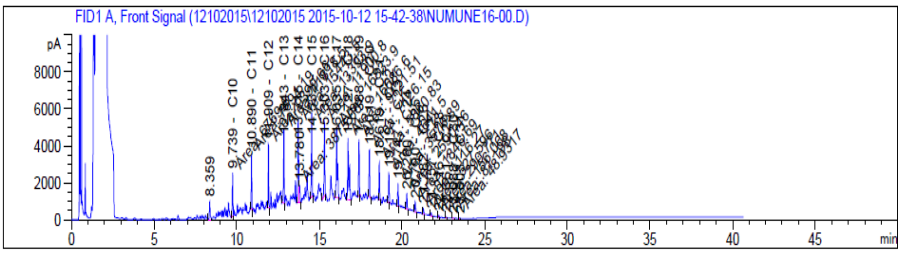

Figure D-82: EX:3, Port:2, T:1500 min, m:1.325 gr, gas chromatogram.

Table D-82: EX:3, Port:2, T:1500 min, m:1.325 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.739	6769.60352	154.85853	0.46457559	C_{10}
10.89	7694.18994	178.71582	0.53614746	C_{11}
11.909	9399.66113	215.57092	0.64671276	C_{12}
12.843	1.18E+04	274.64448	0.82393344	C_{13}
13.715	1.54E+04	351.00287	1.05300861	C_{14}
14.532	1.34E+04	291.33095	0.87399285	C_{15}
15.303	1.19E+04	268.07065	0.80421195	C_{16}
16.035	1.68E+04	382.35218	1.14705654	C_{17}
16.727	1.67E+04	377.38156	1.13214468	C_{18}
17.388	9121.50879	215.38273	0.64614819	C_{19}
18.019	7126.14795	173.40523	0.52021569	C_{20}
18.619	5860.82666	148.3192	0.4449576	C_{21}
19.197	4641.49805	114.10208	0.34230624	C_{22}
19.747	3570.8855	89.17516	0.26752548	C_{23}
20.28	2590.46362	63.58872	0.19076616	C_{24}
20.79	1846.68713	45.09152	0.13527456	C_{25}
21.282	1116.27124	27.20193	0.08160579	C_{26}
21.757	527.59637	13.49605	0.04048815	C_{27}
22.216	290.7706	5.2828	0.0158484	C_{28}
22.661	156.06825	3.87871	0.01163613	C_{29}
23.088	81.19801	0	0	C_{30}
23.503	48.9317	1.24279	0.00372837	C_{31}
24.179	0	0	0	C_{32}

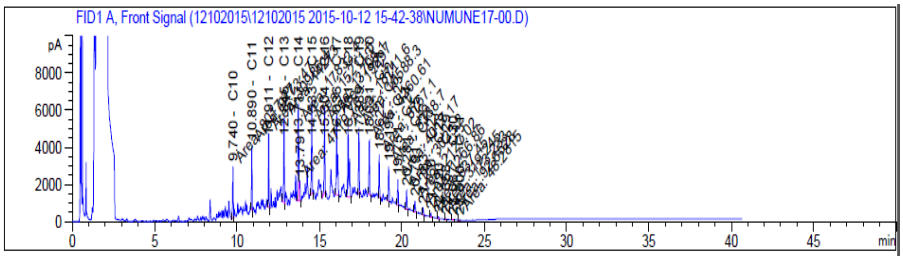

Figure D-83: EX:3, Port:1, T:1560 min, m:1.075 gr, gas chromatogram.

Table D-83: EX:3, Port:1, T:1560 min, m:1.075 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.74	8017.26904	183.95005	0.55185015	C_{10}
10.89	9173.4668	213.07553	0.63922659	C_{11}
11.911	1.10E+04	251.76124	0.75528372	C_{12}
12.845	1.43E+04	331.68404	0.99505212	C_{13}
13.717	1.78E+04	405.07083	1.21521249	C_{14}
14.533	1.52E+04	329.18914	0.98756742	C_{15}
15.304	1.37E+04	308.49745	0.92549235	C_{16}
16.036	1.93E+04	438.29818	1.31489454	C_{17}
16.731	1.87E+04	423.10148	1.26930444	C_{18}
17.389	1.06E+04	250.01749	0.75005247	C_{19}
18.021	8260.61426	201.74926	0.60524778	C_{20}
18.622	6767.10254	171.25421	0.51376263	C_{21}
19.195	5338.7041	131.75755	0.39527265	C_{22}
19.751	4017.16846	100.32011	0.30096033	C_{23}
20.281	3023.20288	74.47062	0.22341186	C_{24}
20.791	2127.01929	51.93653	0.15580959	C_{25}
21.283	1266.8584	30.82609	0.09247827	C_{26}
21.76	637.45001	16.30614	0.04891842	C_{27}
22.22	319.2453	6.00393	0.01801179	C_{28}
22.658	173.23347	4.30531	0.01291593	C_{29}
23.087	92.65279	1.46E-03	4.39047E-06	C_{30}
23.5	48.28149	1.22627	0.00367881	C_{31}
24.179	0	0	0	C_{32}

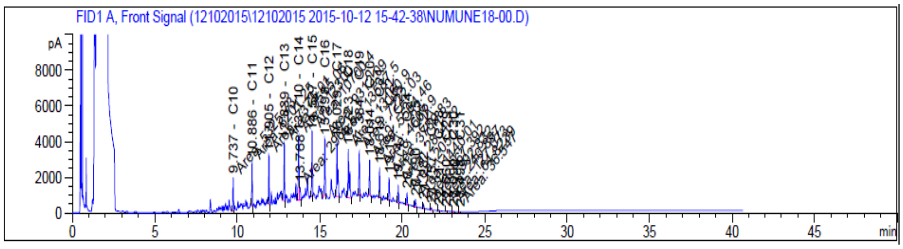

Figure D-84: EX:3, Port:2, T:1560 min, m:1.261 gr, gas chromatogram.

Table D-84: EX:3, Port:2, T:1560 min, m:1.261 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.737	5325.729	121.19205	0.36357615	C_{10}
10.886	6201.25439	144.03885	0.43211655	C_{11}
11.905	7375.00879	169.39346	0.50818038	C_{12}
12.839	9515.05957	221.11644	0.66334932	C_{13}
13.71	1.23E+04	279.85745	0.83957235	C_{14}
14.527	1.07E+04	235.22916	0.70568748	C_{15}
15.298	9312.0918	210.00818	0.63002454	C_{16}
16.029	1.36E+04	308.61599	0.92584797	C_{17}
16.723	1.32E+04	297.78245	0.89334735	C_{18}
17.384	7222.03223	170.53111	0.51159333	C_{19}
18.014	5564.46191	134.38734	0.40316202	C_{20}
18.619	4607.9043	116.61165	0.34983495	C_{21}
19.192	3739.82959	91.26896	0.27380688	C_{22}
19.747	2834.71948	70.791	0.212373	C_{23}
20.279	2050.00464	49.99805	0.14999415	C_{24}
20.79	1440.01233	35.16153	0.10548459	C_{25}
21.282	867.39215	21.21217	0.06363651	C_{26}
21.757	392.83221	10.04875	0.03014625	C_{27}
22.217	240.897	4.01974	0.01205922	C_{28}
22.66	127.07341	3.15811	0.00947433	C_{29}
23.09	64.82388	0	0	C_{30}
23.498	36.547	9.28E-01	0.002784705	C_{31}
24.179	0	0	0	C_{32}

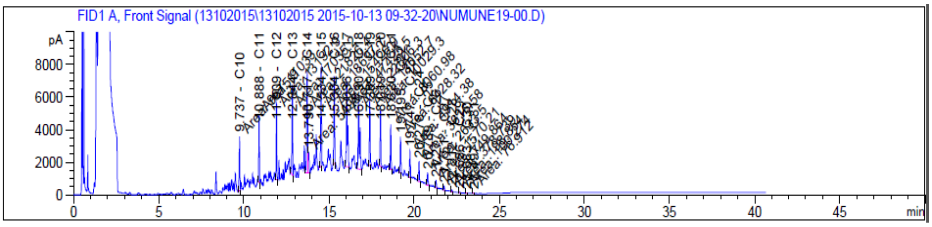

Figure D-85: EX:3, Port:1, T:1620 min, m:1.222 gr, gas chromatogram.

Table D-85: EX:3, Port:1, T:1620 min, m:1.222 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.737	9675.90234	222.62401	0.66787203	C_{10}
10.888	1.10E+04	256.26738	0.76880214	C_{11}
11.909	1.31E+04	300.71639	0.90214917	C_{12}
12.844	1.70E+04	395.8735	1.1876205	C_{13}
13.717	2.18E+04	495.46645	1.48639935	C_{14}
14.534	1.87E+04	401.80101	1.20540303	C_{15}
15.304	1.54E+04	347.15985	1.04147955	C_{16}
16.036	4.74E+04	1077.14007	3.23142021	C_{17}
16.73	2.28E+04	515.54747	1.54664241	C_{18}
17.389	1.31E+04	308.20741	0.92462223	C_{19}
18.019	1.00E+04	245.93801	0.73781403	C_{20}
18.62	8060.98193	203.99826	0.61199478	C_{21}
19.195	6428.32129	159.35013	0.47805039	C_{22}
19.747	4914.3833	122.72611	0.36817833	C_{23}
20.278	3616.57617	89.39191	0.26817573	C_{24}
20.789	2633.49854	64.3035	0.1929105	C_{25}
21.277	1570.21472	38.12694	0.11438082	C_{26}
21.751	749.86432	19.18172	0.05754516	C_{27}
22.212	378.7392	7.51062	0.02253186	C_{28}
22.656	198.85365	4.94204	0.01482612	C_{29}
23.083	100.27431	1.94E-01	0.000582582	C_{30}
23.497	76.91203	1.95344	0.00586032	C_{31}
24.179	0	0	0	C_{32}

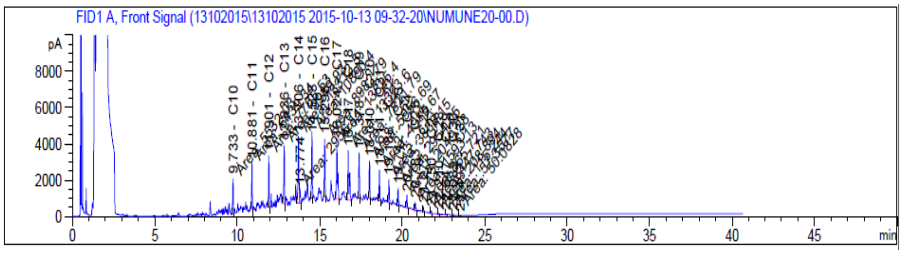

Figure D-86: EX:3, Port:2, T:1620 min, m:1.09 gr, gas chromatogram.

Table D-86: EX:3, Port:2, T:1620 min, m:1.09 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.733	5532.02539	126.00222	0.37800666	C_{10}
10.881	6439.34277	149.56901	0.44870703	C_{11}
11.901	7765.52832	178.30027	0.53490081	C_{12}
12.836	9949.92969	231.2222	0.6936666	C_{13}
13.706	1.33E+04	302.77159	0.90831477	C_{14}
14.523	1.09E+04	239.18742	0.71756226	C_{15}
15.295	8982.79102	202.62212	0.60786636	C_{16}
16.024	1.38E+04	314.01976	0.94205928	C_{17}
16.717	1.33E+04	301.4556	0.9043668	C_{18}
17.378	7821.78613	184.69287	0.55407861	C_{19}
18.01	5956.69336	144.18703	0.43256109	C_{20}
18.611	4915.67432	124.40035	0.37320105	C_{21}
19.188	3838.14966	93.75874	0.28127622	C_{22}
19.742	2954.05371	73.77111	0.22131333	C_{23}
20.273	2049.28491	49.97995	0.14993985	C_{24}
20.783	1593.12537	38.90017	0.11670051	C_{25}
21.273	865.72119	21.17196	0.06351588	C_{26}
21.75	447.74298	11.45338	0.03436014	C_{27}
22.21	208.89366	3.20925	0.00962775	C_{28}
22.647	115.24362	2.86411	0.00859233	C_{29}
23.083	57.35774	0	0	C_{30}
23.497	50.08276	1.27202	0.00381606	C_{31}
24.179	0	0	0	C_{32}

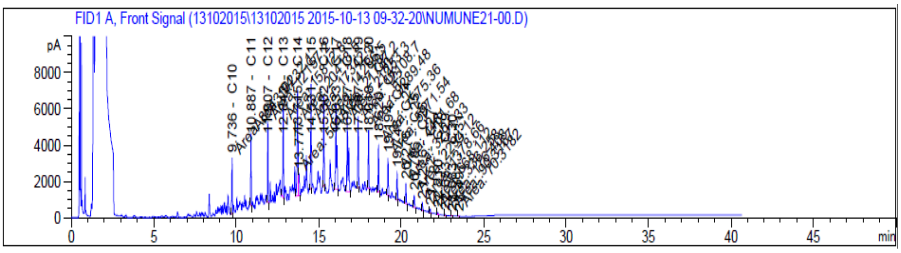

Figure D-87: EX:3, Port:1, T:1680 min, m:1.204 gr, gas chromatogram.

Table D-87: EX:3, Port:1, T:1680 min, m:1.204 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.736	8843.93555	203.22523	0.60967569	C_{10}
10.887	1.02E+04	237.66538	0.71299614	C_{11}
11.907	1.22E+04	278.46381	0.83539143	C_{12}
12.842	1.58E+04	367.4665	1.1023995	C_{13}
13.715	2.04E+04	463.60301	1.39080903	C_{14}
14.531	1.73E+04	373.57048	1.12071144	C_{15}
15.302	1.43E+04	321.58203	0.96474609	C_{16}
16.033	2.18E+04	494.85763	1.48457289	C_{17}
16.727	2.13E+04	480.48409	1.44145227	C_{18}
17.387	1.21E+04	285.9188	0.8577564	C_{19}
18.018	9289.48242	227.45498	0.68236494	C_{20}
18.62	7575.36475	191.7088	0.5751264	C_{21}
19.194	5971.53711	147.7829	0.4433487	C_{22}
19.746	4461.68359	111.42091	0.33426273	C_{23}
20.276	3291.32837	81.21305	0.24363915	C_{24}
20.786	2294.11572	56.01662	0.16804986	C_{25}
21.276	1378.65552	33.51671	0.10055013	C_{26}
21.752	668.11249	17.09049	0.05127147	C_{27}
22.21	336.2579	6.43478	0.01930434	C_{28}
22.653	176.40816	4.38421	0.01315263	C_{29}
23.083	90.31674	0	0	C_{30}
23.497	70.31821	1.78597	0.00535791	C_{31}
24.179	0	0	0	C_{32}

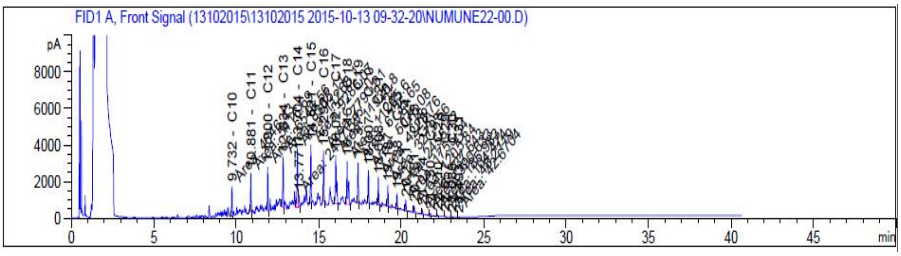

Figure D-88: EX:3, Port:2, T:1680 min, m:1.05 gr, gas chromatogram.

Table D-88: EX:3, Port:2, T:1680 min, m:1.05 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.732	4646.42773	105.35295	0.31605885	C_{10}
10.881	5416.68555	125.81537	0.37744611	C_{11}
11.9	6546.55762	150.49848	0.45149544	C_{12}
12.834	8365.11426	194.39334	0.58318002	C_{13}
13.704	1.13E+04	256.50234	0.76950702	C_{14}
14.521	9286.06543	205.77057	0.61731171	C_{15}
15.292	7791.01416	175.89112	0.52767336	C_{16}
16.023	1.19E+04	270.89664	0.81268992	C_{17}
16.716	1.13E+04	254.99305	0.76497915	C_{18}
17.375	6735.65137	159.04638	0.47713914	C_{19}
18.007	5076.0835	122.18547	0.36655641	C_{20}
18.608	4228.76074	107.01672	0.32105016	C_{21}
19.187	3279.56372	79.61357	0.23884071	C_{22}
19.738	2455.12427	61.31143	0.18393429	C_{23}
20.271	1755.33777	42.58819	0.12776457	C_{24}
20.781	1205.84155	29.44366	0.08833098	C_{25}
21.274	737.64258	18.0895	0.0542685	C_{26}
21.75	390.63287	9.99249	0.02997747	C_{27}
22.21	185.98303	2.62904	0.00788712	C_{28}
22.657	104.47379	2.59645	0.00778935	C_{29}
23.085	48.21193	0	0	C_{30}
23.493	42.67044	1.08376	0.00325128	C_{31}
24.179	0	0	0	C_{32}

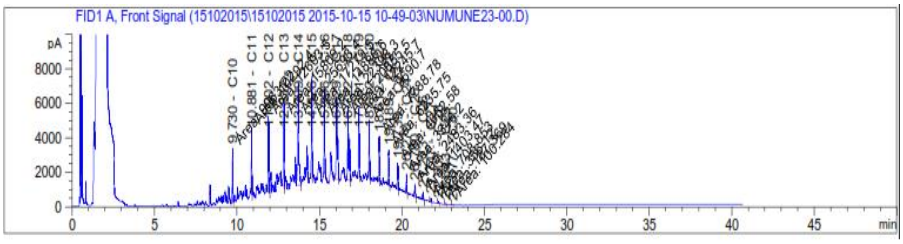

Figure D-89: EX:3; Port:1, T:2880 min, m:1.367 gr, gas chromatogram.

Table D-89: EX:3; Port:1, T:2880 min, m:1.367 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.73	9063.21777	208.33819	0.62501457	C_{10}
10.881	1.03E+04	239.06431	0.71719293	C_{11}
11.902	1.26E+04	288.64279	0.86592837	C_{12}
12.837	1.58E+04	367.38387	1.10215161	C_{13}
13.709	2.57E+04	583.10309	1.74930927	C_{14}
14.526	1.73E+04	372.26231	1.11678693	C_{15}
15.296	1.49E+04	335.0412	1.0051236	C_{16}
16.029	2.24E+04	508.7382	1.5262146	C_{17}
16.722	2.09E+04	471.503	1.414509	C_{18}
17.381	1.22E+04	289.15271	0.86745813	C_{19}
18.012	9690.70117	237.47921	0.71243763	C_{20}
18.612	7788.78467	197.10979	0.59132937	C_{21}
19.189	6235.75	154.47361	0.46342083	C_{22}
19.739	4652.57568	116.18803	0.34856409	C_{23}
20.27	3346.19849	82.59284	0.24777852	C_{24}
20.78	2483.36279	60.63756	0.18191268	C_{25}
21.273	1403.47266	34.11398	0.10234194	C_{26}
21.747	708.85278	18.13264	0.05439792	C_{27}
22.207	356.11975	6.93778	0.02081334	C_{28}
22.643	187.36853	4.6566	0.0139698	C_{29}
23.077	100.2838	1.94E-01	0.000583302	C_{30}
23.776	0	0	0	C_{31}
24.179	0	0	0	C_{32}

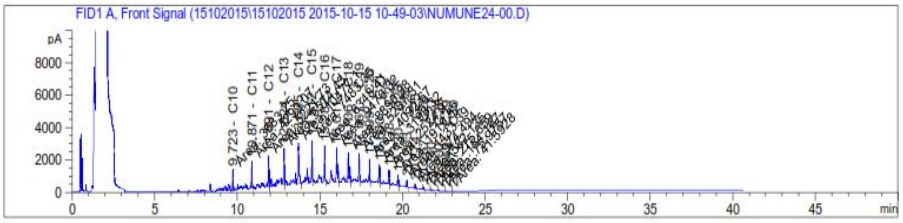

Figure D-90: EX:3; Port:2, T:2880 min, m:1.323 gr, gas chromatogram.

Table D-90: EX:3; Port:2, T:2880 min, m:1.323 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.723	3683.25391	82.89486	0.24868458	**C_{10}**
10.871	4293.06836	99.7167	0.2991501	**C_{11}**
11.891	5221.73438	120.28244	0.36084732	**C_{12}**
12.824	6574.43066	152.78041	0.45834123	**C_{13}**
13.695	1.05E+04	238.60012	0.71580036	**C_{14}**
14.512	7483.35107	168.2227	0.5046681	**C_{15}**
15.282	6348.40576	143.5341	0.4306023	**C_{16}**
16.011	9476.31934	215.2378	0.6457134	**C_{17}**
16.706	8890.97559	201.38096	0.60414288	**C_{18}**
17.367	5287.30664	124.84717	0.37454151	**C_{19}**
17.999	4032.67261	96.1164	0.2883492	**C_{20}**
18.6	3198.32056	80.9395	0.2428185	**C_{21}**
19.178	2524.90112	60.50311	0.18150933	**C_{22}**
19.73	1919.521	47.93589	0.14380767	**C_{23}**
20.263	1433.38794	34.49227	0.10347681	**C_{24}**
20.774	974.49414	23.79473	0.07138419	**C_{25}**
21.267	582.13501	14.34691	0.04304073	**C_{26}**
21.74	275.65887	7.05142	0.02115426	**C_{27}**
22.2	154.16745	1.8233	0.0054699	**C_{28}**
22.643	75.97573	1.8882	0.0056646	**C_{29}**
23.077	41.59275	0	0	**C_{30}**
23.776	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

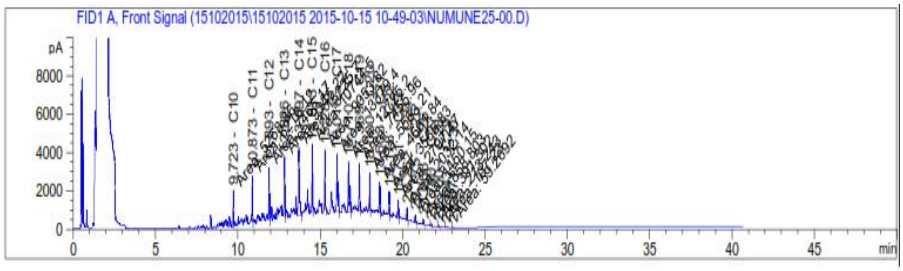

Figure D-91: EX:3; Port:1, T:2940 min, m:1.089 gr, gas chromatogram.

Table D-91: EX:3; Port:1, T:2940 min, m:1.089 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.723	5268.85986	119.86605	0.35959815	C_{10}
10.873	6216.11914	144.38412	0.43315236	C_{11}
11.893	7465.16699	171.44975	0.51434925	C_{12}
12.826	9345.22461	217.16971	0.65150913	C_{13}
13.697	1.52E+04	346.07481	1.03822443	C_{14}
14.513	1.07E+04	236.1467	0.7084401	C_{15}
15.283	9053.82227	204.21532	0.61264596	C_{16}
16.016	1.34E+04	303.88909	0.91166727	C_{17}
16.71	1.27E+04	287.94679	0.86384037	C_{18}
17.369	7455.96338	176.05484	0.52816452	C_{19}
18	5563.2124	134.35612	0.40306836	C_{20}
18.603	4501.84277	113.92757	0.34178271	C_{21}
19.178	3565.83252	86.8628	0.2605884	C_{22}
19.731	2797.46606	69.86067	0.20958201	C_{23}
20.262	2032.13586	49.54871	0.14864613	C_{24}
20.775	1450.14587	35.40896	0.10622688	C_{25}
21.266	858.80267	21.00545	0.06301635	C_{26}
21.74	391.50183	10.01472	0.03004416	C_{27}
22.2	213.24251	3.31939	0.00995817	C_{28}
22.643	107.23022	2.66495	0.00799485	C_{29}
23.071	59.26916	0	0	C_{30}
23.776	0	0	0	C_{31}
24.179	0	0	0	C_{32}

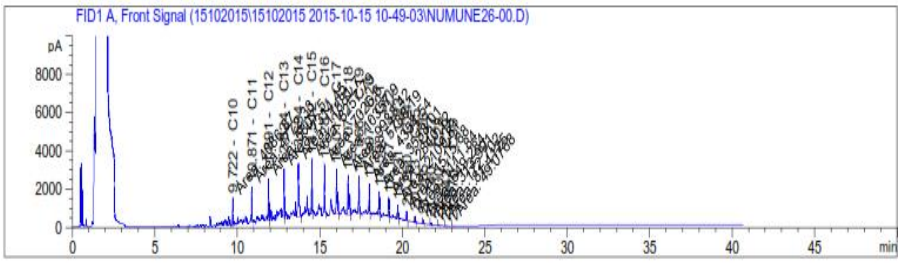

Figure D-92: EX:3; Port:2, T:2940 min, m:1.18 gr, gas chromatogram.

Table D-92: EX:3; Port:2, T:2940 min, m:1.18 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.722	4086.86987	92.30587	0.27691761	**C_{10}**
10.871	4772.32568	110.84859	0.33254577	**C_{11}**
11.891	5807.50049	133.64236	0.40092708	**C_{12}**
12.824	7314.44775	169.97735	0.50993205	**C_{13}**
13.694	1.19E+04	270.38969	0.81116907	**C_{14}**
14.512	8257.78809	184.35307	0.55305921	**C_{15}**
15.281	7026.59863	158.74564	0.47623692	**C_{16}**
16.012	1.04E+04	235.26204	0.70578612	**C_{17}**
16.707	9933.42285	224.91625	0.67474875	**C_{18}**
17.366	5788.19287	136.67441	0.41002323	**C_{19}**
17.997	4354.54395	104.15819	0.31247457	**C_{20}**
18.598	3538.01465	89.53609	0.26860827	**C_{21}**
19.177	2840.12231	68.48551	0.20545653	**C_{22}**
19.731	2109.80664	52.68787	0.15806361	**C_{23}**
20.26	1515.87646	36.56657	0.10969971	**C_{24}**
20.773	1111.83618	27.14828	0.08144484	**C_{25}**
21.265	649.28351	15.96297	0.04788891	**C_{26}**
21.74	313.99051	8.03196	0.02409588	**C_{27}**
22.2	172.70212	2.2927	0.0068781	**C_{28}**
22.643	81.41246	2.02331	0.00606993	**C_{29}**
23.07	49.07683	0	0	**C_{30}**
23.776	-	0	0	**C_{31}**
24.179	-	0	0	**C_{32}**

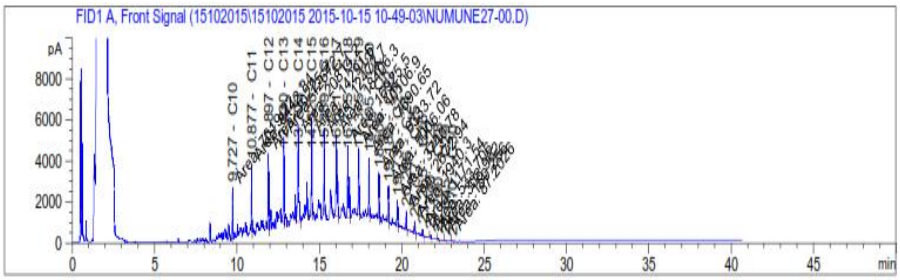

Figure D-93: EX:3; Port:1, T:3000 min, m:1.105 gr, gas chromatogram.

Table D-93: EX:3; Port:1, T:3000 min, m:1.105 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.727	7019.21582	160.67868	0.48203604	C_{10}
10.877	8442.83887	196.10496	0.58831488	C_{11}
11.897	1.02E+04	234.39975	0.70319925	C_{12}
12.83	1.27E+04	294.49519	0.88348557	C_{13}
13.703	2.08E+04	472.55796	1.41767388	C_{14}
14.52	1.43E+04	310.02888	0.93008664	C_{15}
15.289	1.25E+04	280.89815	0.84269445	C_{16}
16.021	1.84E+04	418.06589	1.25419767	C_{17}
16.715	1.69E+04	382.77604	1.14832812	C_{18}
17.375	1.01E+04	238.6505	0.7159515	C_{19}
18.005	7690.65039	187.50902	0.56252706	C_{20}
18.606	6333.7207	160.28667	0.48086001	C_{21}
19.182	5006.05713	123.33387	0.37000161	C_{22}
19.735	3740.77612	93.41781	0.28025343	C_{23}
20.266	2672.93774	65.66266	0.19698798	C_{24}
20.777	1940.29907	47.37729	0.14213187	C_{25}
21.265	1171.53955	28.53206	0.08559618	C_{26}
21.74	533.70636	13.65235	0.04095705	C_{27}
22.2	308.96237	5.74351	0.01723053	C_{28}
22.645	150.25594	3.73425	0.01120275	C_{29}
23.07	87.2026	0	0	C_{30}
23.776	0	0	0	C_{31}
24.179	0	0	0	C_{32}

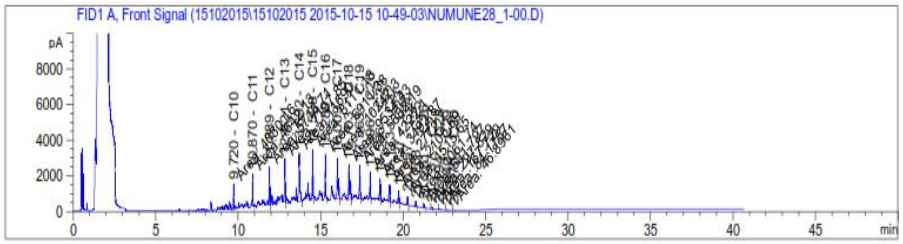

Figure D-94: EX:3; Port:2, T:3000 min, m:0.918 gr, gas chromatogram.

Table D-94: EX:3; Port:2, T:3000 min, m:0.918 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.72	4030.15552	90.98348	0.27295044	**C_{10}**
10.87	4642.1333	107.82456	0.32347368	**C_{11}**
11.889	5716.70605	131.57156	0.39471468	**C_{12}**
12.821	7197.84717	167.26772	0.50180316	**C_{13}**
13.692	1.17E+04	266.04993	0.79814979	**C_{14}**
14.508	8111.18213	181.29949	0.54389847	**C_{15}**
15.28	6911.38086	156.16136	0.46848408	**C_{16}**
16.009	1.02E+04	232.63676	0.69791028	**C_{17}**
16.703	9534.43457	215.9083	0.6477249	**C_{18}**
17.363	5682.1875	134.17134	0.40251402	**C_{19}**
17.996	4222.10156	100.84919	0.30254757	**C_{20}**
18.596	3492.87109	88.39365	0.26518095	**C_{21}**
19.173	2772.69922	66.77815	0.20033445	**C_{22}**
19.727	2105.59375	52.58266	0.15774798	**C_{23}**
20.257	1515.64612	36.56077	0.10968231	**C_{24}**
20.768	1061.74341	25.92514	0.07777542	**C_{25}**
21.261	631.79749	15.54214	0.04662642	**C_{26}**
21.737	297.82852	7.61853	0.02285559	**C_{27}**
22.194	167.7291	2.16675	0.00650025	**C_{28}**
22.64	84.17565	2.09199	0.00627597	**C_{29}**
23.07	46.89608	0	0	**C_{30}**
23.776	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

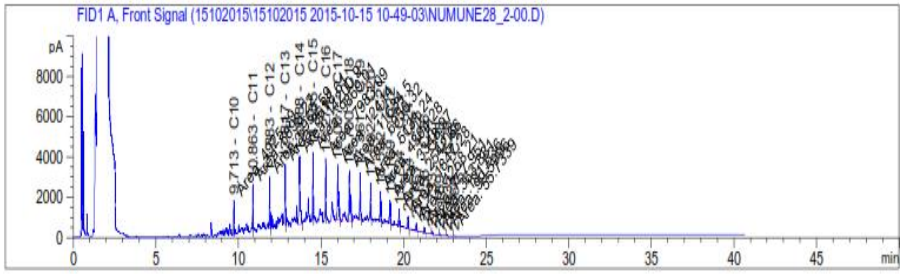

Figure D-95: EX:3; Port:1, T:3060 min, m:1.066 gr, gas chromatogram.

Table D-95: EX:3; Port:1, T:3060 min, m:1.066 gr.

RetTime (min)	Type	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.713	MM	4925.39258	111.85751	0.33557253	C_{10}
10.863	MM	5698.21631	132.35459	0.39706377	C_{11}
11.883	MM	6952.59375	159.75919	0.47927757	C_{12}
12.817	MM	8618.61426	200.28432	0.60085296	C_{13}
13.688	MM	1.42E+04	322.88048	0.96864144	C_{14}
14.505	MM	9869.00977	217.91243	0.65373729	C_{15}
15.274	MM	7983.08691	180.19922	0.54059766	C_{16}
16.007	MM	1.24E+04	281.96266	0.84588798	C_{17}
16.7	MM	1.16E+04	263.32161	0.78996483	C_{18}
17.361	MM	6950.31787	164.11522	0.49234566	C_{19}
17.992	MM	5131.23828	123.56348	0.37069044	C_{20}
18.592	MM	4304.27783	108.92782	0.32678346	C_{21}
19.169	MM	3348.97168	81.3712	0.2441136	C_{22}
19.724	MM	2542.65674	63.49736	0.19049208	C_{23}
20.254	MM	1847.28088	44.90024	0.13470072	C_{24}
20.767	MM	1258.20984	30.72236	0.09216708	C_{25}
21.256	MM	757.95148	18.57827	0.05573481	C_{26}
21.733	MM	363.88071	9.30816	0.02792448	C_{27}
22.189	MM	191.63615	2.7722	0.0083166	C_{28}
22.635	MM	99.59964	2.47531	0.00742593	C_{29}
23.066	MM	55.7339	0	0	C_{30}
23.776	-	0	0	0	C_{31}
24.179	-	0	0	0	C_{32}

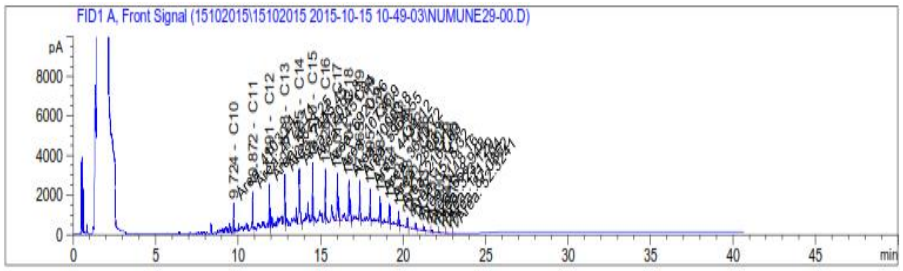

Figure D-96: EX:3; Port:2, T:3060 min, m:1.447 gr, gas chromatogram.

Table D-96: EX:3; Port:2, T:3060 min, m:1.447 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.724	4103.73584	92.69913	0.27809739	C_{10}
10.872	4777.71289	110.97372	0.33292116	C_{11}
11.891	5873.24609	135.14186	0.40542558	C_{12}
12.823	7445.4502	173.02166	0.51906498	C_{13}
13.695	1.21E+04	275.1898	0.8255694	C_{14}
14.51	8451.84277	188.39495	0.56518485	C_{15}
15.281	6920.9585	156.37618	0.46912854	C_{16}
16.01	1.07E+04	243.8706	0.7316118	C_{17}
16.704	1.00E+04	226.50411	0.67951233	C_{18}
17.365	5968.55127	140.93314	0.42279942	C_{19}
17.995	4434.11621	106.14626	0.31843878	C_{20}
18.598	3610.72412	91.37614	0.27412842	C_{21}
19.174	2898.1001	69.9537	0.2098611	C_{22}
19.727	2167.03125	54.11693	0.16235079	C_{23}
20.258	1518.3241	36.62812	0.10988436	C_{24}
20.772	1118.16187	27.30274	0.08190822	C_{25}
21.263	658.94824	16.19557	0.04858671	C_{26}
21.737	323.12915	8.26573	0.02479719	C_{27}
22.2	171.10381	2.25222	0.00675666	C_{28}
22.643	87.08517	2.1643	0.0064929	C_{29}
23.07	52.3241	0	0	C_{30}
23.776	0	0	0	C_{31}
24.179	0	0	0	C_{32}

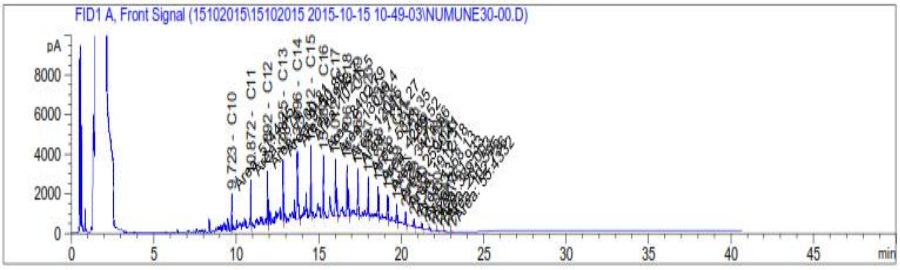

Figure D-97: EX:3; Port:1, T:3120 min, m:1.186 gr, gas chromatogram.

Table D-97: EX:3; Port:1, T:3120 min, m:1.186 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.723	5144.4458	116.96512	0.35089536	**C_{10}**
10.872	5873.99658	136.43751	0.40931253	**C_{11}**
11.892	7200.8125	165.42046	0.49626138	**C_{12}**
12.825	9150.86035	212.65296	0.63795888	**C_{13}**
13.696	1.49E+04	339.8035	1.0194105	**C_{14}**
14.512	1.02E+04	225.1506	0.6754518	**C_{15}**
15.282	8402.79492	189.61308	0.56883924	**C_{16}**
16.012	1.30E+04	296.1675	0.8885025	**C_{17}**
16.706	1.20E+04	271.91149	0.81573447	**C_{18}**
17.365	7131.26953	168.38797	0.50516391	**C_{19}**
17.997	5321.35352	128.31341	0.38494023	**C_{20}**
18.598	4259.52197	107.79519	0.32338557	**C_{21}**
19.176	3471.86279	84.48319	0.25344957	**C_{22}**
19.729	2590.40942	64.68988	0.19406964	**C_{23}**
20.261	1912.18286	46.5323	0.1395969	**C_{24}**
20.769	1358.12939	33.16215	0.09948645	**C_{25}**
21.26	761.93317	18.6741	0.0560223	**C_{26}**
21.737	389.00317	9.9508	0.0298524	**C_{27}**
22.2	201.59528	3.02442	0.00907326	**C_{28}**
22.643	102.73604	2.55326	0.00765978	**C_{29}**
23.07	55.43322	0	0	**C_{30}**
23.776	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

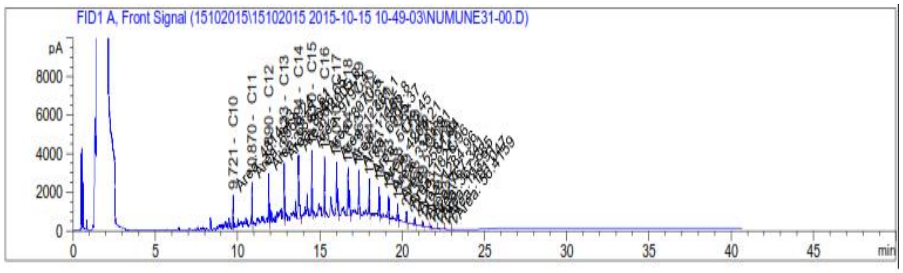

Figure D-98: EX:3; Port:2, T:3120 min, m:1.314 gr, gas chromatogram.

Table D-98: EX:3; Port:2, T:3120 min, m:1.314 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.721	4814.22705	109.26549	0.32779647	C_{10}
10.87	5568.23926	129.33557	0.38800671	C_{11}
11.89	6832.61133	157.02268	0.47106804	C_{12}
12.823	8646.64844	200.9358	0.6028074	C_{13}
13.694	1.40E+04	318.45866	0.95537598	C_{14}
14.51	9797.39551	216.42081	0.64926243	C_{15}
15.28	8070.50049	182.15987	0.54647961	C_{16}
16.01	1.24E+04	280.76141	0.84228423	C_{17}
16.704	1.15E+04	259.51378	0.77854134	C_{18}
17.363	6995.36768	165.17897	0.49553691	C_{19}
17.994	5173.44873	124.61808	0.37385424	C_{20}
18.597	4204.20703	106.39534	0.31918602	C_{21}
19.173	3391.9126	82.4586	0.2473758	C_{22}
19.728	2581.04346	64.45599	0.19336797	C_{23}
20.259	1826.96289	44.38932	0.13316796	C_{24}
20.768	1284.95752	31.37548	0.09412644	C_{25}
21.259	767.34064	18.80424	0.05641272	C_{26}
21.737	367.68536 2	9.40549	0.02821647	C_{27}
22.197	193.90982	2.82979	0.00848937	C_{28}
22.637	101.04726	2.51129	0.00753387	C_{29}
23.07	56.4159	0	0	C_{30}
23.776	0	0	0	C_{31}
24.179	0	0	0	C_{32}

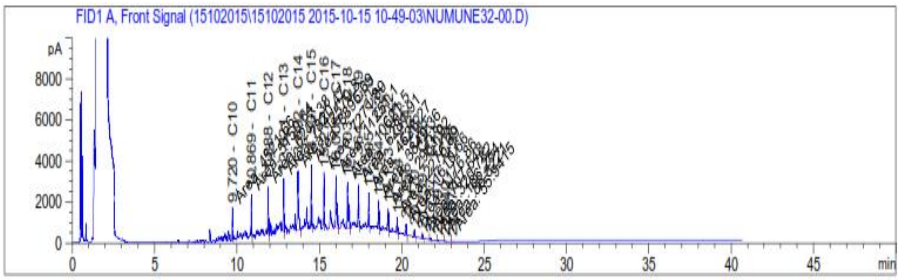

Figure D-99: EX:3; Port:1, T:4320 min, m:0.926 gr, gas chromatogram.

Table D-99: EX:3; Port:1, T:4320 min, m:0.926 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.72	4521.66113	102.4438	0.3073314	**C_{10}**
10.869	5150.83643	119.6404	0.3589212	**C_{11}**
11.888	6211.38281	142.85395	0.42856185	**C_{12}**
12.821	7820.47461	181.73669	0.54521007	**C_{13}**
13.692	1.26E+04	286.18948	0.85856844	**C_{14}**
14.507	8895.68945	197.63961	0.59291883	**C_{15}**
15.277	7271.8877	164.24736	0.49274208	**C_{16}**
16.008	1.13E+04	255.54817	0.76664451	**C_{17}**
16.703	1.06E+04	240.45131	0.72135393	**C_{18}**
17.364	6281.90869	148.33233	0.44499699	**C_{19}**
17.995	4626.26855	110.94708	0.33284124	**C_{20}**
18.594	3849.35522	97.41515	0.29224545	**C_{21}**
19.173	2981.01611	72.05339	0.21616017	**C_{22}**
19.724	2276.38672	56.84784	0.17054352	**C_{23}**
20.256	1610.66479	38.95017	0.11685051	**C_{24}**
20.77	1176.85986	28.736	0.086208	**C_{25}**
21.259	707.64789	17.36762	0.05210286	**C_{26}**
21.737	320.78168	8.20568	0.02461704	**C_{27}**
22.197	166.25438	2.12941	0.00638823	**C_{28}**
22.64	86.82214	2.15776	0.00647328	**C_{29}**
23.07	55.94155	0	0	**C_{30}**
23.776	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

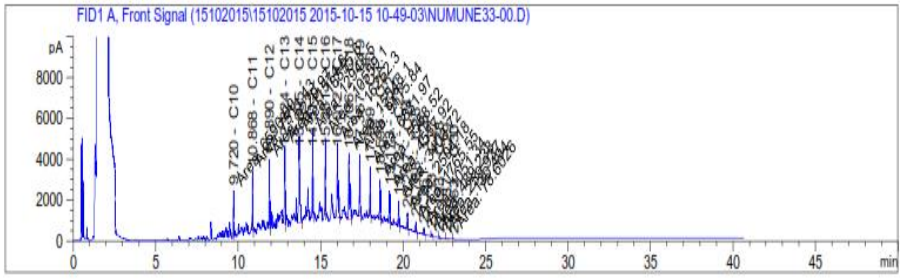

Figure D-100: EX:3, Port:2, T:4320 min, m:1.595 gr, gas chromatogram.

Table D-100: EX:3, Port:2, T:4320 min, m:1.595 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.72	6590.09473	150.67297	0.45201891	**C_{10}**
10.868	7511.42822	174.47074	0.52341222	**C_{11}**
11.89	9229.96973	211.70067	0.63510201	**C_{12}**
12.824	1.16E+04	268.97665	0.80692995	**C_{13}**
13.695	1.89E+04	428.22951	1.28468853	**C_{14}**
14.512	1.29E+04	282.05413	0.84616239	**C_{15}**
15.281	1.06E+04	237.97807	0.71393421	**C_{16}**
16.012	1.63E+04	369.14188	1.10742564	**C_{17}**
16.706	1.55E+04	351.67828	1.05503484	**C_{18}**
17.367	9115.83789	215.24883	0.64574649	**C_{19}**
17.999	6831.96729	166.05528	0.49816584	**C_{20}**
18.598	5558.51855	140.66873	0.42200619	**C_{21}**
19.173	4537.91895	111.47913	0.33443739	**C_{22}**
19.727	3403.71558	85.00045	0.25500135	**C_{23}**
20.257	2504.18384	61.41908	0.18425724	**C_{24}**
20.768	1765.55017	43.11036	0.12933108	**C_{25}**
21.261	1051.34119	25.63926	0.07691778	**C_{26}**
21.733	489.23816	12.51484	0.03754452	**C_{27}**
22.193	259.93723	4.50194	0.01350582	**C_{28}**
22.637	130.49359	3.24311	0.00972933	**C_{29}**
23.063	78.60258	0	0	**C_{30}**
23.776	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

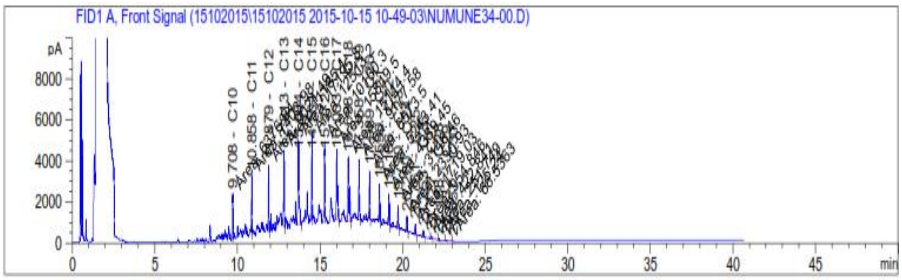

Figure D-101: EX:3; Port:1, T:4380 min, m:1.082 gr, gas chromatogram.

Table D-101: EX:3; Port:1, T:4380 min, m:1.082 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.708	6376.9375	145.70283	0.43710849	**C_{10}**
10.858	7403.97998	171.975	0.515925	**C_{11}**
11.879	9021.49316	206.94582	0.62083746	**C_{12}**
12.813	1.12E+04	259.92656	0.77977968	**C_{13}**
13.684	1.72E+04	390.66306	1.17198918	**C_{14}**
14.501	1.25E+04	272.98748	0.81896244	**C_{15}**
15.272	1.02E+04	229.03355	0.68710065	**C_{16}**
16.003	1.58E+04	359.31151	1.07793453	**C_{17}**
16.698	1.51E+04	341.88687	1.02566061	**C_{18}**
17.358	9177.58496	216.70684	0.65012052	**C_{19}**
17.989	6573.49658	159.59753	0.47879259	**C_{20}**
18.59	5243.4126	132.69438	0.39808314	**C_{21}**
19.166	4339.45361	106.45335	0.31936005	**C_{22}**
19.72	3148.46216	78.62604	0.23587812	**C_{23}**
20.25	2330.92676	57.06227	0.17118681	**C_{24}**
20.761	1719.02502	41.97433	0.12592299	**C_{25}**
21.253	954.84637	23.31693	0.06995079	**C_{26}**
21.727	422.84061	10.81637	0.03244911	**C_{27}**
22.188	251.74921	4.29458	0.01288374	**C_{28}**
22.632	125.24013	3.11255	0.00933765	**C_{29}**
23.057	68.53634	0	0	**C_{30}**
23.776	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

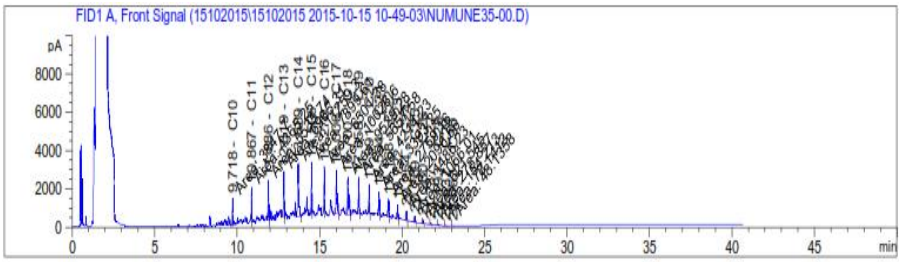

Figure D-102: EX:3; Port:2, T:4380 min, m:1.168 gr, gas chromatogram.

Table D-102: EX:3; Port:2, T:4380 min, m:1.168 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.718	3847.69556	86.7291	0.2601873	C_{10}
10.867	4365.24805	101.39324	0.30417972	C_{11}
11.886	5535.73926	127.44414	0.38233242	C_{12}
12.819	6965.31152	161.86392	0.48559176	C_{13}
13.689	1.13E+04	256.30227	0.76890681	C_{14}
14.506	7899.60596	176.89267	0.53067801	C_{15}
15.276	6501.37646	146.96516	0.44089548	C_{16}
16.006	1.00E+04	227.73554	0.68320662	C_{17}
16.7	9529.27539	215.79183	0.64737549	C_{18}
17.358	5657.58203	133.59034	0.40077102	C_{19}
17.991	4214.22949	100.65251	0.30195753	C_{20}
18.594	3393.25122	85.87258	0.25761774	C_{21}
19.168	2759.15576	66.43518	0.19930554	C_{22}
19.722	2096.55566	52.35695	0.15707085	C_{23}
20.254	1486.23071	35.82108	0.10746324	C_{24}
20.769	1066.0105	26.02933	0.07808799	C_{25}
21.26	621.54462	15.29538	0.04588614	C_{26}
21.737	278.85712	7.13324	0.02139972	C_{27}
22.193	154.21318	1.82446	0.00547338	C_{28}
22.637	78.14127	1.94202	0.00582606	C_{29}
23.063	48.13578	0	0	C_{30}
23.776	0	0	0	C_{31}
24.179	0	0	0	C_{32}

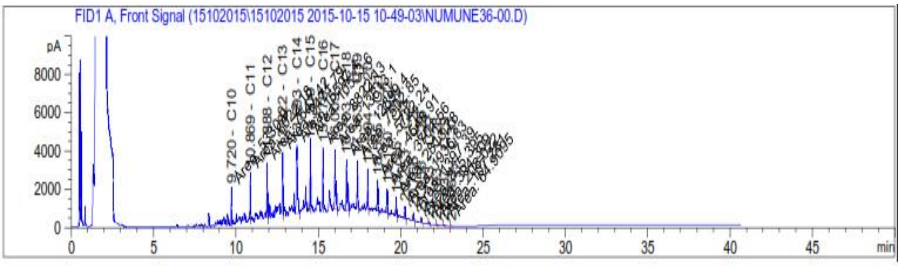

Figure D-103: EX:3; Port:1, T:4440 min, m:0.868 gr, gas chromatogram.

Table D-103: EX:3; Port:1, T:4440 min, m:0.868 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.72	5330.90381	121.31271	0.36393813	C_{10}
10.869	6022.18457	139.87953	0.41963859	C_{11}
11.888	7647.42285	175.60657	0.52681971	C_{12}
12.822	9471.79492	220.11103	0.66033309	C_{13}
13.693	1.56E+04	354.48696	1.06346088	C_{14}
14.509	1.05E+04	231.75587	0.69526761	C_{15}
15.279	8822.13379	199.01865	0.59705595	C_{16}
16.009	1.36E+04	309.19775	0.92759325	C_{17}
16.703	1.29E+04	291.87814	0.87563442	C_{18}
17.363	7502.85352	177.16204	0.53148612	C_{19}
17.994	5722.24023	138.32935	0.41498805	C_{20}
18.595	4548.91211	115.11875	0.34535625	C_{21}
19.17	3701.55835	90.29981	0.27089943	C_{22}
19.725	2813.78149	70.26812	0.21080436	C_{23}
20.253	1936.83105	47.15212	0.14145636	C_{24}
20.766	1397.39136	34.12083	0.10236249	C_{25}
21.256	835.39539	20.44211	0.06132633	C_{26}
21.733	394.30893	10.08652	0.03025956	C_{27}
22.193	208.02182	3.18717	0.00956151	C_{28}
22.637	107.28075	2.66621	0.00799863	C_{29}
23.063	64.90953	0	0	C_{30}
23.776	0	0	0	C_{31}
24.179	0	0	0	C_{32}

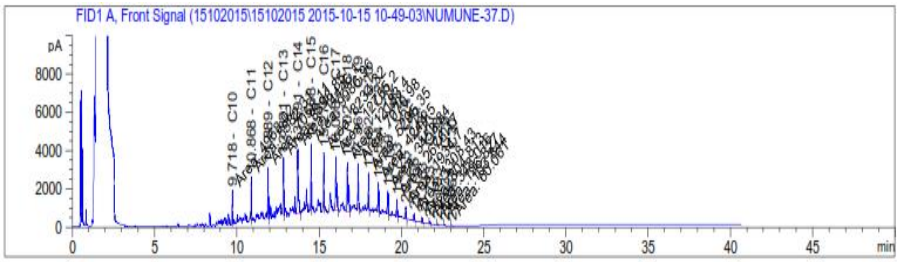

Figure D-104: EX:3, Port:2 T:4440 min, m:1,539 gr, gas chromatogram.

Table D-104: EX:3, Port:2 T:4440 min, m:1,539 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.718	4968.02197	112.85149	0.33855447	C_{10}
10.868	5582.31104	129.66242	0.38898726	C_{11}
11.889	7058.11035	162.16577	0.48649731	C_{12}
12.821	8898.84668	206.79653	0.62038959	C_{13}
13.691	1.44E+04	328.42971	0.98528913	C_{14}
14.508	9986.95605	220.36908	0.66110724	C_{15}
15.276	8234.31641	185.83418	0.55750254	C_{16}
16.008	1.28E+04	289.71246	0.86913738	C_{17}
16.702	1.22E+04	275.71454	0.82714362	C_{18}
17.361	7070.97852	166.96434	0.50089302	C_{19}
17.992	5295.34619	127.66363	0.38299089	C_{20}
18.594	4244.49658	107.41494	0.32224482	C_{21}
19.169	3453.83984	84.02679	0.25208037	C_{22}
19.723	2676.1687	66.83153	0.20049459	C_{23}
20.255	1934.69958	47.09852	0.14129556	C_{24}
20.766	1308.42639	31.94853	0.09584559	C_{25}
21.263	804.8125	19.70607	0.05911821	C_{26}
21.733	348.01593	8.90234	0.02670702	C_{27}
22.193	196.82686	2.90366	0.00871098	C_{28}
22.633	103.8445	2.58081	0.00774243	C_{29}
23.067	60.06097	0	0	C_{30}
23.776	0	0	0	C_{31}
24.179	0	0	0	C_{32}

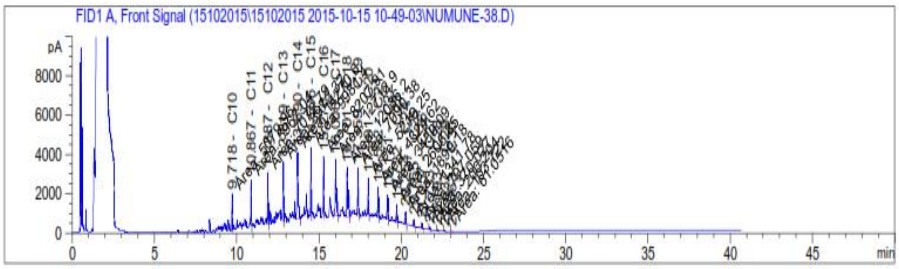

Figure D-105: EX:3; Port:1, T:4500 min, m:1.084 gr, gas chromatogram.

Table D-105: EX:3; Port:1, T:4500 min, m:1.084 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.718	5079.96094	115.46154	0.34638462	C_{10}
10.867	5967.04297	138.59873	0.41579619	C_{11}
11.887	7072.7915	162.50061	0.48750183	C_{12}
12.819	8972.32227	208.50399	0.62551197	C_{13}
13.69	1.43E+04	324.45716	0.97337148	C_{14}
14.506	9981.39844	220.25332	0.66075996	C_{15}
15.276	8207.90723	185.24184	0.55572552	C_{16}
16.008	1.27E+04	288.75203	0.86625609	C_{17}
16.701	1.20E+04	272.39045	0.81717135	C_{18}
17.359	7090.38379	167.42255	0.50226765	C_{19}
17.991	5219.25293	125.76248	0.37728744	C_{20}
18.592	4324.62109	109.44264	0.32832792	C_{21}
19.171	3430.09033	83.42538	0.25027614	C_{22}
19.722	2605.84766	65.07542	0.19522626	C_{23}
20.254	1899.18372	46.20542	0.13861626	C_{24}
20.765	1341.78271	32.76301	0.09828903	C_{25}
21.257	797.05859	19.51946	0.05855838	C_{26}
21.733	370.02701	9.46539	0.02839617	C_{27}
22.193	200.2043	2.98919	0.00896757	C_{28}
22.637	103.72224	2.57777	0.00773331	C_{29}
23.063	61.05162	0	0	C_{30}
23.776	0	0	0	C_{31}
24.179	0	0	0	C_{32}

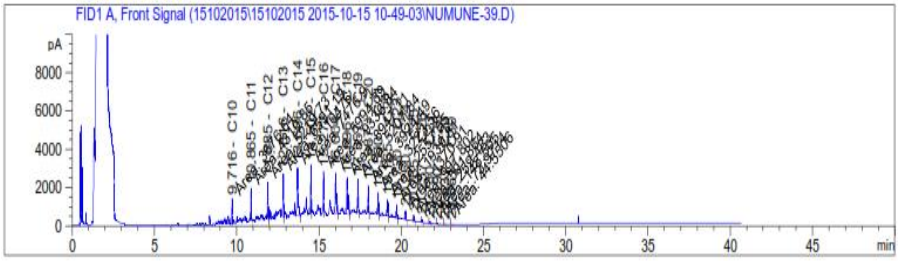

Figure D-106: EX:3; Port:2, T:4500 min, m:0.906 gr, gas chromatogram.

Table D-106: EX:3; Port:2, T:4500 min, m:0.906 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.716	3676.6394	82.74063	0.24822189	**C_{10}**
10.865	4310.84668	100.12964	0.30038892	**C_{11}**
11.885	5219.73438	120.23683	0.36071049	**C_{12}**
12.816	6591.18604	153.16978	0.45950934	**C_{13}**
13.686	1.05E+04	238.57481	0.71572443	**C_{14}**
14.502	7476.90283	168.08839	0.50426517	**C_{15}**
15.272	5994.3916	135.59372	0.40678116	**C_{16}**
16.004	9336.83594	212.06969	0.63620907	**C_{17}**
16.696	8947.11328	202.64838	0.60794514	**C_{18}**
17.357	5207.83887	122.97073	0.36891219	**C_{19}**
17.987	3924.49072	93.41354	0.28024062	**C_{20}**
18.59	3223.55762	81.57817	0.24473451	**C_{21}**
19.165	2557.55347	61.32997	0.18398991	**C_{22}**
19.72	1939.80945	48.44255	0.14532765	**C_{23}**
20.25	1370.90576	32.92105	0.09876315	**C_{24}**
20.765	997.80206	24.36385	0.07309155	**C_{25}**
21.257	591.86414	14.58106	0.04374318	**C_{26}**
21.73	259.48312	6.63765	0.01991295	**C_{27}**
22.19	148.50545	1.67991	0.00503973	**C_{28}**
22.637	73.97138	1.83838	0.00551514	**C_{29}**
23.061	44.55064	0	0	**C_{30}**
23.776	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

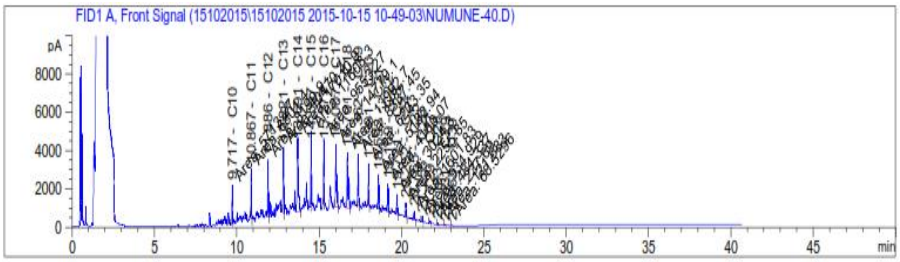

Figure D-107: EX:3; Port:1, T:4560 min, m:1.198 gr, gas chromatogram.

Table D-107: EX:3; Port:1, T:4560 min, m:1.198 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.717	5713.271	130.22828	0.39068484	**C_{10}**
10.867	6801.39697	157.97858	0.47393574	**C_{11}**
11.886	8199.89941	188.20724	0.56462172	**C_{12}**
12.821	1.05E+04	243.31388	0.72994164	**C_{13}**
13.691	1.70E+04	386.47875	1.15943625	**C_{14}**
14.507	1.16E+04	254.13904	0.76241712	**C_{15}**
15.277	9553.27344	215.41777	0.64625331	**C_{16}**
16.007	1.48E+04	335.68071	1.00704213	**C_{17}**
16.701	1.40E+04	316.56346	0.94969038	**C_{18}**
17.362	8337.44629	196.86896	0.59060688	**C_{19}**
17.991	6233.3457	151.09904	0.45329712	**C_{20}**
18.593	5132.93945	129.89865	0.38969595	**C_{21}**
19.169	4180.06543	102.41714	0.30725142	**C_{22}**
19.721	3024.30493	75.52549	0.22657647	**C_{23}**
20.252	2255.85205	55.1744	0.1655232	**C_{24}**
20.765	1601.82581	39.11261	0.11733783	**C_{25}**
21.255	934.92877	22.83757	0.06851271	**C_{26}**
21.729	484.33728	12.38947	0.03716841	**C_{27}**
22.193	237.6904	3.93854	0.01181562	**C_{28}**
22.631	121.6832	3.02415	0.00907245	**C_{29}**
23.063	68.52959	0	0	**C_{30}**
23.776	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

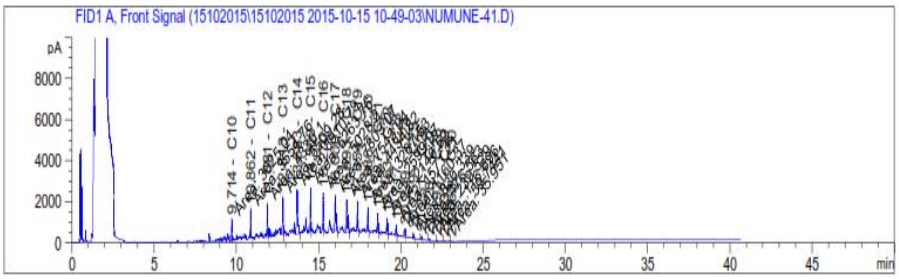

Figure D-108: EX:3; Port:2, T:4560 min, m:1.165 gr, gas chromatogram.

Table D-108: EX:3; Port:2, T:4560 min, m:1.165 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.714	3025.04004	67.54744	0.20264232	C_{10}
10.862	3554.76025	82.56774	0.24770322	C_{11}
11.881	4330.09863	99.94637	0.29983911	C_{12}
12.813	5509.27783	128.02777	0.38408331	C_{13}
13.683	8910.79004	203.1488	0.6094464	C_{14}
14.5	6263.75977	142.82042	0.42846126	C_{15}
15.27	5028.2002	113.92251	0.34176753	C_{16}
16	7803.07178	177.23295	0.53169885	C_{17}
16.693	7543.93848	170.96896	0.51290688	C_{18}
17.354	4434.81982	104.71772	0.31415316	C_{19}
17.986	3267.52563	76.99962	0.23099886	C_{20}
18.587	2599.97217	65.79717	0.19739151	C_{21}
19.163	2146.51758	50.92124	0.15276372	C_{22}
19.717	1571.20874	39.23755	0.11771265	C_{23}
20.249	1160.37305	27.62688	0.08288064	C_{24}
20.759	830.33917	20.27482	0.06082446	C_{25}
21.251	476.56274	11.80612	0.03541836	C_{26}
21.728	239.52924	6.12722	0.01838166	C_{27}
22.193	116.69623	8.74E-01	0.002623011	C_{28}
22.632	59.74407	1.4848	0.0044544	C_{29}
23.063	35.95097	0	0	C_{30}
23.776	0	0	0	C_{31}
24.179	0	0	0	C_{32}

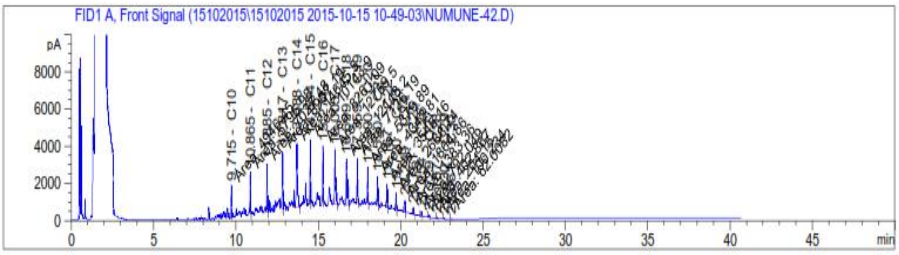

Figure D-109: EX:3; Port:1, T:5760 min, m:1.061 gr, gas chromatogram.

Table D-109: EX:3; Port:1, T:5760 min, m:1.061 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.715	4946.4541	112.34859	0.33704577	**C_{10}**
10.865	5795.9751	134.62527	0.40387581	**C_{11}**
11.885	7027.48486	161.46728	0.48440184	**C_{12}**
12.817	8907.18945	206.9904	0.6209712	**C_{13}**
13.688	1.46E+04	332.94229	0.99882687	**C_{14}**
14.504	1.01E+04	223.63844	0.67091532	**C_{15}**
15.274	8261.09082	186.43472	0.55930416	**C_{16}**
16.005	1.28E+04	289.81034	0.86943102	**C_{17}**
16.699	1.21E+04	274.24139	0.82272417	**C_{18}**
17.359	7126.18506	168.26791	0.50480373	**C_{19}**
17.99	5379.8916	129.77595	0.38932785	**C_{20}**
18.59	4342.8125	109.90301	0.32970903	**C_{21}**
19.167	3545.15747	86.33925	0.25901775	**C_{22}**
19.72	2688.73853	67.14544	0.20143632	**C_{23}**
20.249	1864.85754	45.34224	0.13602672	**C_{24}**
20.761	1383.36279	33.77829	0.10133487	**C_{25}**
21.254	792.04938	19.39891	0.05819673	**C_{26}**
21.729	402.86688	10.30544	0.03091632	**C_{27}**
22.187	204.14973	3.08911	0.00926733	**C_{28}**
22.63	100.23354	2.49107	0.00747321	**C_{29}**
23.061	62.00817	0	0	**C_{30}**
23.776	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

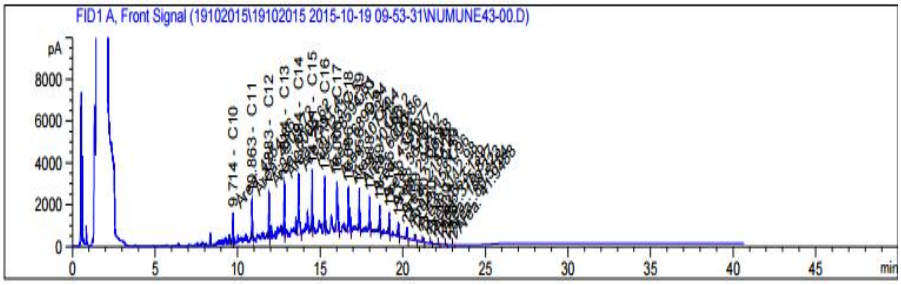

Figure D-110: EX:3; Port:2, T:5760 min, m:1.224 gr, gas chromatogram.

Table D-110: EX:3; Port:2, T:5760 min, m:1.224 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.714	4254.85693	96.22279	0.28866837	**C_{10}**
10.863	4909.72266	114.03996	0.34211988	**C_{11}**
11.883	6005.62451	138.16109	0.41448327	**C_{12}**
12.814	7591.39941	176.41331	0.52923993	**C_{13}**
13.684	1.23E+04	280.25187	0.84075561	**C_{14}**
14.501	8594.61328	191.36864	0.57410592	**C_{15}**
15.271	6899.94141	155.90478	0.46771434	**C_{16}**
16	1.07E+04	243.81277	0.73143831	**C_{17}**
16.696	1.02E+04	230.17165	0.69051495	**C_{18}**
17.356	6000.85986	141.69603	0.42508809	**C_{19}**
17.988	4350.76563	104.06379	0.31219137	**C_{20}**
18.589	3619.41797	91.59616	0.27478848	**C_{21}**
19.166	2936.48413	70.9257	0.2127771	**C_{22}**
19.716	2185.41187	54.57594	0.16372782	**C_{23}**
20.248	1581.96033	38.22835	0.11468505	**C_{24}**
20.759	1112.97595	27.17611	0.08152833	**C_{25}**
21.25	663.1391	16.29643	0.04888929	**C_{26}**
21.73	315.81659	8.07867	0.02423601	**C_{27}**
22.187	159.32274	1.95386	0.00586158	**C_{28}**
22.63	80.51539	2.00102	0.00600306	**C_{29}**
23.057	41.94876	0	0	**C_{30}**
23.776	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

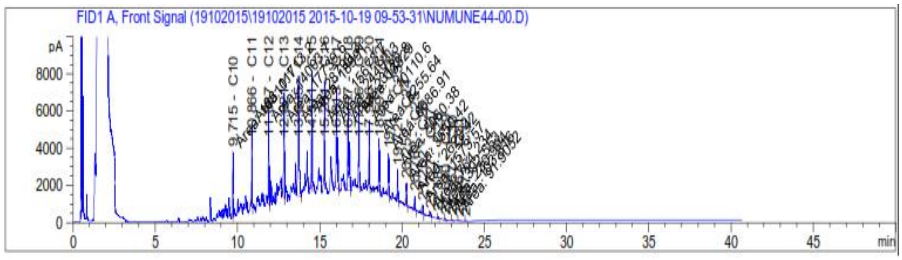

Figure D-111: EX:3; Port:1, T:5820 min, m:1.351 gr, gas chromatogram.

Table D-111: EX:3; Port:1, T:5820 min, m:1.351 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.715	1.03E+04	237.41186	0.71223558	C_{10}
10.866	1.17E+04	272.06766	0.81620298	C_{11}
11.887	1.40E+04	320.57733	0.96173199	C_{12}
12.821	1.77E+04	412.24372	1.23673116	C_{13}
13.695	2.88E+04	653.28412	1.95985236	C_{14}
14.511	1.90E+04	407.90942	1.22372826	C_{15}
15.281	1.57E+04	352.69571	1.05808713	C_{16}
16.013	2.44E+04	554.27796	1.66283388	C_{17}
16.707	2.31E+04	522.84957	1.56854871	C_{18}
17.366	1.38E+04	326.53896	0.97961688	C_{19}
17.996	1.01E+04	247.96991	0.74390973	C_{20}
18.597	8255.64063	208.92446	0.62677338	C_{21}
19.171	6686.91162	165.89846	0.49769538	C_{22}
19.721	5060.37793	126.37201	0.37911603	C_{23}
20.252	3550.42041	87.72832	0.26318496	C_{24}
20.762	2628.42163	64.17954	0.19253862	C_{25}
21.252	1573.57263	38.20776	0.11462328	C_{26}
21.727	764.2345	19.54931	0.05864793	C_{27}
22.187	392.55316	7.86047	0.02358141	C_{28}
22.63	230.99423	5.74081	0.01722243	C_{29}
23.057	103.81578	2.84E-01	0.00085125	C_{30}
23.467	91.9052	2.33425	0.00700275	C_{31}
23.873	33.85313	0	0	C_{32}

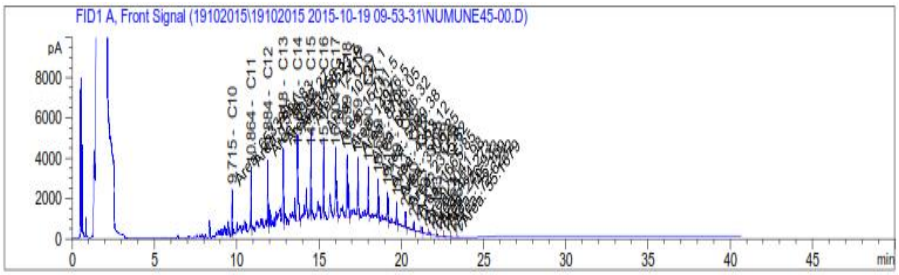

Figure D-112: EX:3; Port:2, T:5820 min, m:1.064 gr, gas chromatogram.

Table D-112: EX:3; Port:2, T:5820 min, m:1.064 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.715	6533.85938	149.36174	0.44808522	**C_{10}**
10.864	7544.82861	175.24655	0.52573965	**C_{11}**
11.884	8982.26953	206.05122	0.61815366	**C_{12}**
12.818	1.15E+04	266.27503	0.79882509	**C_{13}**
13.687	1.85E+04	420.71816	1.26215448	**C_{14}**
14.504	1.24E+04	270.98361	0.81295083	**C_{15}**
15.275	1.02E+04	230.75519	0.69226557	**C_{16}**
16.004	1.57E+04	356.85906	1.07057718	**C_{17}**
16.699	1.50E+04	338.77344	1.01632032	**C_{18}**
17.359	8796.04883	207.69777	0.62309331	**C_{19}**
17.99	6596.31641	160.16767	0.48050301	**C_{20}**
18.589	5499.38428	139.17223	0.41751669	**C_{21}**
19.165	4353.12402	106.79953	0.32039859	**C_{22}**
19.719	3305.25415	82.54159	0.24762477	**C_{23}**
20.247	2315.81519	56.68226	0.17004678	**C_{24}**
20.76	1665.85242	40.67598	0.12202794	**C_{25}**
21.251	1041.98193	25.41401	0.07624203	**C_{26}**
21.725	484.27304	12.38783	0.03716349	**C_{27}**
22.183	246.93256	4.1726	0.0125178	**C_{28}**
22.627	145.10864	3.60633	0.01081899	**C_{29}**
23.063	72.62318	0	0	**C_{30}**
23.467	55.16785	1.40118	0.00420354	**C_{31}**
24.179	0	0	0	**C_{32}**

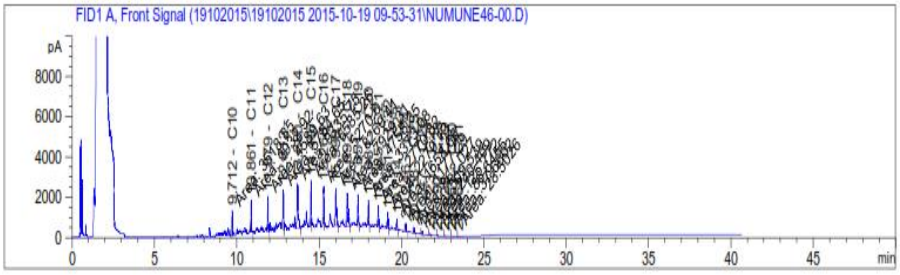

Figure D-113: EX:3; Port:1, T:5880 min, m:1.094 gr, gas chromatogram.

Table D-113: EX:3; Port:1, T:5880 min, m:1.094 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.712	3518.84961	79.06148	0.23718444	C_{10}
10.861	3932.92261	91.35146	0.27405438	C_{11}
11.879	4589.62549	105.86556	0.31759668	C_{12}
12.812	5784.64795	134.42698	0.40328094	C_{13}
13.68	9335.75293	212.76697	0.63830091	C_{14}
14.497	6585.26172	149.51683	0.44855049	C_{15}
15.268	5270.59668	119.35935	0.35807805	C_{16}
15.998	8260.4082	187.62054	0.56286162	C_{17}
16.692	7929.30615	179.66939	0.53900817	C_{18}
17.351	4758.34619	112.35703	0.33707109	C_{19}
17.981	3373.08472	79.63696	0.23891088	C_{20}
18.585	2770.82349	70.12088	0.21036264	C_{21}
19.161	2270.12646	54.05141	0.16215423	C_{22}
19.714	1658.65991	41.42145	0.12426435	C_{23}
20.246	1177.28552	28.05217	0.08415651	C_{24}
20.758	862.02716	21.04856	0.06314568	C_{25}
21.247	509.53925	12.59976	0.03779928	C_{26}
21.723	240.40878	6.14972	0.01844916	C_{27}
22.19	125.77181	1.10418	0.00331254	C_{28}
22.628	86.6455	2.15337	0.00646011	C_{29}
23.061	37.66019	0	0	C_{30}
23.464	28.50257	7.24E-01	0.00217176	C_{31}
24.179	0	0	0	C_{32}

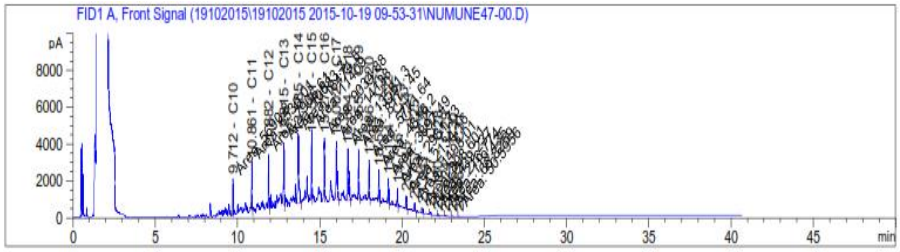

Figure D-114: EX:3; Port:2, T:5880 min, m:1.153 gr, gas chromatogram.

Table D-114: EX:3; Port:2, T:5880 min, m:1.153 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.712	5690.80127	129.70436	0.38911308	**C_{10}**
10.861	6530.01367	151.67506	0.45502518	**C_{11}**
11.882	7906.60645	181.51793	0.54455379	**C_{12}**
12.815	1.01E+04	234.32187	0.70296561	**C_{13}**
13.685	1.65E+04	374.33793	1.12301379	**C_{14}**
14.501	1.14E+04	249.98877	0.74996631	**C_{15}**
15.271	9034.87891	203.79042	0.61137126	**C_{16}**
16.002	1.41E+04	321.11966	0.96335898	**C_{17}**
16.694	1.36E+04	307.27525	0.92182575	**C_{18}**
17.355	8173.44775	192.99653	0.57898959	**C_{19}**
17.986	5771.6377	139.56351	0.41869053	**C_{20}**
18.587	4816.19775	121.88291	0.36564873	**C_{21}**
19.164	3897.4895	95.26141	0.28578423	**C_{22}**
19.716	2981.73022	74.46227	0.22338681	**C_{23}**
20.245	2134.16064	52.11428	0.15634284	**C_{24}**
20.757	1498.01172	36.57773	0.10973319	**C_{25}**
21.247	898.60138	21.96328	0.06588984	**C_{26}**
21.727	439.23672	11.23579	0.03370737	**C_{27}**
22.18	216.774	3.40883	0.01022649	**C_{28}**
22.624	119.43513	2.96828	0.00890484	**C_{29}**
23.063	66.82591	0	0	**C_{30}**
23.463	50.59555	1.28505	0.00385515	**C_{31}**
24.179	0	0	0	**C_{32}**

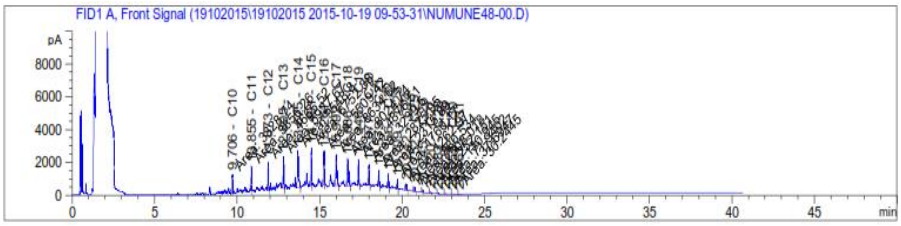

Figure D-115: EX:3; Port:1, T:5940 min, m:0.841 gr, gas chromatogram.

Table D-115: EX:3; Port:1, T:5940 min, m:0.841 gr

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amoun (mg)	Name
9.706	3328.73804	74.62869	0.22388607	C_{10}
10.855	3856.25781	89.57074	0.26871222	C_{11}
11.873	4665.51709	107.59646	0.32278938	C_{12}
12.805	5927.67432	137.75071	0.41325213	C_{13}
13.675	9548.80469	217.58896	0.65276688	C_{14}
14.491	6752.37842	152.99763	0.45899289	C_{15}
15.261	5509.41797	124.71599	0.37414797	C_{16}
15.992	8634.61816	196.12005	0.58836015	C_{17}
16.686	8024.74219	181.82404	0.54547212	C_{18}
17.346	4876.50977	115.14718	0.34544154	C_{19}
17.977	3239.49658	76.29933	0.22889799	C_{20}
18.579	2825.95093	71.51598	0.21454794	C_{21}
19.156	2315.89429	55.21039	0.16563117	C_{22}
19.709	1760.17151	43.95648	0.13186944	C_{23}
20.242	1262.97473	30.20696	0.09062088	C_{24}
20.752	880.5343	21.50046	0.06450138	C_{25}
21.245	508.01788	12.56314	0.03768942	C_{26}
21.72	252.15146	6.4501	0.0193503	C_{27}
22.183	130.94481	1.23518	0.00370554	C_{28}
22.624	71.94019	1.7879	0.0053637	C_{29}
23.053	37.69466	0	0	C_{30}
23.467	30.24454	7.68E-01	0.002304489	C_{31}
24.179	0	0	0	C_{32}

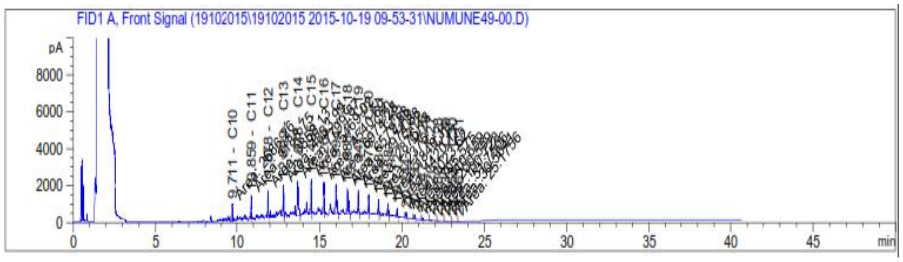

Figure D-116: EX:3; Port:2, T:5940 min, m:1.297 gr, gas chromatogram.

Table D-116: EX:3; Port:2, T:5940 min, m:1.297 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.711	2686.26245	59.64824	0.17894472	**C_{10}**
10.859	3188.75	74.06628	0.22219884	**C_{11}**
11.878	3858.1311	89.18192	0.26754576	**C_{12}**
12.809	4833.99219	112.3351	0.3370053	**C_{13}**
13.678	7799.57471	177.99872	0.53399616	**C_{14}**
14.495	5469.02393	126.26726	0.37880178	**C_{15}**
15.264	4540.68604	102.98779	0.30896337	**C_{16}**
15.994	6974.27588	158.40832	0.47522496	**C_{17}**
16.688	6579.87549	149.20335	0.44761005	**C_{18}**
17.347	3974.88159	93.85737	0.28157211	**C_{19}**
17.979	2876.17725	67.22199	0.20166597	**C_{20}**
18.581	2374.99902	60.1038	0.1803114	**C_{21}**
19.158	1840.18726	43.16398	0.12949194	**C_{22}**
19.712	1420.16797	35.46563	0.10639689	**C_{23}**
20.244	1023.61859	24.18798	0.07256394	**C_{24}**
20.756	705.57489	17.22839	0.05168517	**C_{25}**
21.247	410.65884	10.22001	0.03066003	**C_{26}**
21.72	200.55864	5.13034	0.01539102	**C_{27}**
22.18	100.72751	4.70E-01	0.001409778	**C_{28}**
22.63	51.75057	1.28614	0.00385842	**C_{29}**
23.053	30.56409	0	0	**C_{30}**
23.461	25.17556	6.39E-01	0.001918257	**C_{31}**
24.179	0	0	0	**C_{32}**

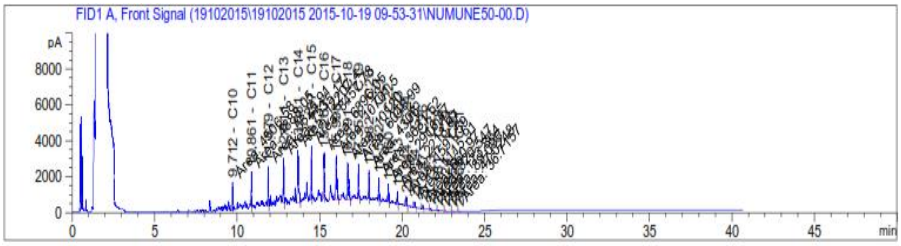

Figure D-117: EX:3; Port:1, T:6000 min, m:0.965 gr, gas chromatogram.

Table D-117: EX:3; Port:1, T:6000 min, m:0.965 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.712	4506.57813	102.09211	0.30627633	**C_{10}**
10.861	4888.0542	113.53666	0.34060998	**C_{11}**
11.879	5825.91064	134.06225	0.40218675	**C_{12}**
12.811	7535.17139	175.10665	0.52531995	**C_{13}**
13.681	1.22E+04	277.76021	0.83328063	**C_{14}**
14.497	8457.7832	188.51868	0.56555604	**C_{15}**
15.267	6896.0459	155.81741	0.46745223	**C_{16}**
15.998	1.07E+04	243.0647	0.7291941	**C_{17}**
16.691	1.01E+04	229.12762	0.68738286	**C_{18}**
17.352	6048.99219	142.83256	0.42849768	**C_{19}**
17.982	4305.99707	102.94527	0.30883581	**C_{20}**
18.582	3631.52466	91.90254	0.27570762	**C_{21}**
19.16	2916.4668	70.4188	0.2112564	**C_{22}**
19.713	2213.9668	55.28904	0.16586712	**C_{23}**
20.244	1591.5885	38.47046	0.11541138	**C_{24}**
20.754	1115.90906	27.24773	0.08174319	**C_{25}**
21.247	660.97015	16.24423	0.04873269	**C_{26}**
21.723	320.54718	8.19968	0.02459904	**C_{27}**
22.181	173.86353	2.32211	0.00696633	**C_{28}**
22.624	89.09502	2.21425	0.00664275	**C_{29}**
23.056	47.02482	0	0	**C_{30}**
23.466	36.71567	9.33E-01	0.002797557	**C_{31}**
24.179	0	0	0	**C_{32}**

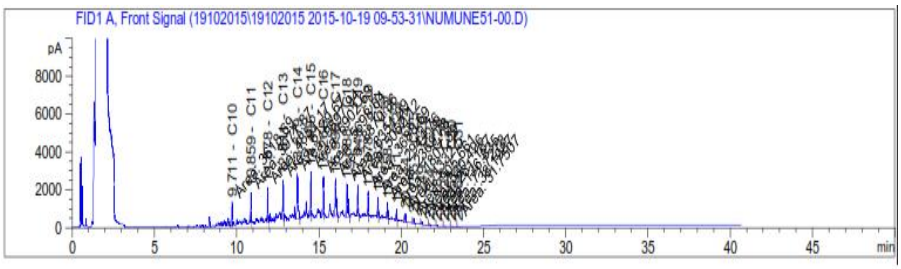

Figure D-118: EX:3; Port:2, T:6000 min, m:0.966 gr, gas chromatogram.

Table D-118: EX:3; Port:2, T:6000 min, m:0.966 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.711	3618.69116	81.38946	0.24416838	**C_{10}**
10.859	3977.86963	92.39546	0.27718638	**C_{11}**
11.878	4851.16504	111.83064	0.33549192	**C_{12}**
12.811	6129.66895	142.44478	0.42733434	**C_{13}**
13.679	9897.93555	225.49082	0.67647246	**C_{14}**
14.495	6902.63477	156.12724	0.46838172	**C_{15}**
15.265	5698.04346	128.94678	0.38684034	**C_{16}**
15.996	8870.3623	201.47456	0.60442368	**C_{17}**
16.688	8351.99219	189.21235	0.56763705	**C_{18}**
17.348	5052.12061	119.29381	0.35788143	**C_{19}**
17.978	3688.68652	87.5221	0.2625663	**C_{20}**
18.582	2944.7627	74.52274	0.22356822	**C_{21}**
19.158	2369.77856	56.57491	0.16972473	**C_{22}**
19.711	1807.39478	45.13578	0.13540734	**C_{23}**
20.244	1332.49646	31.95519	0.09586557	**C_{24}**
20.755	905.66125	22.114	0.066342	**C_{25}**
21.249	530.49609	13.10412	0.03931236	**C_{26}**
21.724	261.16684	6.68071	0.02004213	**C_{27}**
22.183	136.83527	1.38436	0.00415308	**C_{28}**
22.627	71.72778	1.78262	0.00534786	**C_{29}**
23.057	38.1987	0	0	**C_{30}**
23.466	31.75065	8.06E-01	0.002419248	**C_{31}**
24.179	0	0	0	**C_{32}**

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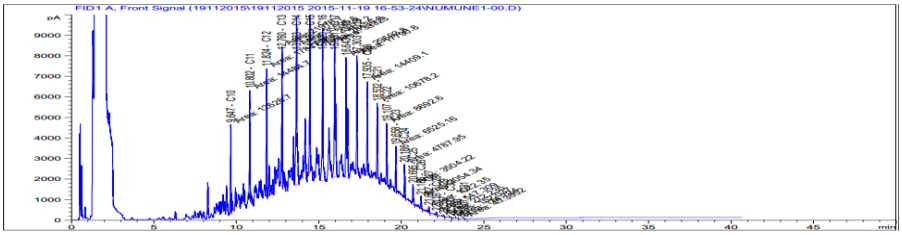

Figure D-119: EX:4, Port:1 T:30 min, m:1.309 gr, gas chromatogram.

Table D-119: EX:4, Port:1 T:30 min, m:1.309 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.647	1.26E+04	291.42735	0.87428205	C_{10}
10.802	1.45E+04	336.44067	1.00932201	C_{11}
11.824	1.78E+04	408.23854	1.22471562	C_{12}
12.76	2.20E+04	510.56767	1.53170301	C_{13}
13.633	3.56E+04	807.10381	2.42131143	C_{14}
14.45	2.40E+04	511.6613	1.5349839	C_{15}
15.22	2.81E+04	632.10279	1.89630837	C_{16}
15.951	3.33E+04	756.87246	2.27061738	C_{17}
16.643	2.96E+04	668.78889	2.00636667	C_{18}
17.303	1.78E+04	420.08809	1.26026427	C_{19}
17.935	1.44E+04	355.36538	1.06609614	C_{20}
18.532	1.07E+04	270.23091	0.81069273	C_{21}
19.107	8692.60156	216.68891	0.65006673	C_{22}
19.658	6525.15674	162.9517	0.4888551	C_{23}
20.186	4787.95361	118.848	0.356544	C_{24}
20.695	3504.22388	85.56445	0.25669335	C_{25}
21.186	2054.34277	49.77841	0.14933523	C_{26}
21.662	1022.34515	26.15185	0.07845555	C_{27}
22.116	547.30884	11.77968	0.03533904	C_{28}
22.557	272.23511	6.76576	0.02029728	C_{29}
22.99	152.03734	1.50316	0.00450948	C_{30}
23.807	45.30525	1.15068	0.00345204	C_{31}
24.179	0	0	0	C_{32}

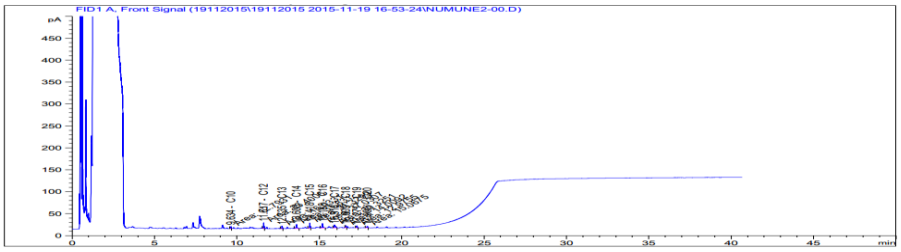

Figure D-120: EX:4, Port:2 T:30 min, m:1.102 gr, gas chromatogram.

Table D-120: EX:4, Port:2 T:30 min, m:1.102 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.634	12.79308	2.96E-01	0.000888753	C_{10}
10.8	0	0	0	C_{11}
11.617	33.40063	7.64E-01	0.002291643	C_{12}
12.735	16.03308	3.73E-01	0.001117758	C_{13}
13.603	31.83097	7.23E-01	0.002168649	C_{14}
14.418	31.32993	6.72E-01	0.002015124	C_{15}
15.188	37.03067	8.33E-01	0.002498328	C_{16}
15.918	30.32508	6.89E-01	0.00206634	C_{17}
16.609	14.0092	3.17E-01	0.00095028	C_{18}
17.271	12.97551	3.06E-01	0.000919158	C_{19}
17.903	15.06747	3.72E-01	0.001117398	C_{20}
18.53	0	0	0	C_{21}
19.107	0	0	0	C_{22}
19.68	0	0	0	C_{23}
20.2	0	0	0	C_{24}
20.7	0	0	0	C_{25}
21.2	0	0	0	C_{26}
21.7	0	0	0	C_{27}
22.2	0	0	0	C_{28}
22.6	0	0	0	C_{29}
23	0	0	0	C_{30}
23.9	0	0	0	C_{31}
24.179	0	0	0	C_{32}

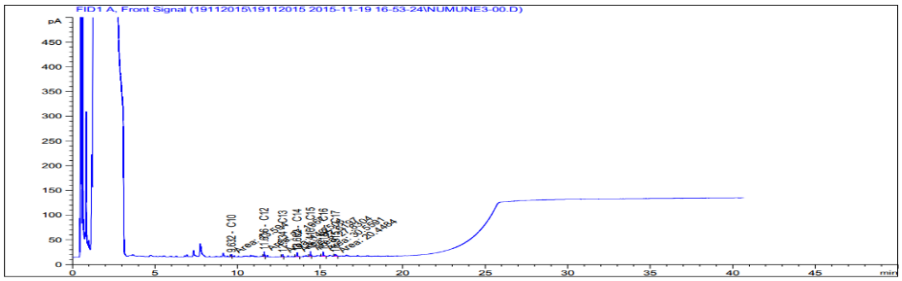

Figure D-121: EX:4, Port:3 T:30 min, m:0.746 gr, gas chromatogram.

Table D-121: EX:4, Port:3 T:30 min, m:0.746 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.632	13.59401	3.15E-01	0.000944397	**C_{10}**
10.8	0	0	0	**C_{11}**
11.616	27.19667	6.22E-01	0.001865985	**C_{12}**
12.734	14.25061	3.31E-01	0.000993492	**C_{13}**
13.602	27.61967	6.27E-01	0.001881732	**C_{14}**
14.416	27.83036	5.97E-01	0.001790034	**C_{15}**
15.186	30.55912	6.87E-01	0.002061714	**C_{16}**
15.915	20.44844	4.64E-01	0.00139335	**C_{17}**
16.65	0	0	0	**C_{18}**
17.35	0	0	0	**C_{19}**
17.95	0	0	0	**C_{20}**
18.53	0	0	0	**C_{21}**
19.107	0	0	0	**C_{22}**
19.68	0	0	0	**C_{23}**
20.2	0	0	0	**C_{24}**
20.7	0	0	0	**C_{25}**
21.2	0	0	0	**C_{26}**
21.7	0	0	0	**C_{27}**
22.2	0	0	0	**C_{28}**
22.6	0	0	0	**C_{29}**
23	0	0	0	**C_{30}**
23.9	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

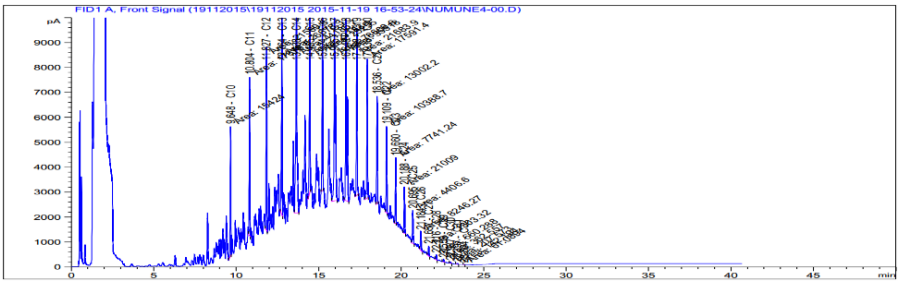

Figure D-122: EX:4, Port:1 T:60 min, m:1.41 gr, gas chromatogram.

Table D-122: EX:4, Port:1 T:60 min, m:1.41 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.648	1.54E+04	356.65157	1.06995471	**C_{10}**
10.804	1.77E+04	410.5855	1.2317565	**C_{11}**
11.827	2.16E+04	493.14308	1.47942924	**C_{12}**
12.764	2.67E+04	619.9664	1.8598992	**C_{13}**
13.638	4.42E+04	1001.52476	3.00457428	**C_{14}**
14.455	2.92E+04	620.17514	1.86052542	**C_{15}**
15.224	2.53E+04	567.59949	1.70279847	**C_{16}**
15.955	7.86E+04	1785.478	5.356434	**C_{17}**
16.648	3.55E+04	802.53915	2.40761745	**C_{18}**
17.308	2.17E+04	512.01424	1.53604272	**C_{19}**
17.936	1.76E+04	434.87336	1.30462008	**C_{20}**
18.536	1.30E+04	329.04472	0.98713416	**C_{21}**
19.109	1.04E+04	259.64033	0.77892099	**C_{22}**
19.66	7741.24219	193.32081	0.57996243	**C_{23}**
20.188	2.10E+04	526.75193	1.58025579	**C_{24}**
20.695	4406.60059	107.59826	0.32279478	**C_{25}**
21.184	8246.26758	198.79894	0.59639682	**C_{26}**
21.657	1303.31567	33.33915	0.10001745	**C_{27}**
22.116	660.28827	14.64091	0.04392273	**C_{28}**
22.559	362.55737	9.0105	0.0270315	**C_{29}**
22.987	207.57324	2.90754	0.00872262	**C_{30}**
23.397	142.1936	3.61149	0.01083447	**C_{31}**
23.804	61.08943	0	0	**C_{32}**

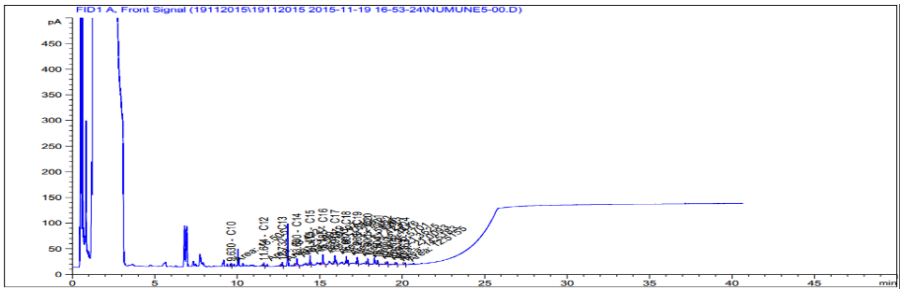

Figure D-123: EX:4 Port:2 T:60 min, m:1.049 gr, gas chromatogram.

Table D-123: EX:4 Port:2 T:60 min, m:1.049 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.63	16.50501	3.82E-01	1.15E-03	**C_{10}**
10.8	0	0	0	**C_{11}**
11.614	18.42212	4.21E-01	0.001263957	**C_{12}**
12.732	23.49187	5.46E-01	0.001637754	**C_{13}**
13.6	55.95973	1.27085	0.00381255	**C_{14}**
14.415	51.78856	1.11034	0.00333102	**C_{15}**
15.185	74.27323	1.67032	0.00501096	**C_{16}**
15.914	72.58961	1.64874	0.00494622	**C_{17}**
16.607	57.42301	1.29838	0.00389514	**C_{18}**
17.268	38.44755	9.08E-01	0.002723541	**C_{19}**
17.9	35.57008	8.79E-01	0.002637867	**C_{20}**
18.504	21.36248	5.41E-01	0.001621854	**C_{21}**
19.08	21.00931	5.28E-01	0.001583514	**C_{22}**
19.635	14.51833	3.63E-01	0.001087692	**C_{23}**
20.167	12.51554	3.14E-01	0.000940797	**C_{24}**
20.7	0	0	0	**C_{25}**
21.2	0	0	0	**C_{26}**
21.7	0	0	0	**C_{27}**
22.2	0	0	0	**C_{28}**
22.6	0	0	0	**C_{29}**
23	0	0	0	**C_{30}**
23.9	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

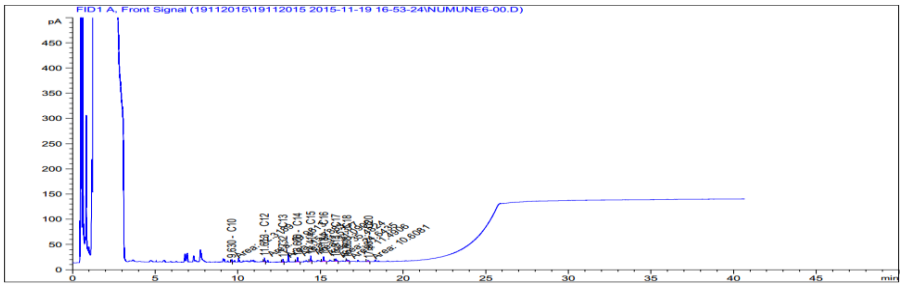

Figure D-124: EX:4, Port:3 T:60 min, m:1.107 gr, gas chromatogram.

Table D-124: EX:4, Port:3 T:60 min, m:1.107 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.63	12.31892	2.85E-01	0.000855813	C_{10}
10.8	0	0	0	C_{11}
11.613	19.9613	4.57E-01	0.00136956	C_{12}
12.732	15.78829	3.67E-01	0.001100691	C_{13}
13.6	31.53773	7.16E-01	0.002148672	C_{14}
14.414	31.09064	6.67E-01	0.001999734	C_{15}
15.184	35.48242	7.98E-01	0.002393874	C_{16}
15.913	24.64346	5.60E-01	0.001679199	C_{17}
16.608	11.49061	2.60E-01	0.000779439	C_{18}
17.35	0	0	0	C_{19}
17.901	10.60811	2.62E-01	0.000786693	C_{20}
18.53	0	0	0	C_{21}
19.107	0	0	0	C_{22}
19.68	0	0	0	C_{23}
20.2	0	0	0	C_{24}
20.7	0	0	0	C_{25}
21.2	0	0	0	C_{26}
21.7	0	0	0	C_{27}
22.2	0	0	0	C_{28}
22.6	0	0	0	C_{29}
23	0	0	0	C_{30}
23.9	0	0	0	C_{31}
24.179	0	0	0	C_{32}

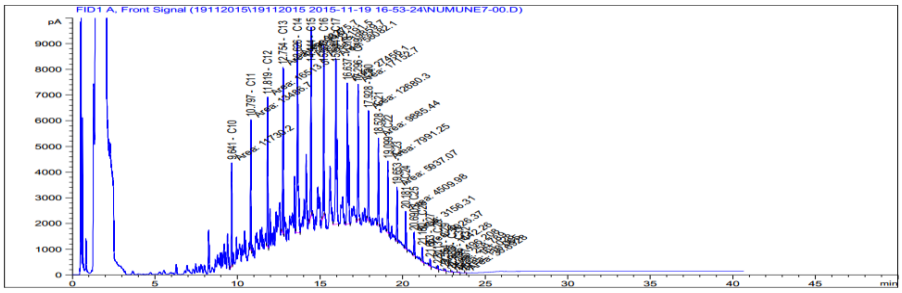

Figure D-125: EX:4, Port:1 T:90 min, m:1.055 gr, gas chromatogram.

Table D-125: EX:4, Port:1 T:90 min, m:1.055 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.641	1.17E+04	270.52246	0.81156738	C_{10}
10.797	1.35E+04	313.26072	0.93978216	C_{11}
11.819	1.65E+04	377.82015	1.13346045	C_{12}
12.754	1.99E+04	462.41603	1.38724809	C_{13}
13.626	3.33E+04	754.59863	2.26379589	C_{14}
14.444	2.22E+04	474.571	1.423713	C_{15}
15.213	1.99E+04	446.58631	1.33975893	C_{16}
15.944	5.81E+04	1319.23149	3.95769447	C_{17}
16.637	2.75E+04	620.52464	1.86157392	C_{18}
17.296	1.72E+04	405.0201	1.2150603	C_{19}
17.928	1.27E+04	312.17149	0.93651447	C_{20}
18.528	9885.4375	250.16952	0.75050856	C_{21}
19.099	7991.25195	198.9285	0.5967855	C_{22}
19.653	5937.07275	148.26557	0.44479671	C_{23}
20.181	4509.98242	111.85799	0.33557397	C_{24}
20.69	3156.31177	77.0693	0.2312079	C_{25}
21.18	1926.37427	46.69861	0.14009583	C_{26}
21.653	1442.25586	36.89328	0.11067984	C_{27}
22.113	496.20816	10.48555	0.03145665	C_{28}
22.554	258.78894	6.43159	0.01929477	C_{29}
22.98	161.02765	1.73051	0.00519153	C_{30}
23.396	110.06525	2.79548	0.00838644	C_{31}
23.807	36.69276	0	0	C_{32}

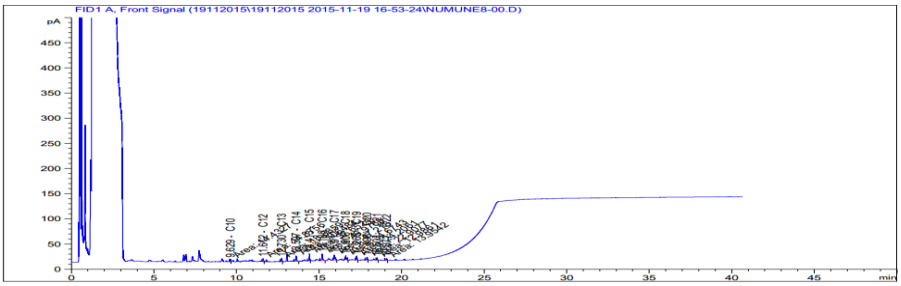

Figure D-126: EX:4, Port:2 T:90 min, m:0.948 gr, gas chromatogram.

Table D-126: EX:4, Port:2 T:90 min, m:0.948 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.629	14.43268	3.34E-01	0.00100266	**C_{10}**
10.8	0	0	0	**C_{11}**
11.612	14.87563	3.40E-01	0.001020627	**C_{12}**
12.73	18.8859	4.39E-01	0.001316643	**C_{13}**
13.597	39.64845	9.00E-01	0.002701257	**C_{14}**
14.413	37.65244	8.07E-01	0.002421786	**C_{15}**
15.183	49.97854	1.12396	0.00337188	**C_{16}**
15.912	47.21801	1.07247	0.00321741	**C_{17}**
16.606	34.67432	7.84E-01	0.002352048	**C_{18}**
17.265	24.20614	5.72E-01	0.00171471	**C_{19}**
17.898	22.90773	5.66E-01	0.001698831	**C_{20}**
18.501	12.98614	3.29E-01	0.000985917	**C_{21}**
19.077	13.95423	3.51E-01	0.001051758	**C_{22}**
19.68	0	0	0	**C_{23}**
20.2	0	0	0	**C_{24}**
20.7	0	0	0	**C_{25}**
21.2	0	0	0	**C_{26}**
21.7	0	0	0	**C_{27}**
22.2	0	0	0	**C_{28}**
22.6	0	0	0	**C_{29}**
23	0	0	0	**C_{30}**
23.9	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

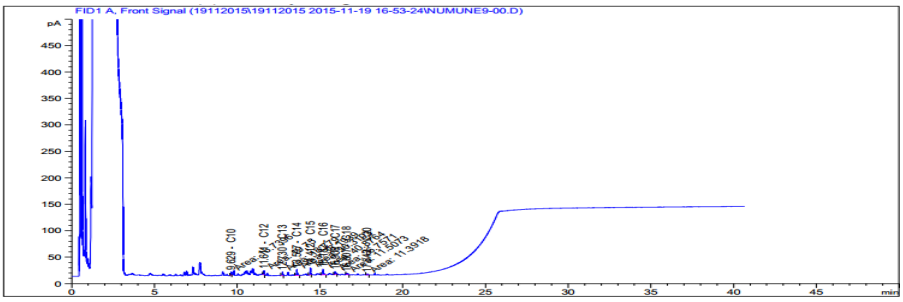

Figure D-127: EX:4, P:3 T:90 min, m:1.034 gr, gas chromatogram.

Table D-127: EX:4, P:3 T:90 min, m:1.034 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.629	18.73958	4.34E-01	0.001301865	**C_{10}**
10.8	0	0	0	**C_{11}**
11.611	19.75	4.52E-01	0.001355064	**C_{12}**
12.73	18.77896	4.36E-01	0.001309188	**C_{13}**
13.597	38.19387	8.67E-01	0.002602155	**C_{14}**
14.412	36.3103	7.78E-01	0.002335461	**C_{15}**
15.182	40.87638	9.19E-01	0.002757783	**C_{16}**
15.908	26.7571	6.08E-01	0.00182322	**C_{17}**
16.607	11.50732	2.60E-01	0.00078057	**C_{18}**
17.35	0	0	0	**C_{19}**
17.842	11.39179	2.82E-01	0.000844812	**C_{20}**
18.53	0	0	0	**C_{21}**
19.107	0	0	0	**C_{22}**
19.68	0	0	0	**C_{23}**
20.2	0	0	0	**C_{24}**
20.7	0	0	0	**C_{25}**
21.2	0	0	0	**C_{26}**
21.7	0	0	0	**C_{27}**
22.2	0	0	0	**C_{28}**
22.6	0	0	0	**C_{29}**
23	0	0	0	**C_{30}**
23.9	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

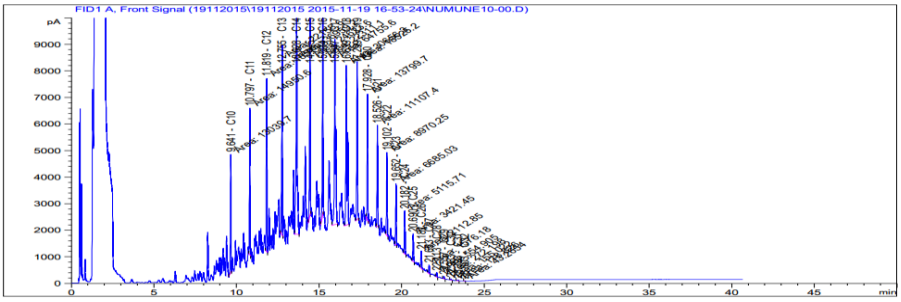

Figure D-128: EX:4, P:1 T:120 min, m:1.178 gr, gas chromatogram.

Table D-128: EX:4, P:1 T:120 min, m:1.178 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.641	1.30E+04	301.05765	0.90317295	C_{10}
10.797	1.50E+04	347.26344	1.04179032	C_{11}
11.819	1.86E+04	424.82327	1.27446981	C_{12}
12.755	2.22E+04	514.93521	1.54480563	C_{13}
13.628	3.70E+04	837.96791	2.51390373	C_{14}
14.445	2.46E+04	525.22888	1.57568664	C_{15}
15.214	2.23E+04	501.56998	1.50470994	C_{16}
15.947	6.48E+04	1470.80813	4.41242439	C_{17}
16.639	3.07E+04	692.77558	2.07832674	C_{18}
17.299	1.85E+04	437.42796	1.31228388	C_{19}
17.928	1.38E+04	340.13998	1.02041994	C_{20}
18.526	1.11E+04	281.0948	0.8432844	C_{21}
19.102	8970.24707	223.71977	0.67115931	C_{22}
19.652	6685.02686	166.94411	0.50083233	C_{23}
20.182	5115.70605	127.08985	0.38126955	C_{24}
20.69	3421.4541	83.54342	0.25063026	C_{25}
21.181	2112.85156	51.18654	0.15355962	C_{26}
21.653	1576.1825	40.31915	0.12095745	C_{27}
22.113	554.90509	11.97206	0.03591618	C_{28}
22.557	272.19803	6.76484	0.02029452	C_{29}
22.983	155.02208	1.57864	0.00473592	C_{30}
23.393	118.82564	3.01798	0.00905394	C_{31}
23.803	43.26542	0	0	C_{32}

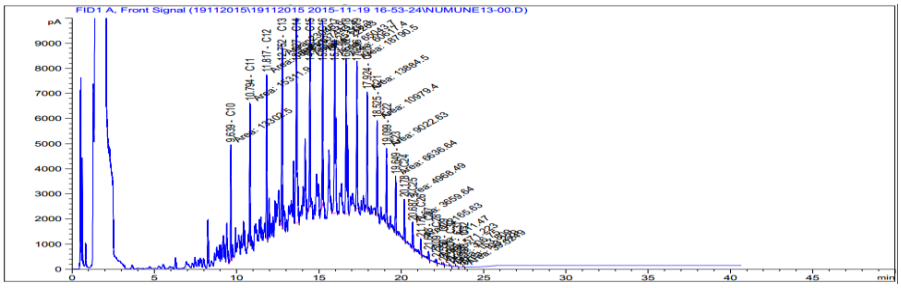

Figure D-129: EX:4, Port:1 T:180 min, m:1.25 gr, gas chromatogram.

Table D-129: EX:4, Port:1 T:180 min, m:1.25 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.639	1.33E+04	308.04706	0.92414118	C_{10}
10.794	1.53E+04	355.65572	1.06696716	C_{11}
11.817	1.86E+04	425.88672	1.27766016	C_{12}
12.752	2.30E+04	535.54683	1.60664049	C_{13}
13.627	3.74E+04	850.36483	2.55109449	C_{14}
14.443	2.52E+04	539.64713	1.61894139	C_{15}
15.212	2.23E+04	500.66785	1.50200355	C_{16}
15.944	6.50E+04	1477.3515	4.4320545	C_{17}
16.636	6.06E+04	1370.61221	4.11183663	C_{18}
17.296	1.88E+04	443.69347	1.33108041	C_{19}
17.924	1.39E+04	343.22449	1.02967347	C_{20}
18.525	1.10E+04	277.85507	0.83356521	C_{21}
19.099	9022.62891	226.68454	0.68005362	C_{22}
19.649	6636.63818	165.73571	0.49720713	C_{23}
20.178	4968.49219	124.49439	0.37348317	C_{24}
20.687	3659.64087	89.35935	0.26807805	C_{25}
21.177	2165.63428	52.16067	0.15648201	C_{26}
21.648	1611.46899	41.22179	0.12366537	C_{27}
22.109	571.22339	14.3972	0.0431916	C_{28}
22.55	306.75037	7.62355	0.02287065	C_{29}
22.98	153.80859	3.86856	0.01160568	C_{30}
23.397	103.22942	2.62186	0.00786558	C_{31}
23.798	39.02491	1.04261	0.00312783	C_{32}

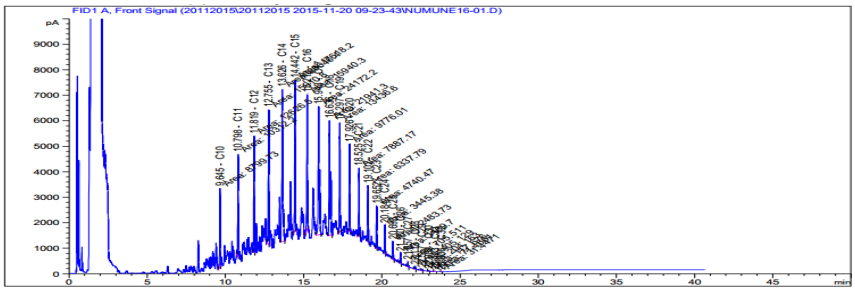

Figure D-130: EX:4, Port:1 T:240 min, m:0.829 gr, gas chromatogram.

Table D-130: EX:4, Port:1 T:240 min, m:0.829 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.645	8799.73242	203.77675	0.61133025	C_{10}
10.798	1.03E+04	239.52616	0.71857848	C_{11}
11.819	1.26E+04	288.77073	0.86631219	C_{12}
12.755	1.59E+04	369.74456	1.10923368	C_{13}
13.626	2.56E+04	582.43109	1.74729327	C_{14}
14.442	1.76E+04	377.73016	1.13319048	C_{15}
15.212	1.59E+04	358.47811	1.07543433	C_{16}
15.943	2.42E+04	549.02943	1.64708829	C_{17}
16.636	2.19E+04	496.11121	1.48833363	C_{18}
17.297	1.34E+04	317.27332	0.95181996	C_{19}
17.926	9776.00586	241.66187	0.72498561	C_{20}
18.525	7887.17139	199.59965	0.59879895	C_{21}
19.102	6337.78857	159.23061	0.47769183	C_{22}
19.652	4740.46777	118.38295	0.35514885	C_{23}
20.184	3445.38208	86.33017	0.25899051	C_{24}
20.693	2483.72974	60.64652	0.18193956	C_{25}
21.18	1469.70239	35.39871	0.10619613	C_{26}
21.657	705.51074	18.04715	0.05414145	C_{27}
22.113	405.12915	10.21093	0.03063279	C_{28}
22.557	204.16348	5.074	0.015222	C_{29}
22.988	117.67555	2.95975	0.00887925	C_{30}
23.403	71.4661	1.81512	0.00544536	C_{31}
23.806	31.44713	8.40E-01	0.002520477	C_{32}

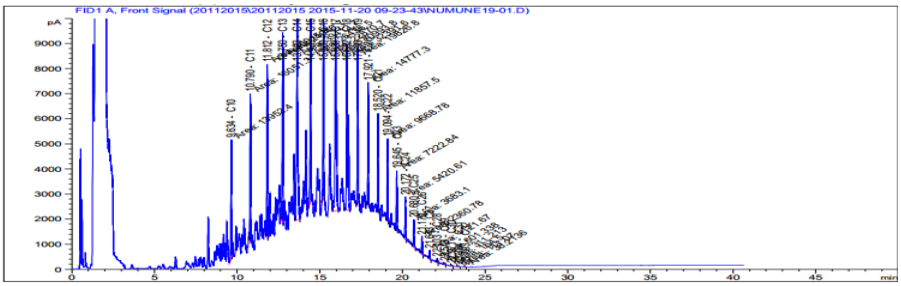

Figure D-131: EX:4, Port:1 T:1440 min, m:1.083 gr, gas chromatogram.

Table D-131: EX:4, Port:1 T:1440 min, m:1.083 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.634	1.40E+04	323.09871	0.96929613	C_{10}
10.79	1.61E+04	372.82984	1.11848952	C_{11}
11.812	2.00E+04	457.7696	1.3733088	C_{12}
12.75	2.40E+04	558.67085	1.67601255	C_{13}
13.623	3.94E+04	895.06436	2.68519308	C_{14}
14.439	2.64E+04	566.79318	1.70037954	C_{15}
15.209	2.29E+04	514.33437	1.54300311	C_{16}
15.939	7.10E+04	1612.49937	4.83749811	C_{17}
16.632	3.24E+04	732.40255	2.19720765	C_{18}
17.293	1.98E+04	468.16251	1.40448753	C_{19}
17.921	1.48E+04	365.29448	1.09588344	C_{20}
18.52	1.19E+04	300.07601	0.90022803	C_{21}
19.094	9668.77734	242.91837	0.72875511	C_{22}
19.645	7222.8374	180.37477	0.54112431	C_{23}
20.172	5420.60645	135.82292	0.40746876	C_{24}
20.68	3683.09766	89.93211	0.26979633	C_{25}
21.17	2360.77832	56.86083	0.17058249	C_{26}
21.643	1121.66846	28.69257	0.08607771	C_{27}
22.103	601.33771	15.1562	0.0454686	C_{28}
22.543	311.21271	7.73445	0.02320335	C_{29}
22.971	164.5004	4.13748	0.01241244	C_{30}
23.384	111.0705	2.82101	0.00846303	C_{31}
23.793	38.21361	1.02094	0.00306282	C_{32}

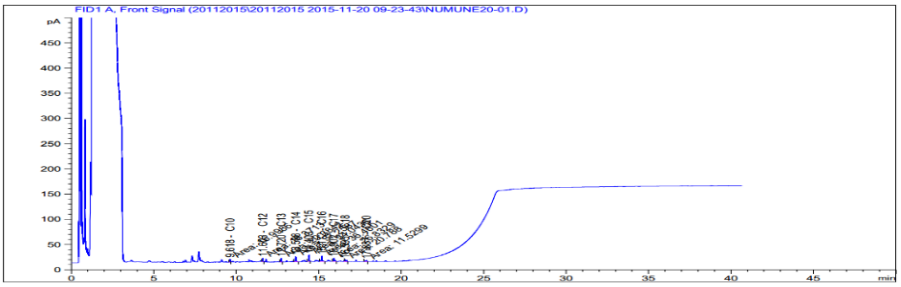

Figure D-132: EX:4, Port:2 T:1440 min, m:0.736 gr, gas chromatogram.

Table D-132: EX:4, Port:2 T:1440 min, m:0.736 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.618	16.99863	3.94E-01	0.00118092	**C_{10}**
10.8	0	0	0	**C_{11}**
11.603	16.37129	3.74E-01	0.001123248	**C_{12}**
12.72	20.38425	4.74E-01	0.001421103	**C_{13}**
13.588	37.25869	8.46E-01	0.002538441	**C_{14}**
14.403	34.04361	7.30E-01	0.002189667	**C_{15}**
15.172	36.46012	8.20E-01	0.002459835	**C_{16}**
15.902	26.83293	6.09E-01	0.001828386	**C_{17}**
16.595	20.78797	4.70E-01	0.001410102	**C_{18}**
17.35	0	0	0	**C_{19}**
17.887	11.52987	2.85E-01	0.000855051	**C_{20}**
18.53	0	0	0	**C_{21}**
19.107	0	0	0	**C_{22}**
19.68	0	0	0	**C_{23}**
20.2	0	0	0	**C_{24}**
20.7	0	0	0	**C_{25}**
21.2	0	0	0	**C_{26}**
21.7	0	0	0	**C_{27}**
22.2	0	0	0	**C_{28}**
22.6	0	0	0	**C_{29}**
23	0	0	0	**C_{30}**
23.9	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

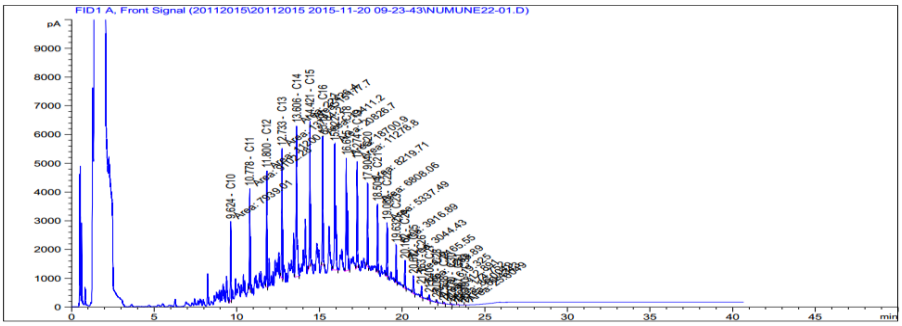

Figure D-133: EX:4, Port:1 T:1500 min, m:0.917 gr, gas chromatogram.

Table D-133: EX:4, Port:1 T:1500 min, m:0.917 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.624	7939.01416	183.84497	0.55153491	**C_{10}**
10.778	9102.27637	211.42197	0.63426591	**C_{11}**
11.8	1.12E+04	256.15993	0.76847979	**C_{12}**
12.733	1.38E+04	320.32507	0.96097521	**C_{13}**
13.606	2.24E+04	509.3047	1.5279141	**C_{14}**
14.421	1.52E+04	325.40657	0.97621971	**C_{15}**
15.191	1.34E+04	301.60117	0.90480351	**C_{16}**
15.922	2.08E+04	473.04122	1.41912366	**C_{17}**
16.615	1.87E+04	422.84416	1.26853248	**C_{18}**
17.274	1.13E+04	266.32168	0.79896504	**C_{19}**
17.904	8219.70801	203.19035	0.60957105	**C_{20}**
18.504	6808.05615	172.29062	0.51687186	**C_{21}**
19.082	5337.49414	134.09921	0.40229763	**C_{22}**
19.632	3916.89478	97.81599	0.29344797	**C_{23}**
20.162	3044.42847	76.28356	0.22885068	**C_{24}**
20.672	2165.55029	52.87737	0.15863211	**C_{25}**
21.163	1268.88684	30.56194	0.09168582	**C_{26}**
21.64	619.32507	15.84249	0.04752747	**C_{27}**
22.095	312.8905	7.88614	0.02365842	**C_{28}**
22.538	174.75232	4.34305	0.01302915	**C_{29}**
22.97	86.00489	2.16318	0.00648954	**C_{30}**
23.387	60.43427	1.53493	0.00460479	**C_{31}**
23.79	25.60489	6.84E-01	0.002052225	**C_{32}**

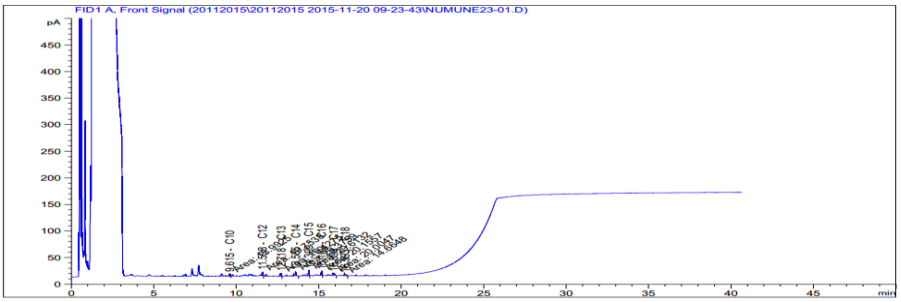

Figure D-134: EX:4, Port:2 T:1500 min, m:0.77 gr, gas chromatogram.

Table D-134: EX:4, Port:2 T:1500 min, m:0.77 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.615	13.99253	0	0	**C_{10}**
10.8	0	0	0	**C_{11}**
11.598	19.75383	1.63775	0.00491325	**C_{12}**
12.718	16.42751	3.82E-01	0.001145256	**C_{13}**
13.585	29.3759	2.13618	0.00640854	**C_{14}**
14.399	29.61317	12.9724	0.0389172	**C_{15}**
15.169	20.15574	1.59443	0.00478329	**C_{16}**
15.898	20.00471	4.54E-01	0.001363116	**C_{17}**
16.593	14.66479	9.81E-01	0.002942568	**C_{18}**
17.35	0	0	0	**C_{19}**
17.95	0	0	0	**C_{20}**
18.53	0	0	0	**C_{21}**
19.107	0	0	0	**C_{22}**
19.68	0	0	0	**C_{23}**
20.2	0	0	0	**C_{24}**
20.7	0	0	0	**C_{25}**
21.2	0	0	0	**C_{26}**
21.7	0	0	0	**C_{27}**
22.2	0	0	0	**C_{28}**
22.6	0	0	0	**C_{29}**
23	0	0	0	**C_{30}**
23.9	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

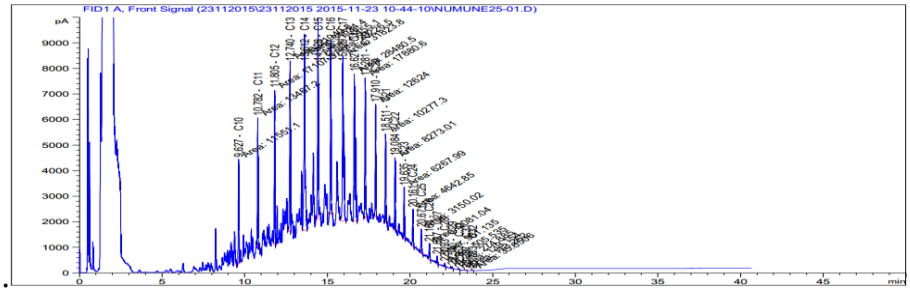

Figure D-135: EX:4, Port:1 T:1560 min, m:1.211 gr, gas chromatogram.

Table D-135: EX:4, Port:1 T:1560 min, m:1.211 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.627	1.16E+04	267.49099	0.80247297	C_{10}
10.782	1.35E+04	312.80668	0.93842004	C_{11}
11.805	1.71E+04	391.24793	1.17374379	C_{12}
12.74	2.10E+04	488.94668	1.46684004	C_{13}
13.612	3.46E+04	786.54921	2.35964763	C_{14}
14.428	2.35E+04	502.87289	1.50861867	C_{15}
15.197	2.02E+04	454.86929	1.36460787	C_{16}
15.929	3.18E+04	722.82205	2.16846615	C_{17}
16.621	2.85E+04	643.96864	1.93190592	C_{18}
17.281	1.79E+04	422.20769	1.26662307	C_{19}
17.91	1.26E+04	312.0652	0.9361956	C_{20}
18.511	1.03E+04	260.08544	0.78025632	C_{21}
19.084	8273.00684	207.85103	0.62355309	C_{22}
19.635	6267.98926	156.5295	0.4695885	C_{23}
20.161	4642.84961	116.33484	0.34900452	C_{24}
20.671	3150.02393	76.91577	0.23074731	C_{25}
21.164	2081.03613	50.12307	0.15036921	C_{26}
21.637	981.13507	25.09769	0.07529307	C_{27}
22.093	505.53537	12.74159	0.03822477	C_{28}
22.54	274.88544	6.83163	0.02049489	C_{29}
22.967	139.15434	3.49998	0.01049994	C_{30}
23.387	113.25216	2.87642	0.00862926	C_{31}
23.783	35.65065	9.52E-01	0.002857389	C_{32}

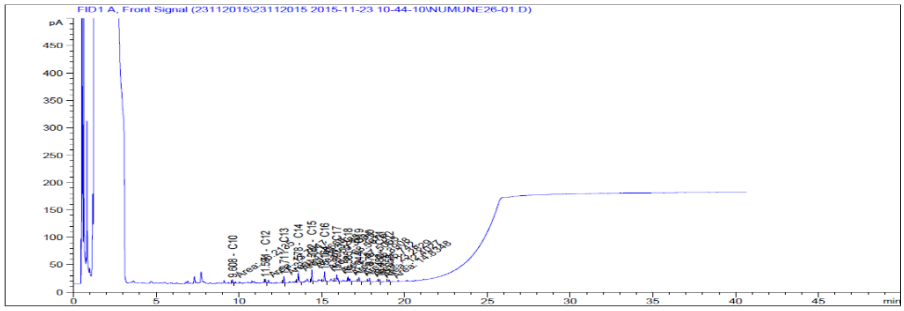

Figure D-136: EX:4, Port:2 T:1560 min, m:1.031 gr, gas chromatogram.

Table D-136: EX:4, Port:2 T:1560 min, m:1.031 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.608	16.21351	3.75E-01	0.001126377	**C_{10}**
10.8	0	0	0	**C_{11}**
11.591	13.70475	3.13E-01	0.000940293	**C_{12}**
12.711	31.56684	7.34E-01	0.002200704	**C_{13}**
13.578	64.32553	1.46084	0.00438252	**C_{14}**
14.392	59.38845	1.27328	0.00381984	**C_{15}**
15.164	68.56762	1.542	0.004626	**C_{16}**
15.892	57.50627	1.30615	0.00391845	**C_{17}**
16.585	45.3908	1.02633	0.00307899	**C_{18}**
17.244	25.74202	6.08E-01	0.001823511	**C_{19}**
17.878	23.28291	5.76E-01	0.001726653	**C_{20}**
18.482	12.40272	3.14E-01	0.000941622	**C_{21}**
19.058	14.83482	3.73E-01	0.00111813	**C_{22}**
19.68	0	0	0	**C_{23}**
20.2	0	0	0	**C_{24}**
20.7	0	0	0	**C_{25}**
21.2	0	0	0	**C_{26}**
21.7	0	0	0	**C_{27}**
22.2	0	0	0	**C_{28}**
22.6	0	0	0	**C_{29}**
23	0	0	0	**C_{30}**
23.9	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

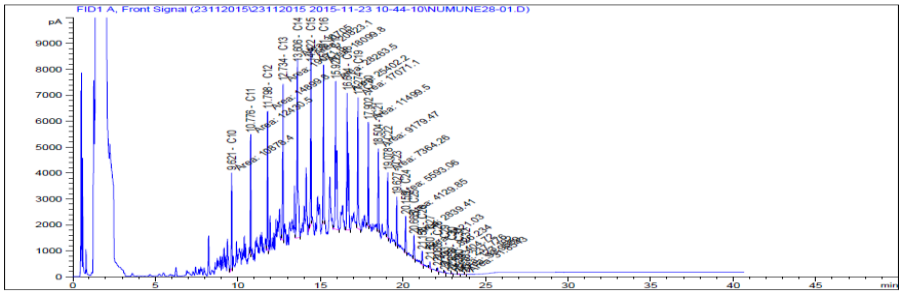

Figure D-137: EX:4, Port:1 T:1620 min, m:1.175 gr, gas chromatogram.

Table D-137: EX:4, Port:1 T:1620 min, m:1.175 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.621	1.09E+04	251.91271	0.75573813	**C_{10}**
10.776	1.24E+04	288.72745	0.86618235	**C_{11}**
11.798	1.49E+04	340.76139	1.02228417	**C_{12}**
12.734	1.91E+04	443.20095	1.32960285	**C_{13}**
13.606	3.07E+04	697.31264	2.09193792	**C_{14}**
14.422	2.08E+04	446.44292	1.33932876	**C_{15}**
15.191	1.81E+04	407.04252	1.22112756	**C_{16}**
15.922	2.83E+04	641.95537	1.92586611	**C_{17}**
16.614	2.54E+04	574.36653	1.72309959	**C_{18}**
17.274	1.71E+04	403.09396	1.20928188	**C_{19}**
17.902	1.15E+04	284.26531	0.85279593	**C_{20}**
18.504	9179.47266	232.30376	0.69691128	**C_{21}**
19.078	7364.26465	185.01979	0.55505937	**C_{22}**
19.627	5593.05762	139.67454	0.41902362	**C_{23}**
20.159	4129.84521	103.4806	0.3104418	**C_{24}**
20.665	2839.41431	69.33145	0.20799435	**C_{25}**
21.158	1821.02759	43.8606	0.1315818	**C_{26}**
21.63	826.23352	21.13527	0.06340581	**C_{27}**
22.088	404.71951	10.20061	0.03060183	**C_{28}**
22.533	237.77644	5.90937	0.01772811	**C_{29}**
22.958	123.19206	3.0985	0.0092955	**C_{30}**
23.38	93.95589	2.38633	0.00715899	**C_{31}**
23.783	31.85433	8.51E-01	0.002553114	**C_{32}**

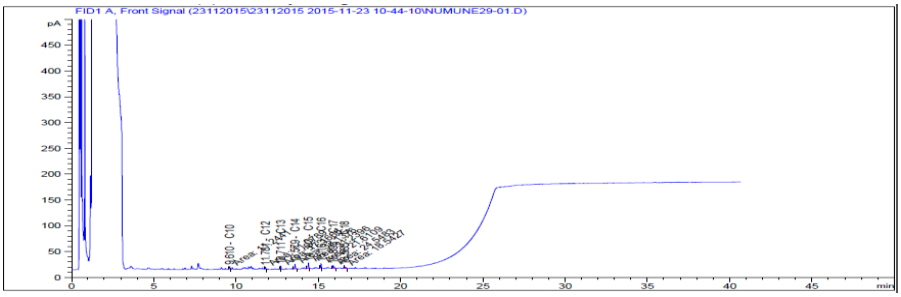

Figure D-138: EX:4, Port:2 T:1620 min, m:0.82 gr, gas chromatogram.

Table D-138: EX:4, Port:2 T:1620 min, m:0.82 gr

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.61	11.24409	2.60E-01	0.000781143	**C_{10}**
10.8	0	0	0	**C_{11}**
11.781	11.07891	2.53E-01	0.000760131	**C_{12}**
12.711	17.16662	3.99E-01	0.001196784	**C_{13}**
13.579	32.13762	7.30E-01	0.002189541	**C_{14}**
14.393	31.23961	6.70E-01	0.002009316	**C_{15}**
15.163	21.61094	4.86E-01	0.001458012	**C_{16}**
15.893	24.54826	5.58E-01	0.00167271	**C_{17}**
16.585	18.54272	4.19E-01	0.001257801	**C_{18}**
17.35	0	0	0	**C_{19}**
17.95	0	0	0	**C_{20}**
18.53	0	0	0	**C_{21}**
19.107	0	0	0	**C_{22}**
19.68	0	0	0	**C_{23}**
20.2	0	0	0	**C_{24}**
20.7	0	0	0	**C_{25}**
21.2	0	0	0	**C_{26}**
21.7	0	0	0	**C_{27}**
22.2	0	0	0	**C_{28}**
22.6	0	0	0	**C_{29}**
23	0	0	0	**C_{30}**
23.9	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

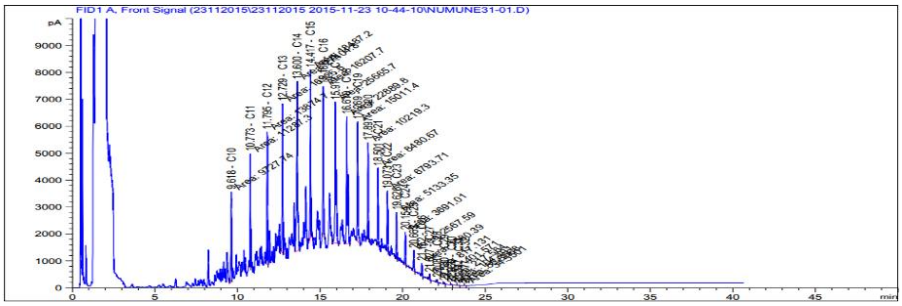

Figure D-139: EX:4, Port:1 T:1680 min, m:1.089 gr, gas chromatogram.

Table D-139: EX:4, Port:1 T:1680 min, m:1.089 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.618	9727.74219	225.26681	0.67580043	C_{10}
10.773	1.13E+04	262.17405	0.78652215	C_{11}
11.795	1.39E+04	317.31766	0.95195298	C_{12}
12.729	1.69E+04	393.34971	1.18004913	C_{13}
13.6	2.74E+04	622.36416	1.86709248	C_{14}
14.417	1.85E+04	396.36313	1.18908939	C_{15}
15.186	1.62E+04	364.49156	1.09347468	C_{16}
15.917	2.57E+04	582.95102	1.74885306	C_{17}
16.61	2.29E+04	517.55731	1.55267193	C_{18}
17.269	1.50E+04	354.45766	1.06337298	C_{19}
17.897	1.02E+04	252.6195	0.7578585	C_{20}
18.501	8480.66699	214.61917	0.64385751	C_{21}
19.073	6793.70996	170.68517	0.51205551	C_{22}
19.626	5133.35303	128.19441	0.38458323	C_{23}
20.154	3691.01465	92.48493	0.27745479	C_{24}
20.663	2567.58716	62.69411	0.18808233	C_{25}
21.152	1580.38855	38.06465	0.11419395	C_{26}
21.627	817.13135	20.90243	0.06270729	C_{27}
22.087	401.57053	10.12124	0.03036372	C_{28}
22.53	217.56425	5.40704	0.01622112	C_{29}
22.96	104.49138	2.62815	0.00788445	C_{30}
23.377	85.8568	2.18063	0.00654189	C_{31}
23.777	34.55011	9.23E-01	0.00276918	C_{32}

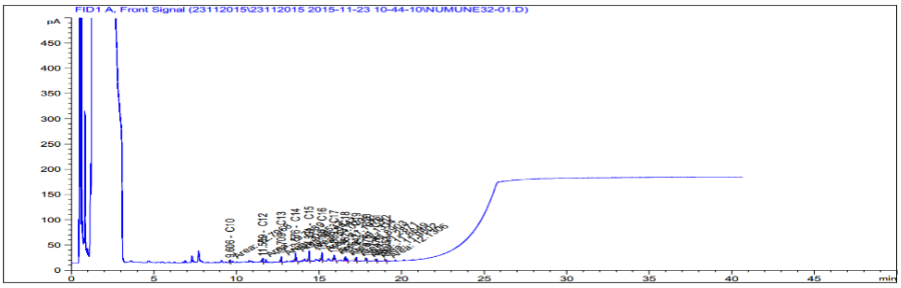

Figure D-140: EX:4, Port:2 T:1680 min, m:1.003 gr, gas chromatogram.

Table D-140: EX:4, Port:2 T:1680 min, m:1.003 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.606	12.7968	2.96E-01	0.000889011	**C_{10}**
10.8	0	0	0	**C_{11}**
11.589	19.78892	4.53E-01	0.001357734	**C_{12}**
12.709	30.35323	7.05E-01	0.002116098	**C_{13}**
13.576	46.84471	1.06385	0.00319155	**C_{14}**
14.391	54.07327	1.15932	0.00347796	**C_{15}**
15.16	41.19755	9.26E-01	0.002779452	**C_{16}**
15.889	49.13144	1.11593	0.00334779	**C_{17}**
16.582	41.89027	9.47E-01	0.002841525	**C_{18}**
17.242	21.28708	5.03E-01	0.001507932	**C_{19}**
17.875	11.86487	2.93E-01	0.000879894	**C_{20}**
18.476	11.98015	3.03E-01	0.00090954	**C_{21}**
19.053	12.13063	3.05E-01	0.00091431	**C_{22}**
19.68	0	0	0	**C_{23}**
20.2	0	0	0	**C_{24}**
20.7	0	0	0	**C_{25}**
21.2	0	0	0	**C_{26}**
21.7	0	0	0	**C_{27}**
22.2	0	0	0	**C_{28}**
22.6	0	0	0	**C_{29}**
23	0	0	0	**C_{30}**
23.9	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

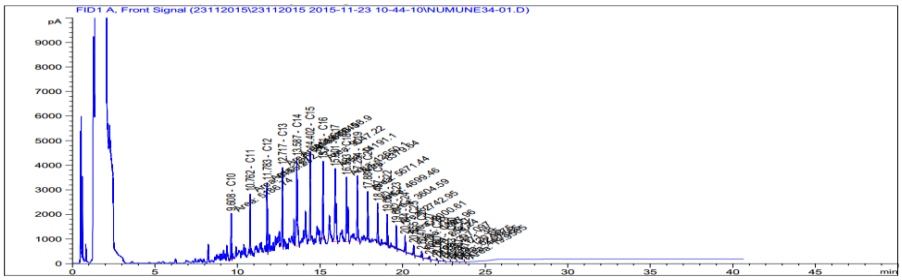

Figure D-141: EX:4, Port:1 T:2880 min, m:1.002 gr, gas chromatogram.

Table D-141: EX:4, Port:1 T:2880 min, m:1.002 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.608	5186.74023	120.11014	0.36033042	C_{10}
10.762	6155.22949	142.96981	0.42890943	C_{11}
11.783	7672.23193	175.46592	0.52639776	C_{12}
12.717	9418.66699	218.87641	0.65662923	C_{13}
13.587	1.54E+04	350.56434	1.05169302	C_{14}
14.402	1.05E+04	225.09357	0.67528071	C_{15}
15.171	9047.22363	203.46133	0.61038399	C_{16}
15.901	1.42E+04	322.32486	0.96697458	C_{17}
16.593	1.27E+04	286.02876	0.85808628	C_{18}
17.254	8379.6377	197.86521	0.59359563	C_{19}
17.884	5671.44043	140.19743	0.42059229	C_{20}
18.487	4699.46289	118.92872	0.35678616	C_{21}
19.062	3604.59351	90.56181	0.27168543	C_{22}
19.612	2742.95313	68.49933	0.20549799	C_{23}
20.144	2000.60767	50.12878	0.15038634	C_{24}
20.655	1387.95959	33.89053	0.10167159	C_{25}
21.147	858.23975	20.67125	0.06201375	C_{26}
21.622	397.09714	10.15785	0.03047355	C_{27}
22.08	171.38016	4.31949	0.01295847	C_{28}
22.527	120.65039	2.99848	0.00899544	C_{29}
22.953	62.96748	1.58374	0.00475122	C_{30}
23.367	44.75546	1.13672	0.00341016	C_{31}
23.773	19.95646	5.33E-01	0.001599504	C_{32}

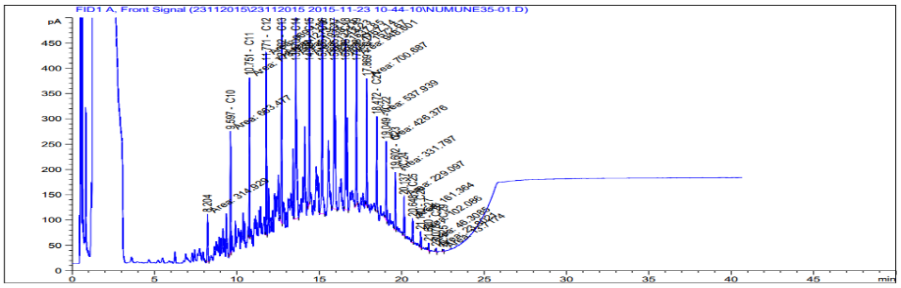

Figure D-142: EX:4, Port:2 T:2880 min, m:0.938 gr, gas chromatogram.

Table D-142: EX:4, Port:2 T:2880 min, m:0.938 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.597	663.47668	15.36423	0.04609269	C_{10}
10.751	778.62885	18.0855	0.0542565	C_{11}
11.771	969.1131	22.16387	0.06649161	C_{12}
12.702	1213.30505	28.19548	0.08458644	C_{13}
13.57	1938.79468	44.03015	0.13209045	C_{14}
14.384	1342.22876	28.77715	0.08633145	C_{15}
15.156	1537.84875	34.58439	0.10375317	C_{16}
15.885	1767.13611	40.13737	0.12041211	C_{17}
16.578	1572.66919	35.55941	0.10667823	C_{18}
17.238	948.60132	22.39896	0.06719688	C_{19}
17.869	700.68689	17.32091	0.05196273	C_{20}
18.472	537.93921	13.61356	0.04084068	C_{21}
19.049	426.37619	10.71228	0.03213684	C_{22}
19.602	331.79712	8.28592	0.02485776	C_{23}
20.137	229.0968	5.74043	0.01722129	C_{24}
20.648	161.36403	3.94011	0.01182033	C_{25}
21.14	102.08607	2.45881	0.00737643	C_{26}
21.62	46.30853	1.18458	0.00355374	C_{27}
22.078	23.80205	6.00E-01	0.00179973	C_{28}
22.525	13.71735	3.41E-01	0.001022736	C_{29}
23	0	0	0	C_{30}
23.9	0	0	0	C_{31}
24.179	0	0	0	C_{32}

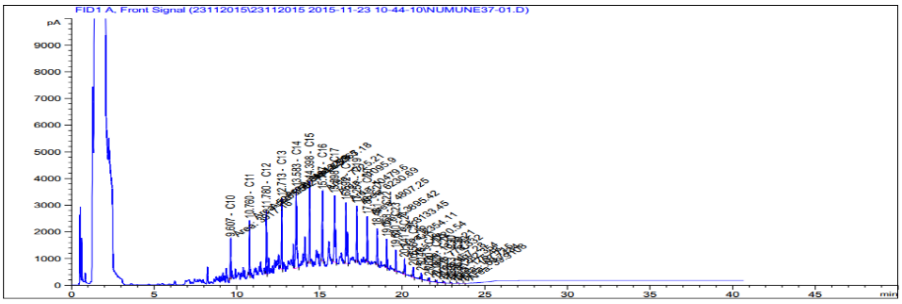

Figure D-143: EX:4, Port:1 T:2940 min, m:1.254 gr, gas chromatogram.

Table D-143: EX:4, Port:1 T:2940 min, m:1.254 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.607	3917.16089	90.71029	0.27213087	C_{10}
10.76	5295.56104	123.00197	0.36900591	C_{11}
11.78	6552.76904	149.86352	0.44959056	C_{12}
12.713	8134.85498	189.04245	0.56712735	C_{13}
13.583	1.32E+04	300.41891	0.90125673	C_{14}
14.398	8967.17578	192.25471	0.57676413	C_{15}
15.167	7725.21436	173.73091	0.52119273	C_{16}
15.898	1.11E+04	252.02261	0.75606783	C_{17}
16.592	1.05E+04	236.95354	0.71086062	C_{18}
17.251	6230.69287	147.12299	0.44136897	C_{19}
17.881	4807.24609	118.83463	0.35650389	C_{20}
18.481	3895.42407	98.58101	0.29574303	C_{21}
19.058	3133.44971	78.72479	0.23617437	C_{22}
19.61	2354.1106	58.78883	0.17636649	C_{23}
20.141	1720.53601	43.11108	0.12933324	C_{24}
20.656	1318.20984	32.18741	0.09656223	C_{25}
21.146	778.33191	18.74661	0.05623983	C_{26}
21.62	467.28046	11.95315	0.03585945	C_{27}
22.08	282.35446	7.1165	0.0213495	C_{28}
22.523	175.47981	4.36113	0.01308339	C_{29}
22.953	107.71529	2.70923	0.00812769	C_{30}
23.363	69.74336	1.77137	0.00531411	C_{31}
23.773	39.91079	1.06628	0.00319884	C_{32}

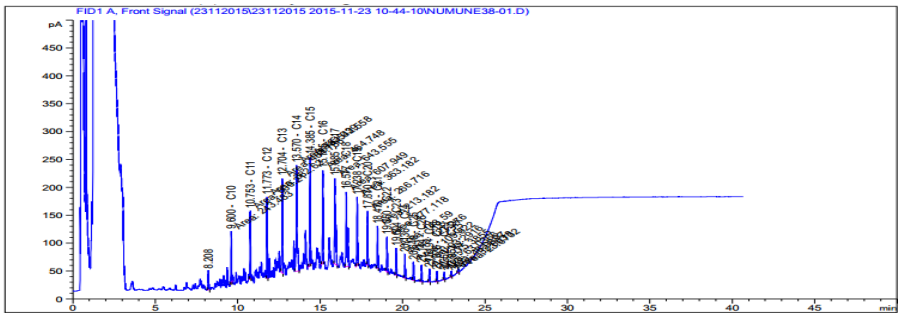

Figure D-144: EX:4, Port:2 T:2940 min, m:0.833 gr, gas chromatogram.

Table D-144: EX:4, Port:2 T:2940 min, m:0.833 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.6	243.48306	5.63837	0.01691511	C_{10}
10.753	300.21008	6.97309	0.02091927	C_{11}
11.773	382.62033	8.75063	0.02625189	C_{12}
12.704	484.7865	11.26575	0.03379725	C_{13}
13.57	781.03894	17.73744	0.05321232	C_{14}
14.385	542.55811	11.63235	0.03489705	C_{15}
15.155	464.74826	10.45164	0.03135492	C_{16}
15.885	643.55505	14.61721	0.04385163	C_{17}
16.577	607.94855	13.74624	0.04123872	C_{18}
17.238	363.18195	8.57568	0.02572704	C_{19}
17.87	266.71649	6.5932	0.0197796	C_{20}
18.47	213.18214	5.39497	0.01618491	C_{21}
19.05	177.11823	4.44992	0.01334976	C_{22}
19.604	143.58957	3.58584	0.01075752	C_{23}
20.136	127.27635	3.18913	0.00956739	C_{24}
20.649	109.52197	2.67425	0.00802275	C_{25}
21.144	93.29157	2.24699	0.00674097	C_{26}
21.619	75.38554	1.92838	0.00578514	C_{27}
22.076	63.0366	1.58878	0.00476634	C_{28}
22.522	46.96966	1.16732	0.00350196	C_{29}
22.951	32.60382	8.20E-01	0.002460132	C_{30}
23.37	23.67321	6.01E-01	0.001803786	C_{31}
24.179	0	0	0	C_{32}

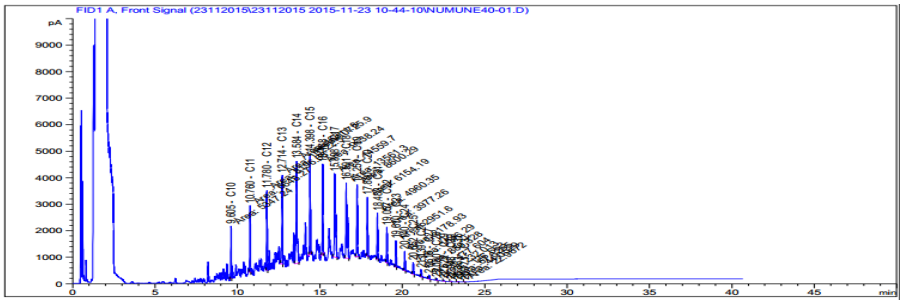

Figure D-145: EX:4, Port:1 T:3000 min, m:1.007 gr, gas chromatogram.

Table D-145: EX:4, Port:1 T:3000 min, m:1.007 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.605	5347.24121	123.82688	0.37148064	C_{10}
10.76	6648.2666	154.42177	0.46326531	C_{11}
11.78	8196.67871	187.46015	0.56238045	C_{12}
12.714	1.02E+04	237.55637	0.71266911	C_{13}
13.584	1.68E+04	381.79729	1.14539187	C_{14}
14.398	1.07E+04	229.96115	0.68988345	C_{15}
15.168	9638.23633	216.7525	0.6502575	C_{16}
15.898	1.46E+04	330.69715	0.99209145	C_{17}
16.591	1.36E+04	306.63344	0.91990032	C_{18}
17.251	8600.28809	203.07535	0.60922605	C_{19}
17.88	6154.18945	152.13094	0.45639282	C_{20}
18.483	4960.35254	125.53102	0.37659306	C_{21}
19.057	3977.26343	99.92477	0.29977431	C_{22}
19.61	2951.60059	73.70985	0.22112955	C_{23}
20.14	2178.93481	54.59708	0.16379124	C_{24}
20.652	1546.29004	37.75657	0.11326971	C_{25}
21.139	880.32788	21.20325	0.06360975	C_{26}
21.616	477.60422	12.21724	0.03665172	C_{27}
22.08	232.01254	5.84768	0.01754304	C_{28}
22.523	126.66324	3.14791	0.00944373	C_{29}
22.948	67.6255	1.7009	0.0051027	C_{30}
23.363	44.05294	1.11887	0.00335661	C_{31}
23.771	22.96723	6.14E-01	0.001840818	C_{32}

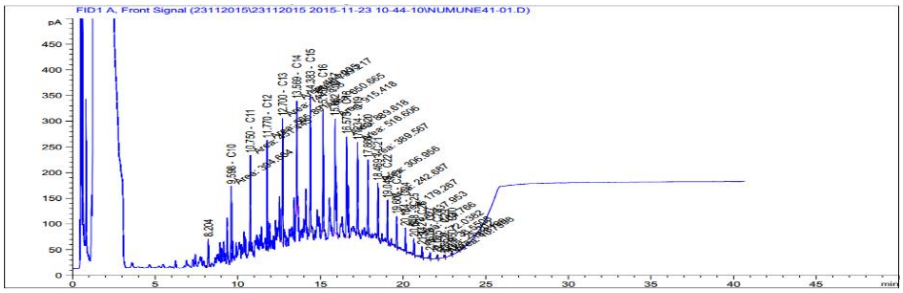

Figure D-146: EX:4, P:2 T:3000 min, m:0.872 gr, gas chromatogram.

Table D-146: EX:4, P:2 T:3000 min, m:0.872 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.598	394.6644	9.1393	0.0274179	C_{10}
10.75	451.4455	10.48589	0.03145767	C_{11}
11.77	565.89105	12.94207	0.03882621	C_{12}
12.7	744.85809	17.30944	0.05192832	C_{13}
13.569	484.03458	10.99245	0.03297735	C_{14}
14.383	739.21716	15.84869	0.04754607	C_{15}
15.152	650.66516	14.63269	0.04389807	C_{16}
15.882	915.41809	20.7921	0.0623763	C_{17}
16.575	889.61774	20.11502	0.06034506	C_{18}
17.234	516.60565	12.19841	0.03659523	C_{19}
17.866	389.56683	9.63005	0.02889015	C_{20}
18.469	306.95642	7.76811	0.02330433	C_{21}
19.049	242.68716	6.09727	0.01829181	C_{22}
19.601	179.26714	4.47681	0.01343043	C_{23}
20.134	137.95325	3.45666	0.01036998	C_{24}
20.648	104.76637	2.55813	0.00767439	C_{25}
21.142	72.03822	1.73509	0.00520527	C_{26}
21.616	38.5508	9.86E-01	0.002958417	C_{27}
22.075	25.20202	6.35E-01	0.001905585	C_{28}
22.521	18.81986	4.68E-01	0.001403169	C_{29}
22.95	10.75076	2.70E-01	0.000811203	C_{30}
23.9	0	0	0	C_{31}
24.179	0	0	0	C_{32}

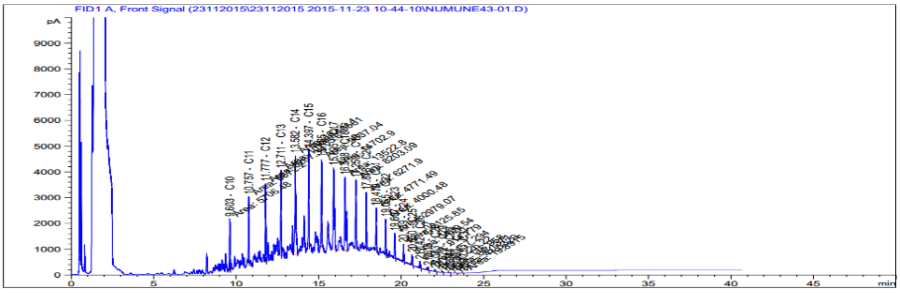

Figure D-147: EX:4, Port:1 T:3060 min, m:1.108 gr, gas chromatogram.

Table D-147: EX:4, Port:1 T:3060 min, m:1.108 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.603	5706.48291	132.1459	0.3964377	**C_{10}**
10.757	6672.20068	154.97769	0.46493307	**C_{11}**
11.777	8267.33691	189.07613	0.56722839	**C_{12}**
12.711	1.02E+04	236.23327	0.70869981	**C_{13}**
13.582	1.62E+04	368.65408	1.10596224	**C_{14}**
14.397	1.06E+04	226.42684	0.67928052	**C_{15}**
15.165	9637.03809	216.72556	0.65017668	**C_{16}**
15.895	1.47E+04	333.95066	1.00185198	**C_{17}**
16.588	1.35E+04	305.76305	0.91728915	**C_{18}**
17.25	8203.09082	193.69648	0.58108944	**C_{19}**
17.878	6271.89648	155.04064	0.46512192	**C_{20}**
18.479	4771.49316	120.75158	0.36225474	**C_{21}**
19.055	4000.47632	100.50797	0.30152391	**C_{22}**
19.607	2979.06885	74.39581	0.22318743	**C_{23}**
20.139	2125.854	53.26705	0.15980115	**C_{24}**
20.65	1439.54077	35.15001	0.10545003	**C_{25}**
21.142	914.77893	22.03303	0.06609909	**C_{26}**
21.613	457.29367	11.69769	0.03509307	**C_{27}**
22.073	226.22023	5.70169	0.01710507	**C_{28}**
22.522	116.95761	2.9067	0.0087201	**C_{29}**
22.944	66.13709	1.66347	0.00499041	**C_{30}**
23.36	41.53288	1.05487	0.00316461	**C_{31}**
23.771	19.89151	5.31E-01	0.001594299	**C_{32}**

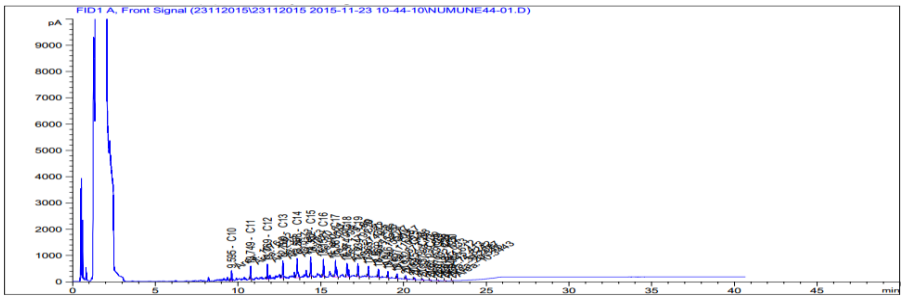

Figure D-148: EX:4, Port:2 T:3060 min, m:0.971 gr, gas chromatogram.

Table D-148: EX:4, Port:2 T:3060 min, m:0.971 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.595	1076.62061	24.93147	0.07479441	**C_{10}**
10.749	1233.12634	28.64229	0.08592687	**C_{11}**
11.769	1529.30005	34.97549	0.10492647	**C_{12}**
12.7	1870.63	43.47078	0.13041234	**C_{13}**
13.568	3008.79858	68.33	0.20499	**C_{14}**
14.382	1999.88916	42.87728	0.12863184	**C_{15}**
15.151	1797.22363	40.41743	0.12125229	**C_{16}**
15.881	2749.42627	62.44835	0.18734505	**C_{17}**
16.574	2452.76587	55.45915	0.16637745	**C_{18}**
17.234	1530.57422	36.14087	0.10842261	**C_{19}**
17.865	1105.38086	27.3249	0.0819747	**C_{20}**
18.469	873.13922	22.09642	0.06628926	**C_{21}**
19.046	696.85608	17.50781	0.05252343	**C_{22}**
19.597	529.45184	13.22192	0.03966576	**C_{23}**
20.132	392.03262	9.82307	0.02946921	**C_{24}**
20.645	244.61169	5.97281	0.01791843	**C_{25}**
21.137	145.41284	3.50236	0.01050708	**C_{26}**
21.611	74.8242	1.91402	0.00574206	**C_{27}**
22.071	39.2687	9.90E-01	0.002969202	**C_{28}**
22.518	20.54499	5.11E-01	0.001531791	**C_{29}**
22.946	10.34432	2.60E-01	0.000780534	**C_{30}**
23.5	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

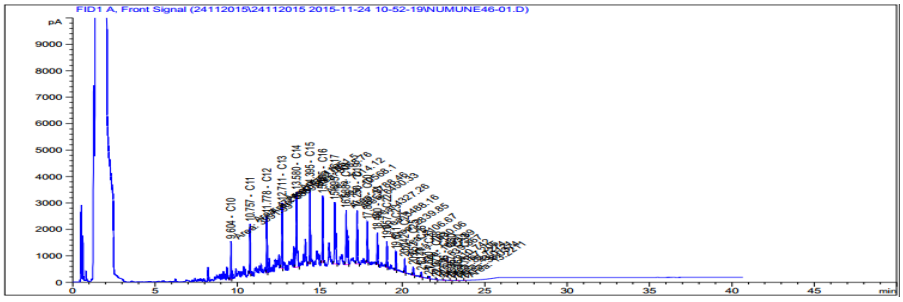

Figure D-149: EX:4, Port:1 T:3120 min, m:1.038 gr, gas chromatogram.

Table D-149: EX:4, Port:1 T:3120 min, m:1.038 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.604	3991.99463	92.44323	0.27732969	C_{10}
10.757	4728.68701	109.83498	0.32950494	C_{11}
11.778	5859.8291	134.0158	0.4020474	C_{12}
12.711	7252.06738	168.52772	0.50558316	C_{13}
13.58	1.17E+04	264.60667	0.79382001	C_{14}
14.395	8058.75977	172.77842	0.51833526	C_{15}
15.165	7014.11914	157.73922	0.47321766	C_{16}
15.895	1.06E+04	240.03657	0.72010971	C_{17}
16.588	9788.46289	221.32559	0.66397677	C_{18}
17.25	6450.33203	152.30925	0.45692775	C_{19}
17.88	4327.25879	106.9694	0.3209082	C_{20}
18.48	3488.15942	88.27441	0.26482323	C_{21}
19.057	2839.84717	71.34832	0.21404496	C_{22}
19.611	2106.66748	52.60947	0.15782841	C_{23}
20.142	1530.05518	38.33825	0.11501475	C_{24}
20.652	1063.89099	25.97758	0.07793274	C_{25}
21.147	639.36658	15.39955	0.04619865	C_{26}
21.62	310.7417	7.94885	0.02384655	C_{27}
22.077	167.20532	4.21427	0.01264281	C_{28}
22.526	85.7274	2.13055	0.00639165	C_{29}
22.957	43.01208	1.08183	0.00324549	C_{30}
23.367	38.0374	9.66E-01	0.002898267	C_{31}
23.775	13.22112	3.53E-01	0.001059669	C_{32}

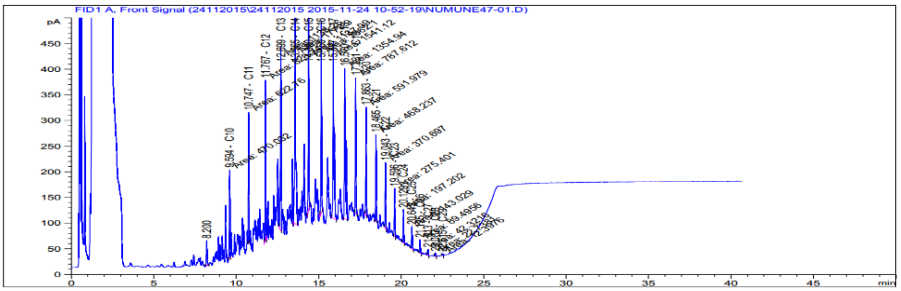

Figure D-150: EX:4, Port:2 T:3120 min, m:0.872 gr, gas chromatogram.

Table D-150: EX:4, Port:2 T:3120 min, m:0.872 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.594	470.0321	10.88461	0.03265383	C_{10}
10.747	622.75995	14.46508	0.04339524	C_{11}
11.767	828.24036	18.94207	0.05682621	C_{12}
12.699	1138.2616	26.45158	0.07935474	C_{13}
13.565	1778.90039	40.39894	0.12119682	C_{14}
14.38	1137.98621	24.39823	0.07319469	C_{15}
15.15	1062.10034	23.88538	0.07165614	C_{16}
15.877	1541.1156	35.00371	0.10501113	C_{17}
16.57	1354.94104	30.63639	0.09190917	C_{18}
17.231	787.612	18.59758	0.05579274	C_{19}
17.863	591.97882	14.63366	0.04390098	C_{20}
18.465	468.23743	11.84963	0.03554889	C_{21}
19.043	370.69708	9.31339	0.02794017	C_{22}
19.596	275.40137	6.87755	0.02063265	C_{23}
20.129	197.20247	4.94126	0.01482378	C_{24}
20.643	143.02872	3.49241	0.01047723	C_{25}
21.135	89.49563	2.15556	0.00646668	C_{26}
21.613	42.3216	1.0826	0.0032478	C_{27}
22.067	22.73806	5.73E-01	0.001719279	C_{28}
22.515	12.39759	3.08E-01	0.000924339	C_{29}
23	0	0	0	C_{30}
23.9	0	0	0	C_{31}
24.179	0	0	0	C_{32}

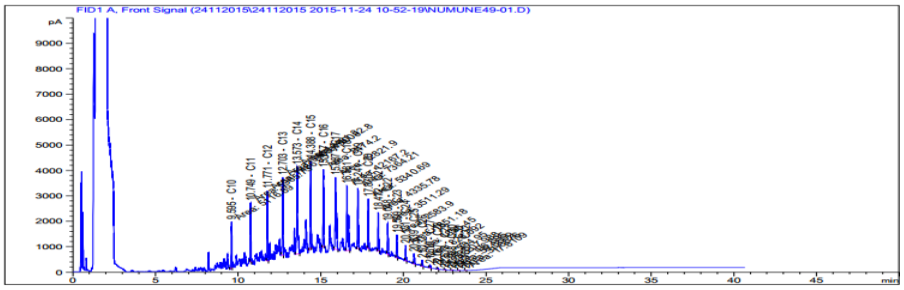

Figure D-151: EX:4, Port:1 T:4320 min, m:1.106 gr, gas chromatogram.

Table D-151: EX:4, Port:1 T:4320 min, m:1.106 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.595	5116.88574	118.49251	0.35547753	C_{10}
10.749	5965.73096	138.56826	0.41570478	C_{11}
11.771	7486.9502	171.22848	0.51368544	C_{12}
12.703	9103.43457	211.55086	0.63465258	C_{13}
13.573	1.45E+04	328.8708	0.9866124	C_{14}
14.388	1.01E+04	216.17452	0.64852356	C_{15}
15.157	8474.19824	190.57467	0.57172401	C_{16}
15.887	1.28E+04	291.22675	0.87368025	C_{17}
16.581	1.22E+04	275.11136	0.82533408	C_{18}
17.241	7364.20703	173.88823	0.52166469	C_{19}
17.87	5340.68994	132.02131	0.39606393	C_{20}
18.472	4335.77686	109.72496	0.32917488	C_{21}
19.048	3511.2937	88.21775	0.26465325	C_{22}
19.599	2583.90161	64.52736	0.19358208	C_{23}
20.131	1851.17578	46.3845	0.1391535	C_{24}
20.639	1396.45337	34.09793	0.10229379	C_{25}
21.132	826.09155	19.89694	0.05969082	C_{26}
21.61	384.95004	9.84712	0.02954136	C_{27}
22.067	207.98758	5.24215	0.01572645	C_{28}
22.513	106.69466	2.65164	0.00795492	C_{29}
22.938	59.86088	1.50561	0.00451683	C_{30}
23.353	31.86761	8.09E-01	0.002428158	C_{31}
23.76	17.8109	4.76E-01	0.001427538	C_{32}

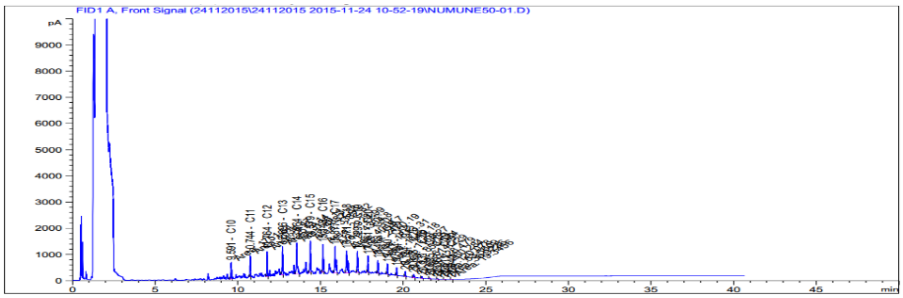

Figure D-152: EX:4, Port:2 T:4320 min, m:0.747 gr, gas chromatogram.

Table D-152: EX:4, Port:2 T:4320 min, m:0.747 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.591	1751.54297	40.56075	0.12168225	C_{10}
10.744	2034.47327	47.25547	0.14176641	C_{11}
11.764	2513.13672	57.47608	0.17242824	C_{12}
12.696	3136.12573	72.8791	0.2186373	C_{13}
13.564	4832.87598	109.75491	0.32926473	C_{14}
14.379	3382.82397	72.52716	0.21758148	C_{15}
15.148	2924.99487	65.77967	0.19733901	C_{16}
15.877	4304.80029	97.77591	0.29332773	C_{17}
16.571	4049.69775	91.56716	0.27470148	C_{18}
17.229	2470.19458	58.32777	0.17498331	C_{19}
17.861	1813.30774	44.82478	0.13447434	C_{20}
18.463	1449.17651	36.67413	0.11002239	C_{21}
19.04	1165.26538	29.27613	0.08782839	C_{22}
19.594	853.52374	21.31491	0.06394473	C_{23}
20.124	614.22913	15.3906	0.0461718	C_{24}
20.638	428.47891	10.46239	0.03138717	C_{25}
21.131	260.2836	6.26909	0.01880727	C_{26}
21.605	120.07819	3.07163	0.00921489	C_{27}
22.066	63.5609	1.602	0.004806	C_{28}
22.511	36.92365	9.18E-01	0.00275295	C_{29}
22.94	19.34565	4.87E-01	0.001459734	C_{30}
23.5	0	0	0	C_{31}
24.179	0	0	0	C_{32}

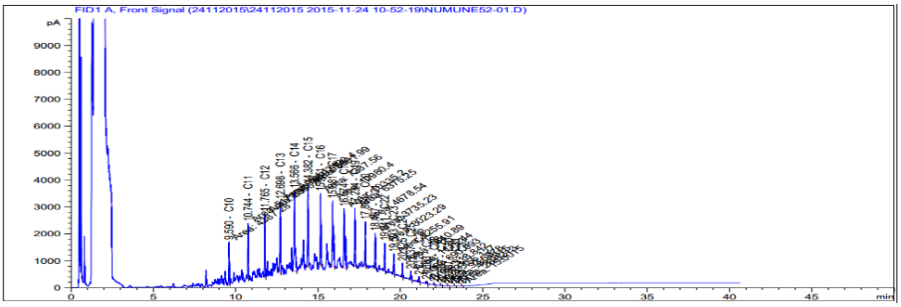

Figure D-153: EX:4, Port:1 T:4380 min, m:0.999 gr, gas chromatogram.

Table D-153: EX:4, Port:1 T:4380 min, m:0.999 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.59	4387.28027	101.59692	0.30479076	C_{10}
10.744	5173.96826	120.17769	0.36053307	C_{11}
11.765	6366.47852	145.603	0.436809	C_{12}
12.698	7819.52441	181.71461	0.54514383	C_{13}
13.566	1.24E+04	282.06814	0.84620442	C_{14}
14.382	8591.99316	184.21086	0.55263258	C_{15}
15.151	7287.56348	163.88866	0.49166598	C_{16}
15.881	1.10E+04	249.40074	0.74820222	C_{17}
16.574	1.03E+04	233.68669	0.70106007	C_{18}
17.234	6375.25244	150.53642	0.45160926	C_{19}
17.864	4678.53809	115.65299	0.34695897	C_{20}
18.467	3735.22632	94.5269	0.2835807	C_{21}
19.041	3023.28906	75.95712	0.22787136	C_{22}
19.593	2255.90942	56.33647	0.16900941	C_{23}
20.125	1640.88916	41.11539	0.12334617	C_{24}
20.637	1115.44397	27.23637	0.08170911	C_{25}
21.128	690.9928	16.643	0.049929	C_{26}
21.603	318.84167	8.15605	0.02446815	C_{27}
22.063	156.12654	3.93504	0.01180512	C_{28}
22.507	93.59783	2.32615	0.00697845	C_{29}
22.937	46.89146	1.1794	0.0035382	C_{30}
23.353	26.62126	6.76E-01	0.002028411	C_{31}
23.754	15.00146	4.01E-01	0.001202364	C_{32}

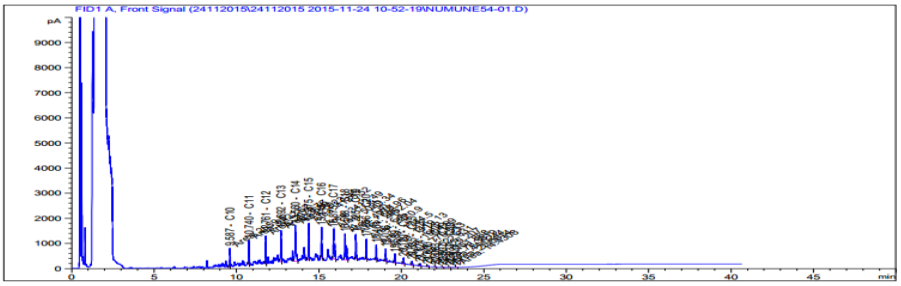

Figure D-154: EX:4, Port:2 T:4380 min, m:0.786 gr, gas chromatogram.

Table D-154: EX:4, Port:2 T:4380 min, m:0.786 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.587	2059.59619	47.69438	0.14308314	C_{10}
10.74	2422.61572	56.271	0.168813	C_{11}
11.761	2978.7583	68.12497	0.20437491	C_{12}
12.692	3680.00439	85.51806	0.25655418	C_{13}
13.56	5923.94141	134.53307	0.40359921	C_{14}
14.375	4125.52295	88.4505	0.2653515	C_{15}
15.145	3413.48633	76.76526	0.23029578	C_{16}
15.875	5029.33643	114.23247	0.34269741	C_{17}
16.568	4979.96045	112.6012	0.3378036	C_{18}
17.225	2962.04028	69.94154	0.20982462	C_{19}
17.856	2220.90137	54.90046	0.16470138	C_{20}
18.461	1714.49976	43.38863	0.13016589	C_{21}
19.036	1419.13428	35.65433	0.10696299	C_{22}
19.589	1064.9856	26.59572	0.07978716	C_{23}
20.12	770.5127	19.30656	0.05791968	C_{24}
20.635	522.63098	12.76135	0.03828405	C_{25}
21.124	329.20676	7.92915	0.02378745	C_{26}
21.6	151.86807	3.88482	0.01165446	C_{27}
22.063	78.36193	1.97505	0.00592515	C_{28}
22.507	44.02438	1.09412	0.00328236	C_{29}
22.937	25.06139	6.30E-01	0.001891017	C_{30}
23.347	14.43082	3.67E-01	0.00109956	C_{31}
24.179	0	0	0	C_{32}

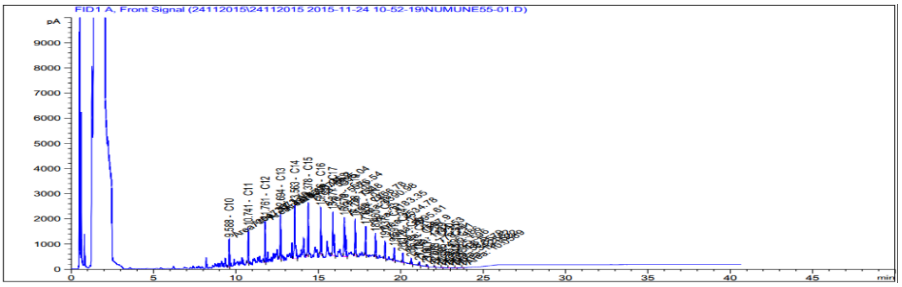

Figure D-155: EX:4, Port:1 T:4440 min, m:0.884 gr, gas chromatogram.

Table D-155: EX:4, Port:1 T:4440 min, m:0.884 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.588	3047.17041	70.56379	0.21169137	C_{10}
10.741	3573.48975	83.00278	0.24900834	C_{11}
11.761	4379.16846	100.15271	0.30045813	C_{12}
12.694	5331.0376	123.88572	0.37165716	C_{13}
13.563	8745.19922	198.60401	0.59581203	C_{14}
14.378	5995.03857	128.5326	0.3855978	C_{15}
15.146	5076.53711	114.1653	0.3424959	C_{16}
15.877	7547.99658	171.43937	0.51431811	C_{17}
16.57	7266.7832	164.30824	0.49292472	C_{18}
17.228	4390.97705	103.68248	0.31104744	C_{19}
17.859	3183.35254	78.69215	0.23607645	C_{20}
18.46	2534.78149	64.1474	0.1924422	C_{21}
19.037	2095.60669	52.65002	0.15795006	C_{22}
19.591	1567.90198	39.15497	0.11746491	C_{23}
20.122	1141.53064	28.60308	0.08580924	C_{24}
20.633	778.71063	19.01418	0.05704254	C_{25}
21.124	496.98618	11.97023	0.03591069	C_{26}
21.601	225.5956	5.77079	0.01731237	C_{27}
22.063	106.50014	2.68425	0.00805275	C_{28}
22.505	58.85787	1.46277	0.00438831	C_{29}
22.933	34.25522	8.62E-01	0.00258474	C_{30}
23.348	19.15222	4.86E-01	0.001459308	C_{31}
23.752	10.05886	2.69E-01	0.000806214	C_{32}

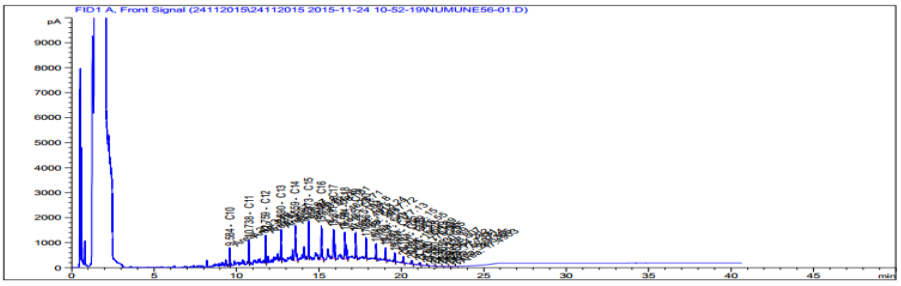

Figure D-156: EX:4, Port:2 T:4440 min, m:1.188 gr, gas chromatogram.

Table D-156: EX:4, Port:2 T:4440 min, m:1.188 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.584	2023.79199	46.86526	0.14059578	**C_{10}**
10.738	2381.57349	55.31769	0.16595307	**C_{11}**
11.759	2957.67065	67.64269	0.20292807	**C_{12}**
12.69	3575.79736	83.09644	0.24928932	**C_{13}**
13.559	5970.76367	135.59641	0.40678923	**C_{14}**
14.373	4081.80884	87.51328	0.26253984	**C_{15}**
15.142	4628.71387	104.09428	0.31228284	**C_{16}**
15.871	5194.79541	117.99057	0.35397171	**C_{17}**
16.564	4913.24365	111.09268	0.33327804	**C_{18}**
17.225	2947.72021	69.6034	0.2088102	**C_{19}**
17.856	2177.13477	53.81855	0.16145565	**C_{20}**
18.459	1749.14893	44.26549	0.13279647	**C_{21}**
19.034	1425.54614	35.81542	0.10744626	**C_{22}**
19.587	1064.39209	26.58089	0.07974267	**C_{23}**
20.121	776.96509	19.46824	0.05840472	**C_{24}**
20.632	530.58954	12.95568	0.03886704	**C_{25}**
21.124	338.80707	8.16038	0.02448114	**C_{26}**
21.6	154.29173	3.94682	0.01184046	**C_{27}**
22.06	77.73306	1.9592	0.0058776	**C_{28}**
22.505	45.97239	1.14253	0.00342759	**C_{29}**
22.932	28.53651	7.18E-01	0.002153232	**C_{30}**
23.352	17.49026	4.44E-01	0.001332675	**C_{31}**
24.179	0	0	0	**C_{32}**

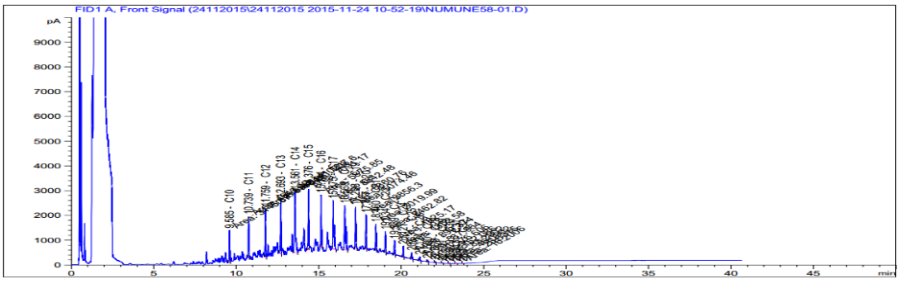

Figure D-157: EX:4, Port:1 T:4500 min, m:0.855 gr, gas chromatogram.

Table D-157: EX:4, Port:1 T:4500 min, m:0.855 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.585	3445.87476	79.79665	0.23938995	**C_{10}**
10.739	4043.01636	93.90865	0.28172595	**C_{11}**
11.759	5166.87842	118.16784	0.35450352	**C_{12}**
12.693	6441.12207	149.68251	0.44904753	**C_{13}**
13.561	1.02E+04	232.04202	0.69612606	**C_{14}**
14.376	7091.16602	152.03338	0.45610014	**C_{15}**
15.144	5875.85352	132.14098	0.39642294	**C_{16}**
15.875	8842.47852	200.84123	0.60252369	**C_{17}**
16.568	8360.75586	189.0439	0.5671317	**C_{18}**
17.228	5074.46045	119.82131	0.35946393	**C_{19}**
17.857	3856.30298	95.32742	0.28598226	**C_{20}**
18.46	3019.99487	76.42663	0.22927989	**C_{21}**
19.034	2462.81714	61.87582	0.18562746	**C_{22}**
19.589	1825.16504	45.57956	0.13673868	**C_{23}**
20.121	1352.57983	33.89129	0.10167387	**C_{24}**
20.631	890.37415	21.74073	0.06522219	**C_{25}**
21.124	587.96381	14.16148	0.04248444	**C_{26}**
21.6	276.6059	7.07565	0.02122695	**C_{27}**
22.06	152.0858	3.83319	0.01149957	**C_{28}**
22.501	83.29016	2.06998	0.00620994	**C_{29}**
22.929	45.09022	1.1341	0.0034023	**C_{30}**
23.347	25.63155	6.51E-01	0.001953	**C_{31}**
23.754	16.20061	4.33E-01	0.001298475	**C_{32}**

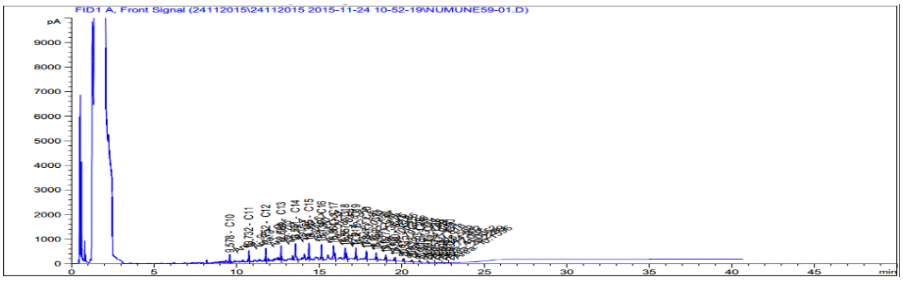

Figure D-158: EX:4, Port:2 T:4500 min, m:0.71 gr, gas chromatogram.

Table D-158: EX:4, Port:2 T:4500 min, m:0.71 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.578	923.00537	21.37418	0.06412254	**C_{10}**
10.732	1103.39783	25.62903	0.07688709	**C_{11}**
11.752	1390.67188	31.80502	0.09541506	**C_{12}**
12.684	1690.5332	39.28558	0.11785674	**C_{13}**
13.551	2732.28906	62.05045	0.18615135	**C_{14}**
14.365	1866.76953	40.02322	0.12006966	**C_{15}**
15.134	1621.45142	36.46452	0.10939356	**C_{16}**
15.864	2307.46582	52.41	0.15723	**C_{17}**
16.557	2223.74951	50.2809	0.1508427	**C_{18}**
17.217	1362.86304	32.18077	0.09654231	**C_{19}**
17.847	1002.97986	24.79356	0.07438068	**C_{20}**
18.45	791.51086	20.03067	0.06009201	**C_{21}**
19.027	633.70929	15.92131	0.04776393	**C_{22}**
19.58	494.99457	12.36142	0.03708426	**C_{23}**
20.115	337.81641	8.46459	0.02539377	**C_{24}**
20.628	226.56889	5.53225	0.01659675	**C_{25}**
21.118	144.90219	3.49006	0.01047018	**C_{26}**
21.597	72.00701	1.84196	0.00552588	**C_{27}**
22.057	41.00521	1.0335	0.0031005	**C_{28}**
22.504	20.22993	5.03E-01	0.001508301	**C_{29}**
22.932	10.15958	2.56E-01	0.000766596	**C_{30}**
23.5	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

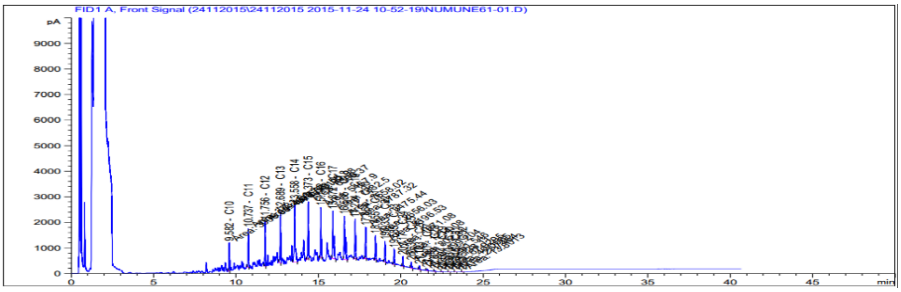

Figure D-159: EX:4, Port:1 T:4560 min, m:0.914 gr, gas chromatogram.

Table D-159: EX:4, Port:1 T:4560 min, m:0.914 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.582	3008.08765	69.65875	0.20897625	C_{10}
10.737	3733.61255	86.72201	0.26016603	C_{11}
11.756	4672.56445	106.86275	0.32058825	C_{12}
12.689	5723.55664	133.00731	0.39902193	C_{13}
13.558	9192.97559	208.77304	0.62631912	C_{14}
14.373	6399.36523	137.20129	0.41160387	C_{15}
15.142	5467.90039	122.96659	0.36889977	C_{16}
15.872	7882.50049	179.03703	0.53711109	C_{17}
16.565	7558.01514	170.89324	0.51267972	C_{18}
17.224	4787.32471	113.04129	0.33912387	C_{19}
17.854	3475.44263	85.91259	0.25773777	C_{20}
18.455	2656.02734	67.21575	0.20164725	C_{21}
19.033	2196.53442	55.18573	0.16555719	C_{22}
19.585	1671.08081	41.73164	0.12519492	C_{23}
20.117	1214.07666	30.42085	0.09126255	C_{24}
20.63	802.81	19.60263	0.05880789	C_{25}
21.123	499.20364	12.02363	0.03607089	C_{26}
21.591	251.54567	6.4346	0.0193038	C_{27}
22.054	138.11041	3.48096	0.01044288	C_{28}
22.504	67.9295	1.68823	0.00506469	C_{29}
22.93	40.05646	1.00749	0.00302247	C_{30}
23.346	21.7454	5.52E-01	0.001656894	C_{31}
23.753	13.80128	3.69E-01	0.001106169	C_{32}

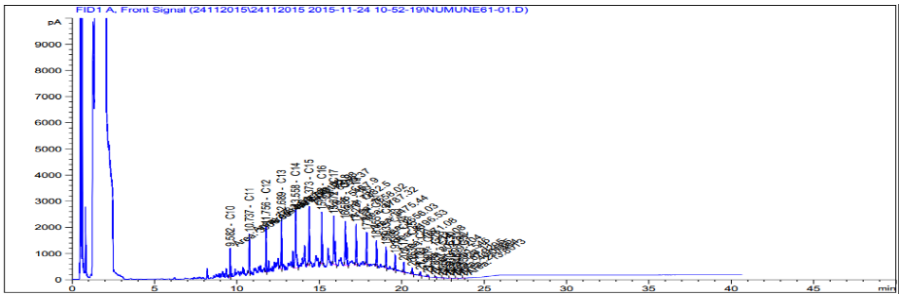

Figure D-160: EX:4, Port:2 T:4560 min, m:0.932 gr, gas chromatogram.

Table D-160: EX:4, Port:2 T:4560 min, m:0.932 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.579	2039.82263	47.23648	0.14170944	C_{10}
10.734	2495.84668	57.97196	0.17391588	C_{11}
11.754	3082.70679	70.5023	0.2115069	C_{12}
12.686	3744.75	87.02266	0.26106798	C_{13}
13.554	6063.396	137.70009	0.41310027	C_{14}
14.369	4250.01367	91.11956	0.27335868	C_{15}
15.137	3564.93237	80.1711	0.2405133	C_{16}
15.867	5182.16602	117.70372	0.35311116	C_{17}
16.561	4961.01807	112.1729	0.3365187	C_{18}
17.22	3038.63281	71.75009	0.21525027	C_{19}
17.85	2250.92871	55.64273	0.16692819	C_{20}
18.456	1764.13562	44.64476	0.13393428	C_{21}
19.03	1419.53711	35.66445	0.10699335	C_{22}
19.585	1051.34045	26.25496	0.07876488	C_{23}
20.116	792.04816	19.84617	0.05953851	C_{24}
20.626	543.85712	13.27964	0.03983892	C_{25}
21.117	326.55344	7.86525	0.02359575	C_{26}
21.591	162.07469	4.14591	0.01243773	C_{27}
22.057	79.19716	1.9961	0.0059883	C_{28}
22.501	48.05468	1.19429	0.00358287	C_{29}
22.932	21.48559	5.40E-01	0.001621203	C_{30}
23.337	14.45647	3.67E-01	0.001101513	C_{31}
24.179	0	0	0	C_{32}

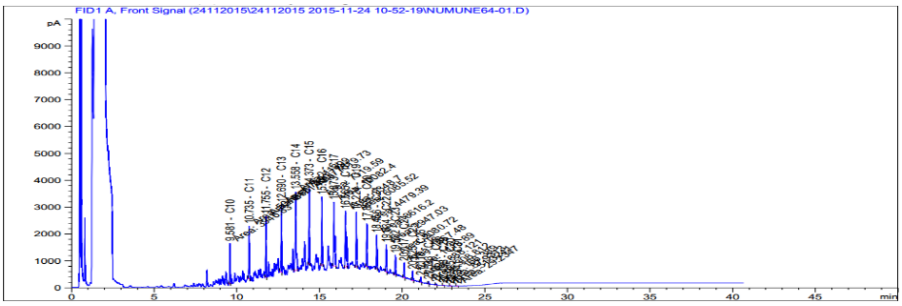

Figure D-161: EX:4, Port:1 T:5760 min, m:1.122 gr, gas chromatogram.

Table D-161: EX:4, Port:1 T:5760 min, m:1.122 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.581	3946.82568	91.39725	0.27419175	**C_{10}**
10.735	5046.67529	117.22101	0.35166303	**C_{11}**
11.755	6171.42773	141.14214	0.42342642	**C_{12}**
12.69	7390.77197	171.75102	0.51525306	**C_{13}**
13.558	1.14E+04	258.87101	0.77661303	**C_{14}**
14.373	7619.73486	163.36581	0.49009743	**C_{15}**
15.142	7119.59131	160.11116	0.48033348	**C_{16}**
15.873	1.01E+04	229.00297	0.68700891	**C_{17}**
16.565	9348.70313	211.38224	0.63414672	**C_{18}**
17.224	6085.51953	143.69507	0.43108521	**C_{19}**
17.855	4479.39209	110.73012	0.33219036	**C_{20}**
18.456	3616.19653	91.51463	0.27454389	**C_{21}**
19.034	2947.03418	74.04129	0.22212387	**C_{22}**
19.582	2080.72046	51.9615	0.1558845	**C_{23}**
20.117	1567.47595	39.27589	0.11782767	**C_{24}**
20.625	1118.88953	27.32051	0.08196153	**C_{25}**
21.118	688.1214	16.57384	0.04972152	**C_{26}**
21.593	308.81247	7.8995	0.0236985	**C_{27}**
22.057	166.38878	4.19369	0.01258107	**C_{28}**
22.498	87.93131	2.18532	0.00655596	**C_{29}**
22.925	51.32406	1.29089	0.00387267	**C_{30}**
23.341	29.23467	7.43E-01	0.002227542	**C_{31}**
24.179	0	0	0	**C_{32}**

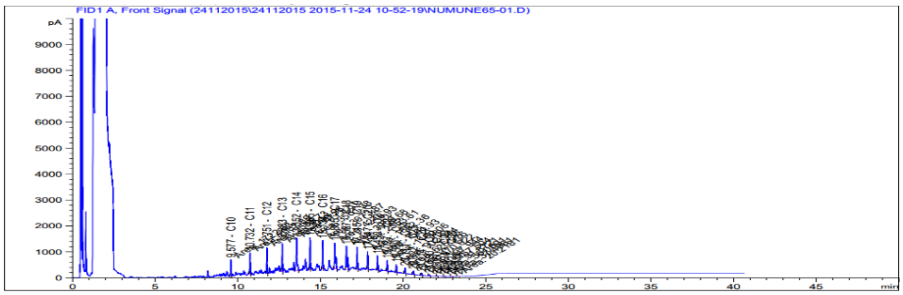

Figure D-162: EX:4, Port:2 T:5760 min, m:0.821 gr, gas chromatogram.

Table D-162: EX:4, Port:2 T:5760 min, m:0.821 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.577	1722.63464	39.89131	0.11967393	C_{10}
10.732	2087.88843	48.49616	0.14548848	C_{11}
11.751	2589.73022	59.2278	0.1776834	C_{12}
12.683	3099.96387	72.03875	0.21611625	C_{13}
13.552	4775.81201	108.45898	0.32537694	C_{14}
14.365	3561.38013	76.35538	0.22906614	C_{15}
15.134	3073.87451	69.12779	0.20738337	C_{16}
15.865	4246.9292	96.46147	0.28938441	C_{17}
16.557	3969.67529	89.75778	0.26927334	C_{18}
17.215	2553.61328	60.2975	0.1808925	C_{19}
17.847	1852.35547	45.79004	0.13737012	C_{20}
18.45	1501.92603	38.00905	0.11402715	C_{21}
19.027	1190.05566	29.89896	0.08969688	C_{22}
19.58	902.94397	22.54908	0.06764724	C_{23}
20.111	626.97614	15.71	0.04713	C_{24}
20.622	470.02246	11.47678	0.03443034	C_{25}
21.114	297.94443	7.17618	0.02152854	C_{26}
21.59	157.50389	4.02899	0.01208697	C_{27}
22.05	91.87207	2.31556	0.00694668	C_{28}
22.494	56.06915	1.39347	0.00418041	C_{29}
22.927	37.49612	9.43E-01	0.002829285	C_{30}
23.344	20.21806	5.14E-01	0.001540518	C_{31}
24.179	0	0	0	C_{32}

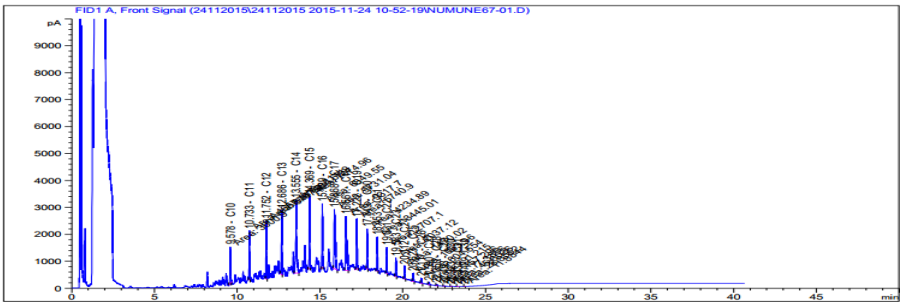

Figure D-163 EX:4, P:1 T:5820 min, m:0.976 gr, gas chromatogram.

Table D-163: EX:4, P:1 T:5820 min, m:0.976 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.578	3600.90356	83.38667	0.25016001	C_{10}
10.733	4657.13818	108.17308	0.32451924	C_{11}
11.752	5767.89502	131.91325	0.39573975	C_{12}
12.686	7086.62451	164.68306	0.49404918	C_{13}
13.555	1.11E+04	252.35444	0.75706332	C_{14}
14.369	7674.95898	164.5498	0.4936494	C_{15}
15.139	6849.54785	154.03821	0.46211463	C_{16}
15.868	9731.03809	221.02329	0.66306987	C_{17}
16.561	9317.69922	210.68122	0.63204366	C_{18}
17.222	5740.90088	135.55772	0.40667316	C_{19}
17.849	4234.88623	104.68596	0.31405788	C_{20}
18.453	3445.00806	87.18239	0.26154717	C_{21}
19.031	2707.09717	68.01311	0.20403933	C_{22}
19.583	2037.12134	50.87271	0.15261813	C_{23}
20.112	1470.01514	36.83384	0.11050152	C_{24}
20.623	1063.96448	25.97937	0.07793811	C_{25}
21.117	604.55438	14.56107	0.04368321	C_{26}
21.59	291.215	7.44935	0.02234805	C_{27}
22.05	157.29568	3.9645	0.0118935	C_{28}
22.493	77.38558	1.92324	0.00576972	C_{29}
22.923	45.60264	1.14699	0.00344097	C_{30}
23.334	28.85525	7.33E-01	0.002198631	C_{31}
23.742	11.88439	3.18E-01	0.00095253	C_{32}

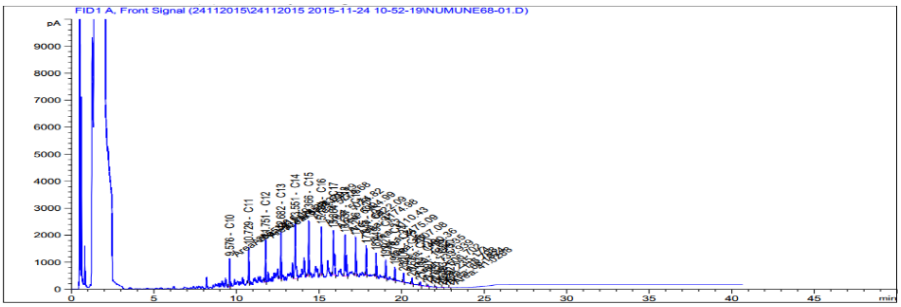

Figure D-164: EX:4, Port:2 T:5820 min, m:1.166 gr, gas chromatogram.

Table D-164: EX:4, Port:2 T:5820 min, m:1.166 gr.

RetTime (min)	Area (pA*s)	Amount (mg/L)	Amount (mg)	Name
9.576	2855.26245	66.11975	0.19835925	**C_{10}**
10.729	3416.19263	79.34918	0.23804754	**C_{11}**
11.751	4174.2793	95.46684	0.28640052	**C_{12}**
12.682	5151.68652	119.71786	0.35915358	**C_{13}**
13.551	8379.19043	190.29192	0.57087576	**C_{14}**
14.366	5774.68359	123.80822	0.37142466	**C_{15}**
15.134	5074.81543	114.12658	0.34237974	**C_{16}**
15.864	6994.98877	158.87878	0.47663634	**C_{17}**
16.557	6922.09277	156.51449	0.46954347	**C_{18}**
17.216	4174.979	98.5822	0.2957466	**C_{19}**
17.847	3110.43481	76.88963	0.23066889	**C_{20}**
18.449	2475.08521	62.63667	0.18791001	**C_{21}**
19.027	2007.07751	50.42582	0.15127746	**C_{22}**
19.578	1490.36011	37.21853	0.11165559	**C_{23}**
20.109	1048.35217	26.26833	0.07880499	**C_{24}**
20.621	733.93854	17.92096	0.05376288	**C_{25}**
21.114	506.70227	12.20424	0.03661272	**C_{26}**
21.591	235.1745	6.01582	0.01804746	**C_{27}**
22.051	115.79794	2.91859	0.00875577	**C_{28}**
22.493	66.1924	1.64506	0.00493518	**C_{29}**
22.927	41.02876	1.03195	0.00309585	**C_{30}**
23.5	0	0	0	**C_{31}**
24.179	0	0	0	**C_{32}**

D.2 Gasoline GC Results

Table D-165:EX:5, P:1 T:30min, m:1.339 gr.

Time	Index	Component	Mass%	Corredcted Mass%
14.31	564.8	2,3-dimethylbutane-1	0.1324	2.96
14.533	569.2	2-dimethylpentane	0.1889	4.23
15.289	583.3	3-dimethylpentane	1.244	27.86
16.444	602.5	c-hexene-3	95.0292	
18.222	626.4	methylcyclopentane	1.6382	36.69
34.78	757.4	Toluene	0.5502	12.32
55.848	857.1	1,3-dimethylbenzene	0.3328	7.45
56.13	858.2	1,4-dimethylbenzene	0.1579	3.53
61.77	879.9	1,2-dimethylbenzene	0.2205	4.94

Table D-166: EX:5, Port:2 T:30 min, m=0.843 gr.

Time	Index	Component	Mass%	Corredcted Mass%
15.256	582.8	3-methylpentane	1.1366	40.92
16.408	601.9	t-hexene-3	97.2225	
18.188	626	methylcyclopentane	1.6409	59.07

Table D-167: EX:5, Port:3 T:30 min, m=1,093 gr.

Time	Index	Component	Mass%	Corredcted Mass%
15.255	582.7	3-methylpentane	1.149	41.21
16.408	601.9	t-hexene-3	97.2122	
18.185	625.9	methylcyclopentane	1.6388	58.78

Table D-168: EX:5, P:1 T:60 min, m:1.238 gr.

Time	Index	Component	Mass%	Corredcted Mass%
11.029	472.2	i-pentane	0.1534	3.05
13.006	535.8	2,2-dimethylbutane	0.0914	1.81
14.274	564.1	cyclopentene	0.1941	3.85
14.5	568.6	2-dimethylpentane	0.2723	5.41
15.254	582.7	3-dimethylpentane	1.2957	25.75
16.407	601.9	t-hexene-3	94.4661	
18.185	625.9	methylcyclopentane	1.64	32.6
22.896	674.7	3-methylhexane	0.0903	1.8
34.741	757.2	Toluene	0.5789	11.50
55.822	857	1,3-dimethylbenzene	0.3348	6.65
56.105	858.1	1,4-dimethylbenzene	0.1594	3.16
61.75	87908	1,2-dimethylbenzene	0.2207	4.38

Table D-169: EX:5, Port:2 T:60 min, m:0.826 gr.

Time	Index	Component	Mass%	Corredcted Mass%
15.255	582.7	3-methylpentane	1.133	40.83
16.409	602	t-hexene-3	97.2254	
18.186	625.9	methylcyclopentane	1.6417	59.16

Table D-170: EX:5, Port:3 T:60 min, m:1.048 gr.

Time	Index	Component	Mass%	Corredcted Mass%
15.254	582.7	3-methylpentane	1.1445	41.11
16.411	602	t-hexene-3	97.2161	
18.184	625.9	methylcyclopentane	1.6394	58.88

Table D-171: EX:5, Port:1 T:90 min, m:1,342 gr.

Time	Index	Component	Mass%	Corredcted Mass%
11.03	472.3	i-pentane	0.3657	6.47
13.007	535.8	2,2-dimethylbutane	0.1424	2.52
14.274	564.1	cyclopentene	0.2731	4.83
14.501	568.6	2-dimethylpentane	0.3693	6.54
15.255	582.8	3-dimethylpentane	1.355	24
16.406	601.9	t-hexene-3	93.8203	
18.186	625.9	methylcyclopentane	1.64	29.05
22.899	674.7	3-methylhexane	0.1025	1.81
34.744	757.3	Toluene	0.6354	11.25
55.827	857	1,3-dimethylbenzene	0.3572	6.327
56.109	858.1	1,4-dimethylbenzene	0.17	3.01
61.756	87908	1,2-dimethylbenzene	0.2345	4.15

Table D-172: EX:5, Port:2 T:90 min, m:1.072 gr.

Time	Index	Component	Mass%	Corredcted Mass%
11.03	472.3	i-pentane	0.1509	3.71
14.274	564.1	cyclopentene	0.1208	2.97
14.501	568.6	2-dimethylpentane	0.188	4.63
15.255	582.8	3-dimethylpentane	1.251	30.82
16.406	601.9	t-hexene-3	95.8072	
18.186	625.9	methylcyclopentane	1.6426	40.47
34.744	757.3	Toluene	0.3204	7.89
55.827	857	1,3-dimethylbenzene	0.1842	4.53
56.109	858.1	1,4-dimethylbenzene	0.0879	2.16
61.756	87908	1,2-dimethylbenzene	0.121	2.98

Table D-173: EX:5, Port:3 T:90 min, m:1.146 gr.

Time	Index	Component	Mass%	Corredcted Mass%
15.254	582.7	3-dimethylpentane	1.1402	41.03
16.411	602	t-hexene-3	97.221	
18.185	625.9	methylcyclopentane	1.6389	58.97

Table D-174: EX:5, Port:1 T:120 min, m=1.38 gr.

Time	Index	Component	Mass%	Corredcted Mass%
11.034	472.4	i-pentane	0.2437	5.05
13.012	536	2,2-dimethylbutane	0.0999	2.07
14.279	564.2	2,3-dimethylbutane	0.2048	4.24
14.506	568.7	2-dimethylpentane	0.2676	5.55
15.26	582.8	3-dimethylpentane	1.2979	26.92
16.413	602	t-hexene-3	94.7722	
18.191	626	methylcyclopentane	1.6418	34.06
34.748	757.3	Toluene	0.4827	10.01
55.827	857	1,3-dimethylbenzene	0.2727	5.65
56.11	858.1	1,4-dimethylbenzene	0.1299	2.69
61.756	87908	1,2-dimethylbenzene	0.1791	3.71

Table D-175: EX:5, Port:2 T:120 min, m=1.224 gr.

Time	Index	Component	Mass%	Corredcted Mass%
11.03	472.4	i-pentane	0.1953	4.24
13.007	536	2,2-dimethylbutane	0.0872	1.89
14.275	564.1	cyclopentene	0.165	3.58
14.5	568.7	2-dimethylpentane	0.2401	5.21
15.255	582.8	3-dimethylpentane	1.2808	27.84
16.406	602	t-hexene-3	95.0173	
18.185	626	methylcyclopentane	1.6423	35.7
34.741	757.3	Toluene	0.4458	9.69
55.824	857	1,3-dimethylbenzene	0.2549	5.54
56.107	858.1	1,4-dimethylbenzene	0.1214	2.63
61.755	87908	1,2-dimethylbenzene	0.1675	3.64

Table D-176: EX:5, Port:3 T:120 min, m=0.529 gr.

Time	Index	Component	Mass%	Corredcted Mass%
15.254	582.7	3-dimethylpentane	1.1467	41.15
16.407	601.9	t-hexene-3	97.2138	
18.184	625.9	methylcyclopentane	1.6395	58.84

Table D-177: EX:5, Port:1 T:180 min, m:1.09 gr.

Time	Index	Component	Mass%	Corredcted Mass%
11.03	472.4	i-pentane	0.2052	4.84
14.275	564.1	cyclopentene	0.1477	3.48
14.501	568.7	2-dimethylpentane	0.2068	4.87
15.256	582.8	3-dimethylpentane	1.2554	29.62
16.409	602	t-hexene-3	95.6178	
18.186	626	methylcyclopentane	1.6445	38.8
34.742	757.3	Toluene	0.3525	8.31
55.825	857	1,3-dimethylbenzene	0.2	4.71
56.111	858.1	1,4-dimethylbenzene	0.0953	2.24
61.759	87908	1,2-dimethylbenzene	0.1309	3.08

Table D-178: EX:5, Port:2 T:180 min, m:0.94 gr.

Time	Index	Component	Mass%	Corredcted Mass%
11.03	472.4	i-pentane	0.2441	5.45
13.007	536	2,2-dimethylbutane	0.0884	1.97
14.275	564.1	cyclopentene	0.1611	3.59
14.5	568.7	2-methylpentane	0.2289	5.11
15.255	582.8	3-methylpentane	1.2774	28.52
16.406	602	t-hexene-3	95.1985	
18.185	626	methylcyclopentane	1.6395	36.60
34.741	757.3	Toluene	0.3802	8.48
55.824	857	1,3-dimethylbenzene	0.2151	4.80
56.107	858.1	1,4-dimethylbenzene	0.1025	2.28
61.755	87908	1,2-dimethylbenzene	0.1416	3.16

Table D-179: EX:5, Port:3 T:180 min, m:1.012 gr.

Time	Index	Component	Mass%	Corredcted Mass%
15.255	582.8	3-methylpentane	1.1457	41.13
16.411	602	t-hexene-3	97.215	
18.185	626	methylcyclopentane	1.6393	58.86

Table D-180: EX:5, Port:1 T:240 min, m:1.117 gr.

Time	Index	Component	Mass%	Corredcted Mass%
11.03	472.3	i-pentane	0.2553	5.81
13.008	535.8	2,2-dimethylbutane	0.0861	1.96
14.275	564.1	cyclopentene	0.1592	3.62
14.501	568.6	2-methylpentane	0.218	4.96
15.256	582.8	3-methylpentane	1.2679	28.89
16.408	601.9	t-hexene-3	95.4738	
18.186	625.9	methylcyclopentane	1.6433	37.45
34.743	757.2	Toluene	0.3455	7.87
55.828	857	1,3-dimethylbenzene	0.1935	4.41
56.115	858.2	1,4-dimethylbenzene	0.0921	2.1
61.76	879.9	1,2-dimethylbenzene	0.1266	2.88

Table D-181: EX:5, Port:2 T:240 min, m:1.146 gr.

Time	Index	Component	Mass%	Corredcted Mass%
11.03	472.3	i-pentane	0.3429	6.56
13.008	535.8	2,2-dimethylbutane	0.1241	2.37
14.274	564.1	cyclopentene	0.2275	4.35
14.501	568.6	2-methylpentane	0.3174	6.08
15.256	582.8	3-methylpentane	1.3239	25.35
16.408	601.9	t-hexene-3	94.3376	
18.186	625.9	methylcyclopentane	1.64	31.41
22.899	674.7	3-methylhexane	0.0849	1.62
34.745	757.3	Toluene	0.5265	10.08
55.836	857	1,3-dimethylbenzene	0.2971	5.69
56.116	858.2	1,4-dimethylbenzene	0.1423	2.72
61.764	879.9	1,2-dimethylbenzene	0.1942	3.71

Table D-182: EX:5, Port:3 T:240 min, m=1.38 gr.

Time	Index	Component	Mass%	Corredcted Mass%
15.257	582.8	3-methylpentane	1.1564	41.36
16.413	602	t-hexene-3	97.2041	
18.187	626	methylcyclopentane	1.6395	58.64

Table D-183: EX:5, Port:1 T:1440 min, m=1.034 gr.

Time	Index	Component	Mass%	Corredcted Mass%
15.255	582.8	3-methylpentane	1.176	36.13
16.409	601.9	t-hexene-3	96.6467	
18.185	625.9	methylcyclopentane	1.646	50.57
34.741	757.3	Toluene	0.2126	6.53
55.823	857	1,3-dimethylbenzene	0.1326	4.07
61.754	879.9	1,2-dimethylbenzene	0.0874	2.68

Table D-184: EX:5, Port:2 T:1440 min, m:1.29 gr.

Time	Index	Component	Mass%	Corredcted Mass%
14.281	535.8	2,3-dimethylbutane	0.1191	2.9
14.505	568.6	2-methylpentane	0.1683	4.09
15.26	582.8	3-methylpentane	1.2246	29.82
16.413	601.9	t-hexene-3	95.5169	
18.191	625.9	methylcyclopentane	1.6458	40.08
34.751	757.3	Toluene	0.4167	10.14
55.832	857	1,3-dimethylbenzene	0.249	6.06
56.117	858.2	1,4-dimethylbenzene	0.1182	2.87
61.763	879.9	1,2-dimethylbenzene	0.1645	4.006

Table D-185: EX:5, Port:3 T:1440 min, m:1.266 gr.

Time	Index	Component	Mass%	Corredcted Mass%
15.265	582.9	3-methylpentane	1.1881	37.97
16.421	601.9	t-hexene-3	96.788	
18.197	625.9	methylcyclopentane	1.6486	52.68
34.758	757.3	Toluene	0.1813	5.79
55.845	857	1,3-dimethylbenzene	0.111	3.54

Table D-186: EX:5, Port:1 T:1500 min, m:1.173 gr.

Time	Index	Component	Mass%	Corredcted Mass%
14.502	568.6	2-methylpentane	0.089	2.62
15.257	582.8	3-methylpentane	1.18	34.75
16.412	602	t-hexene-3	96.4974	
18.187	626	methylcyclopentane	1.6473	48.51
34.741	757.2	Toluene	0.238	7.01
55.822	857	1,3-dimethylbenzene	0.1455	4.28
61.756	879.9	1,2-dimethylbenzene	0.0956	2.81

Table D-187: EX:5, Port:2 T:1500 min, m:1.382 gr.

Time	Index	Component	Mass%	Corredcted Mass%
11.03	472.2	i-pentane	0.2327	5.22
13.007	535.8	2,2-dimethylbutane	0.0855	1.91
14.274	564.1	cyclopentene	0.1645	3.68
14.501	568.6	2-methylpentane	0.2237	5.01
15.255	582.8	3-methylpentane	1.2779	28.66
16.408	601.9	t-hexene-3	95.2222	
18.185	625.9	methylcyclopentane	1.6415	36.81
34.741	757.2	Toluene	0.3772	8.46
55.824	857	1,3-dimethylbenzene	0.2134	4.78
56.111	858.1	1,4-dimethylbenzene	0.1021	2.29
61.759	879.9	1,2-dimethylbenzene	0.1397	3.13

Table D-188: EX:5, Port:3 T:1500 min, m:1.087 gr.

Time	Index	Component	Mass%	Corredcted Mass%
15.255	582.8	3-methylpentane	1.1596	36.18
16.411	602	t-hexene-3	96.7045	
18.185	625.9	methylcyclopentane	1.6482	51.42
34.738	757.2	Toluene	0.1957	6.10
55.821	857	1,3-dimethylbenzene	0.1214	3.78
61.756	879.9	1,2-dimethylbenzene	0.08	2.49

Table D-189: EX:5, Port:1 T:1560 min, m:1.178 gr.

Time	Index	Component	Mass%	Corredcted Mass%
14.501	568.6	2-methylpentane	0.0947	2.8
15.256	582.8	3-methylpentane	1.1633	34.36
16.409	602	t-hexene-3	96.508	
18.186	626	methylcyclopentane	1.652	48.79
34.744	757.2	Toluene	0.237	7.0
55.827	857	1,3-dimethylbenzene	0.1437	4.24
61.759	879.9	1,2-dimethylbenzene	0.0949	2.80

Table D-190: EX:5, Port:2 T:1560 min, m=1.092 gr.

Time	Index	Component	Mass%	Corredcted Mass%
14.501	568.6	2-methylpentane	0.0996	2.78
15.256	582.8	3-methylpentane	1.1564	32.27
16.409	602	t-hexene-3	96.2832	
18.186	626	methylcyclopentane	1.6518	46.09
34.744	757.2	Toluene	0.2914	8.13
55.827	857	1,3-dimethylbenzene	0.1801	5.02
56.121	858.1	1,4-dimethylbenzene	0.0857	2.39
61.759	879.9	1,2-dimethylbenzene	0.1184	3.30

Table D-191: EX:5, Port:3 T:1560 min, m=0.893 gr.

Time	Index	Component	Mass%	Corredcted Mass%
15.256	582.8	3-methylpentane	1.157	37.42
16.409	602	t-hexene-3	96.9081	
18.186	626	methylcyclopentane	1.6519	53.42
34.744	757.2	Toluene	0.1754	5.67
55.827	857	1,3-dimethylbenzene	0.1076	3.48

Table D-192: EX:5, Port:1 T:1620 min, m:1.083 gr.

Time	Index	Component	Mass%	Corredcted Mass%
11.03	472.2	i-pentane	0.134	3.78
14.278	535.8	2,3-dimethylbutane	0.0971	2.74
14.501	568.6	2-methylpentane	0.1239	3.49
15.256	582.8	3-methylpentane	1.2194	34.43
16.409	602	t-hexene-3	96.3748	
18.186	626	methylcyclopentane	1.6444	46.43
34.744	757.2	Toluene	0.2063	5.82
55.827	857	1,3-dimethylbenzene	0.116	3.27

Table D-193: EX:5, Port:2 T:1620 min, m:0.79 gr.

Time	Index	Component	Mass%	Corredcted Mass%
11.03	472.2	i-pentane	0.093	2.77
14.501	568.6	2-methylpentane	0.1073	3.20
15.256	582.8	3-methylpentane	1.1985	35.76
16.409	602	t-hexene-3	96.6491	
18.186	626	methylcyclopentane	1.6513	49.28
34.744	757.2	Toluene	0.1918	5.72
55.827	857	1,3-dimethylbenzene	0.109	3.25

Table D-194: EX:5, Port:3 T:1620 min, m:0.696 gr.

Time	Index	Component	Mass%	Corredcted Mass%
15.256	582.8	3-methylpentane	1.1919	38.87
16.409	602	t-hexene-3	96.9341	
18.186	626	methylcyclopentane	1.6471	53.72
34.744	757.2	Toluene	0.1411	4.60
55.827	857	1,3-dimethylbenzene	0.0858	2.8

Table D-195: EX:5, Port:1 T:1680 min, m:1.134 gr.

Time	Index	Component	Mass%	Corredcted Mass%
11.049	473.1	i-pentane	0.1031	2.9
14.296	564.5	2,3-dimethylbutane-1	0.0869	2.43
14.521	569	2-methylpentane	0.1171	3.28
15.276	583.1	3-methylpentane	1.2022	33.71
16.431	602.3	c-hexene-3	96.3465	
18.207	626.2	methylcyclopentane	1.6473	46.2
34.765	757.4	Toluene	0.2097	5.88
55.839	857	1,3-dimethylbenzene	0.1204	3.37
61.766	879.9	1,2-dimethylbenzene	0.0789	2.21

Table D-196: EX:5, Port:2 T:1680 min, m:0.883 gr.

Time	Index	Component	Mass%	Corredcted Mass%
11.034	472.4	i-pentane	0.1394	3.74
14028	564.2	2,3-dimethylbutane	0.1071	2.87
14.505	568.7	2-methylpentane	0.1415	3.8
15.259	582.8	3-methylpentane	1.2214	32.8
16.412	602	t-hexene-3	96.1759	
18.189	626	methylcyclopentane	1.6458	44.19
34.747	757.3	Toluene	0.2426	6.51
88.825	857	1,3-dimethylbenzene	0.1368	3.67
61.756	879.9	1,2-dimethylbenzene	0.0895	2.40

Table D-197: Pure gasoline analysis

Time	Index	Component	Mass %
11.029	471.7	i-pentane	1.6007
11.711	499.3	n-pentane	1.749
16.254	599.3	hexane	0.4601
20.167	648.3	benzene	0.852
34.881	757.8	toluene	11.053
55.999	857.6	1,3-dimethylbenzene	5.9683
56.254	858.6	1,4-dimethylbenzene	2.8092
61.876	880.2	1,2-dimethylbenzene	3.9029
		dimethylbenzene	12.6804

APPENDIX E

COMPONENTS CONCENTRATION CALCULATIONS

Table E-1: Components concentration at 60th minute.

Time:60 min (Port:1)			
Component	**Amount of each component in the collected sample**	**Original amount of each component in pure diesel oil**	**Amount in sample/ Original amount in diesel oil**
C_{10}	0.66	3.60	0.18
C_{11}	0.78	4.67	0.16
C_{12}	0.92	4.39	0.20
C_{17}	1.63	9.40	0.17
C_{18}	1.53	8.08	0.18
C_{26}	0.11	0.56	0.19
C_{27}	0.05	0.29	0.18

Table E-2: Components concentration at 60th minute.

Time:120 min (Port:1)			
Component	**Amount of each component in the collected sample**	**Original amount of each component in pure diesel oil**	**Amount in sample/ Original amount in diesel oil**
C_{10}	1.38	3.60	0.38
C_{11}	1.53	4.67	0.32
C_{12}	1.80	4.39	0.41
C_{17}	3.17	9.40	0.33
C_{18}	2.94	8.08	0.36
C_{26}	0.21	0.56	0.37
C_{27}	0.10	0.29	0.35

Table E-3: Components concentration at 240th minute.

Time:240 min (Port:1)			
Component	**Amount of each component in the collected sample**	**Original amount of each component in pure diesel oil**	**Amount in sample/ Original amount in diesel oil**
C_{10}	1.44	3.60	0.40
C_{11}	1.62	4.67	0.34
C_{12}	1.92	4.39	0.43
C_{17}	3.14	9.40	0.33
C_{18}	3.10	8.08	0.38
C_{26}	0.20	0.56	0.35
C_{27}	0.10	0.29	0.36

E.2 Wet and Dry System

Table E-4: Components' concentration in dry and wet systems (second day).

Time: 2880 min (Port:2)			
Component	**Wet System(%)**	**Dry System(%)**	**Dry/Wet**
C_{10}	1.27	6.90	5.39
C_{11}	1.16	6.39	5.51
C_{12}	1.51	8.21	5.42
C_{17}	1.27	6.86	5.36
C_{18}	1.31	7.47	5.66
C_{26}	1.31	7.67	5.83
C_{27}	1.2	7.09	5.95
C_{28}	1.11	3.38	3.03
Time: 3000 min (Port:2)			
Component	**Wet System(%)**	**Dry System(%)**	**Dry/Wet**
C_{10}	0.76	7.57	9.95
C_{11}	0.67	6.91	10.28
C_{12}	0.88	8.98	10.16
C_{17}	0.66	7.41	11.18
C_{18}	0.74	8.01	10.73
C_{26}	0.92	8.31	8.95
C_{27}	0.99	7.66	7.72
C_{28}	1.17	4.02	3.41

Table E-4 Continued.

Time: 3120 min (Port:2)			
Component	**Wet System(%)**	**Dry System(%)**	**Dry/Wet**
C_{10}	0.90	9.09	10.03
C_{11}	0.92	8.3	8.94
C_{12}	1.29	10.71	8.28
C_{17}	1.11	8.95	8.02
C_{18}	1.13	9.63	8.47
C_{26}	1.15	10.06	8.72
C_{27}	1.09	9.46	8.68
C_{28}	1.06	5.25	4.94

Table E-5: Components' concentration in dry and wet systems (second day).

Time: 4320 min (Port:2)			
Component	**Wet System(%)**	**Dry System(%)**	**Dry/Wet**
C_{10}	3.37	12.5	3.71
C_{11}	3.03	11.19	3.69
C_{12}	3.9	14.45	3.683
C_{17}	3.1	11.77	3.77
C_{18}	3.39	13.05	3.84
C_{26}	3.35	13.71	4.089
C_{27}	3.09	12.59	4.074
C_{28}	2.97	8.35	2.81
Time: 4440 min (Port:2)			
Component	**Wet System(%)**	**Dry System(%)**	**Dry/Wet**
C_{10}	3.9	9.39	2.40
C_{11}	3.55	8.32	2.34
C_{12}	4.61	11.06	2.39
C_{17}	3.76	9.23	2.45
C_{18}	4.12	10.23	2.48
C_{26}	4.36	10.54	2.41
C_{27}	3.97	8.95	2.25
C_{28}	3.63	5.38	1.48

Table E-5 Continued.

Time: 4560 min (Port:2)			
Component	**Wet System(%)**	**Dry System(%)**	**Dry/Wet**
C_{10}	3.93	5.62	1.42
C_{11}	3.72	5.29	1.42
C_{12}	4.81	6.82	1.41
C_{17}	3.752	5.65	1.505
C_{18}	4.16	6.34	1.52
C_{26}	4.20	6.31	1.50
C_{27}	4.17	6.16	1.47
C_{28}	3.70	1.62	0.44

APPENDIX F

GASOLINE EVAPORATION RATE

As it was mentioned before**,** an experiment was conducted in order to investigate the gasoline evaporation rate. For this purpose, 54.3 cm^3 gasoline poured in a beaker which was open to the atmosphere. 3 samples were collected from the beaker at 60^{th}, 120^{th} and 240^{th} minutes. Samples were analyzed in GC. Mass percent of the components were determined for each sample. Mass percent of toluene, benzene, dimethylbenzene, hexane, and lighter hydrocarbons such as i-pentane and n-pentane were considered and compared at three time intervals. Table (F-1), (F-2) and (F-3) show results of selected components at 60^{th}, 120^{th} and 240^{th} minutes respectively.

Table F-1: Gasoline evaporation analysis at 60^{th} minute.

Time	Index	Component	Mass %
11.029	471.7	i-pentane	15.1549
11.711	499.3	n-pentane	1.4244
16.254	599.3	hexane	0.4549
20.167	648.3	benzene	0.8689
34.881	757.8	toluene	11.5663
55.999	857.6	1,3-dimethylbenzene	6.3213
56.254	858.6	1,4-dimethylbenzene	2.9595
61.876	880.2	1,2-dimethylbenzene	4.1464
		dimethylbenzene	13.43

Table F-2: Gasoline evaporation analysis at 120th minute.

Time	Index	Component	Mass %
11.029	471.7	i-pentane	13.1476
11.711	499.3	n-pentane	1.3004
16.254	599.3	hexane	0.4589
20.167	648.3	benzene	0.8833
34.881	757.8	toluene	11.9773
55.999	857.6	1,3-dimethylbenzene	6.5848
56.254	858.6	1,4-dimethylbenzene	4.3145
61.876	880.2	1,2-dimethylbenzene	4.3145
		dimethylbenzene	15.214

Table F-3: Gasoline evaporatipon analysis at 240th minute.

Time	Index	Component	Mass %
11.029	471.7	i-pentane	9.3108
11.711	499.3	n-pentane	1.0331
16.254	599.3	hexane	0.4626
20.167	648.3	benzene	0.8938
34.881	757.8	toluene	12.611
55.999	857.6	1,3-dimethylbenzene	6.9973
56.254	858.6	1,4-dimethylbenzene	3.2719
61.876	880.2	1,2-dimethylbenzene	4.5783
		dimethylbenzene	14.843