

The Republic of Iraq
Ministry of Higher Education and
Scientific Research
College of Applied Sciences-Heet
Environment Department



**Development of a new method to protect
the environment from light hydrocarbon
fumes pollution from oil and gasoline
tanks without adding equipment**

search submitted by

Farhan Mohammed Farhan

Hussein Daa Karim

Arshad Mhmood Hsean

Hind Jamal Rahem

Ibrahim Mahmood Abd Ulmohsin

Supervisor

A.M.D. Marwan Mohamed Farhan

1442

2021



زَوَالِقَلَمٍ وَمَا يَسْطُرُونَ (١) مَا أَنْتَ بِنِعْمَةِ رَبِّكَ بِمَجْنُونٍ (٢) وَإِنَّكَ لَأَجْرًا

غَيْرَ مَمْنُونٍ (٣) وَإِنَّكَ لَعَلَى خُلُقٍ عَظِيمٍ (٤) فَسَبِّحْهُ وَبُصِّرْهُ وَبُصِّرْهُ (٥) بِأَيْكُمْ

الْمَقْتُولِ (٦) إِذْ رَبُّكَ هُوَ أَعْلَمُ بِمَنْ ضَلَّ عَنْ سَبِيلِهِ وَهُوَ أَعْلَمُ بِالْمُهْتَدِينَ (٧) فَلَا

تُطْعِمُ الْمُكْذِبِينَ (٨) وَذُؤَالُو تَدْمِهِمْ فَيَذَرُوهُمْ هَؤُلَاءِ (٩) وَلَا تُطْعَمُ كُلَّ حَلَّافٍ

مَهِينٍ (١٠) هَمَّازٍ مَشَاءٍ بِنَمِيمٍ (١١) مَنَّاعٍ لِلْخَيْرِ مُعْتَدٍ أَثِيمٍ (١٢) عَتَلٍ

بَعْدَ ذَلِكَ زَنِيمٍ (١٣) أَزْكَارَ ذَا مَالٍ وَبَنِينَ (١٤) إِذَا تَلَّى عَلَيْهِ آيَاتُنَا قَالَ

أَسَاطِيرُ الْأَوَّلِينَ (١٥)

صَدَقَ اللَّهُ الْعَظِيمَ

القلم (١-١٥)

الأهداء

اللّٰهُ مِنْ جَعَلَهُ اللهُ رِضَاهُ فَخَيْرٌ مِنْهُمَا وَالْخَيْرُ وَالْبِرُّ حَقٌّ بِسَيِّئِهَا

أُمَّهُ وَأَبُوهُ ... وَفَاءٌ لِمَنْعَتِهِمَا

اللّٰهُ أَفْوَتَهُ وَأَفْوَتَهُ

تَقْدِيرًا لِعَنْتِهِمْ وَمَوْجِدَةً لِمَنْعَتِهِمْ

اللّٰهُ إِسْرَاقَتَهُ

جَزَاءً لِمَنْعَتِهِمْ وَجَمِيلًا لِمَنْعَتِهِمْ

ثُمَّ اللّٰهُ جَعَلَهُ مِنْ أَحِبَّنَا فَخَيْرٌ مِنَ اللهِ وَأَحِبَّنَا وَأَرْشَدَنَا اللّٰهُ

طَرِيقَ الْخَيْرِ وَأَرْشَدَنَا وَمَنْ أَوْصَانَا بِدَعَا

الْخَيْرِ وَأَوْصَانَا

الباحث

تنتهجى و عرفانى

. ان من الواجب على ان اسجل بالغ الشكر و العرفان الى
استاذى الفاضل الاستاذ الدكتور (مروان محمد فرحان) وانى
اشهد بالجهود التي بذلها في رعاية البحث لقد اشرف على
خطته و تابع مراحل تنفيذها بصبراً و قلباً كبيراً و روح مخلصه
وكانت لتوجيهاته القيمة و ارشاداته العلمية ابلغ الأثر في تذليل
المصاعب البحث و تشعباته حتى ظهر هذا البحث بصورته
الحالية فله منى كل الشكر و التقدير سائلين المولى عزوجل ان
يوفقه الى كل خير

. كما لا يفوتني ان اعرب عن خالص شكري و عرفاني لكثير
من الأخوة ذوي الأيثار الذين كان لهم الفضل في مساعدتي
في عملي المتواضع هذا

وشكري الى كل من قدم لي نصراً أو ارشاداً و الله لا يضيع
اجر من أحسن عملاً

﴿ومن الله التوفيق﴾

content list

s.	<i>subject</i>	page
	Abstract	
Chapter One		
	Introduction	
	1. Crude oil	
	1.1. Classification of crude oil	
	1.1.1 Chemical classification	
	1.1.2. Physical classification (API)	
	1.2 Chemical Composition of Fuel	
	1.3. Gasoline	
	1.4. Evaporation	
	1.4.1. Hydrocarbon Release During Fuel Storage and Transfer at Gas Stations	
	1.4.2. Vapor Fuel Releases	
	1.4.3. Light hydrocarbons in western Siberian fields	
	1.4.4. Loss of light hydrocarbons in Iraqi fields	
	1.5. The negative effects and risks of evaporation of petroleum hydrocarbons from gas stations and large tanks on humans, the environment and the economy	
	1.6. The methods of reducing losses of petroleum products from tanks	
	1.7. Tanks of petroleum	
	1.7.1. Storage tanks	
	1.7.2. Kind of tanks	
	1.8. Objectivity of the problem	
	1.9. The main objectives of the study	
Chapter Two		
	(Theories Used)	
	2: Basic theories on the use of surface-active compounds and on the quality and method of reducing hydrocarbons in gasoline tanks	
	2.1 Real hydrocarbon losses from gasoline tanks	
	2-2 The evaporation rate of liquids can be explained by the following equation	
	2-3 :- Properties and mechanics of active compounds on liquid surfaces	
	2-3-1 Mechanism of preparation of active compounds on surfaces	
	2-3-2 Mechanical properties Effectiveness of surface-active compounds in tanks	
	2-4 Brief information about the active compounds on surfaces	
	2-5 Structural formulas of real hydrocarbons in gasoline, petroleum and its derivatives	
	3-6 How to Calculations:	
	3-7 Treatment of experimental results and determination of the accuracy of the research method	

Chapter Three		
	practical part	
	3-Flow chart the path of searches:	
	3-1 chemical materials used	
	3-2 Instruments and Apparatuses used	
	3-3 Experimental methods	
	3-4 Steam pressure measurement	
	3-5 Measuring the steam saturated pressure and determining the optimum concentration	
Chapter Four		
	4- Discussion and results	
	Accounts	
	Recommendations	
	Reference	

Abstract.

A new method was used to reduce the evaporation of liquids (petroleum and gasoline) by preparing a new compound of the active compounds on the surfaces of liquids, which was synthesized from the reaction of EDTA with TBM in ratios of 1: 4 and the result was diagnosed spectroscopically by means of FTIR spectrum, ¹H.NMR spectrum, ¹³C. NMR, CHN, and DMNR. Which confirmed and proved the proposed formula for the resulting compounds which is (tetrakis (2,6-di-tert-butyl-4-methylphenyl 2,2 ', 2', 2 ") - (ethane-1,2-diylbis (azanetriyl)) tetraacetate.

And through the use of the previous compound, the process of reducing the rates of evaporation of light hydrocarbons was successful, and by this, by taking certain concentrations of the above-prepared compound, in determining and reducing the rates of evaporation of volatile hydrocarbons from gasoline and oil during storage and transportation and at different temperatures (25, 37, 50 degrees Celsius) was done determining the optimal concentration by determining the lowest steam saturated pressure of the corresponding concentration, which is (1.5 mg / kg) for the prepared compound versus gasoline and petroleum, and the reduction ratios were estimated (95, 92.5, 91.5%) for gasoline and for oil (87.2, 86.0, 85.6%), respectively for degrees various thermocouple (25, 37, 50 ° C).

Chapter One

Introduction

The great importance of the environment has prompted man to think seriously about ways and means that help protect this environment from pollution. The continuation of human life on this planet is clearly dependent on the extent to which the environment continues to provide what it offers to humans of the ways and elements of life. Life will not continue on this earth, so man must think clearly of ways and means that will reduce environmental pollution and will preserve the earth's air, water and soil away from pollution that may affect the various components of the environment. Environmental pollution is caused by pollutants in the form of solid particles, liquid droplets, or gases, in addition to that they may be natural or caused by human activity, with a percentage of 40% in the Arab world. Pollutants can be classified into primary and secondary pollutants. Typically, primary pollutants are substances that are directly emitted from a process, such as ash from a volcanic eruption, carbon monoxide from vehicle exhaust, or carbon dioxide from factory chimneys. As for secondary pollutants, they are not emitted directly into the air. Rather, these pollutants are formed in the air when primary pollutants activate or interact with each other. An important example of secondary pollutants is the proximity of ozone to the Earth's surface - one of the many secondary pollutants that make up photochemical smog. But we must also bear in mind that some pollutants may be primary and secondary at the same time, that is, they are emitted directly into the air and are also caused by some other primary pollutants. According to the Engineering and Environmental Sciences Program at the Harvard School of Public Health, approximately 4 percent of deaths in the United States can be attributed to environmental pollution.

1. Crude oil

Oil is the backbone of the country's economy. Oil reserves and production are considered to be the economy of the world countries. Crude oil is a thick liquid consists of a mixture of organic and organic compounds. The latter is the main component of petroleum, containing hydrocarbons of the basic C1-C64. Crude oil consists of a group of different hydrocarbon group. These include aromatic, naphtha and paraffin compounds, each with individual sub-

assemblies. The composition and length of carbon-carbon structure of crude oil and different from country to country and even inside the same country, among different fields [1]. Petroleum is a Latin word consisting of two syllables, petro and the geologic world. Agricola was using leum, which means Rock oil. This word is used for the first time in 1564, the founder of geology[2]. The attention of the world to this material has been increased in recent years dramatically leading many different scientific institutions to develop the disciplines concerned with studying the various aspects of the oil industry [3]. There's oil in a different part of the world in different qualities and structures, rough close to the earth's surface and this type is not good because of the loss of many volatile components, etc. Are found in deeper places and good quality despite the additional costs of the revision [5].

Crude oil consists of various hydrocarbons in which lighter components may evaporate in the storage tanks at ambient temperature and pressure. The evaporated materials are usually released to the atmosphere causing environmental pollution and reducing the quality of the crude oil. Considering the economic importance of the petroleum and also restricting standards in air pollution, any reductions in evaporative losses are of significant practical values. With the increase in air pollutions, federal and state laws have progressively changed over the years, requiring controls on storage tanks to reduce the emission of certain pollutants (212).

1.1. Classification of crude oil

Crude oil is classified in two according to types:

Chemical classification and physical classification

1.1.1 Chemical classification

These chemical classification are as follows:

Paraffinic(C_nH_{2n+2}) .1

Naphthenic (C_nH_{2n}).2

3.Aromatic ($C_{4n+2}H_{4n+2}$)

Crude oil is a complex mixture containing thousands of compounds from many different chemical classes with a large variety in physical properties[8].The chemical composition of crude oil is generally divided into four categories depending on their characteristics. These include saturated hydrocarbons, aromatic compounds, resins and asphalt. Saturated hydrocarbons are compounds such as straight-line alkanes (octane) paraffin's (methane and propane),and naphtha rings are the simplest hydrocarbons and the lighter part of crude oil. Hydrocarbon aromatics can be either mono,binary or polycyclic such as benzene, naphthalene and fluorine [9]. Crude oil is also classified as light, medium and heavy depending on the density with respect to the specific gravity value [10]. Its density is allocated to the concentration of various components in crude oil. Oil, which is light, will contain mostly saturated hydrocarbons and less molecular weight aromatic, while medium and heavy oils contain a large portion of aromatics, resins and basins. In addition, crude oils containing high sulfur(more than1%sulfur by weight)are "acid" while those containing less than 1% sulfur content are considered 'sweetener'[11].

1.1.2. Physical classification (API)

Oil can be classified in to heavy and light. It depends on its density. API degree (American petroleum institute) is a common measurement supported by

oil density [12]. If the API increases, the viscosity will decrease, usually increasing API grade means that crude oil contains high levels of naphtha with volatile hydrocarbon paraffin which can be easily processed to produce gas oil, and this crude is light .Heavy crude oil is more viscous, has high boiling points, densities and less API grade, and is usually rich in aromatic and tends to contain more than other substances such as asphalt and heterogeneous rings containing sulfur, nitrogen and hydrocarbons containing oxygen[12].The value of API grade currently accepted which can distinguish between heavy and light oil is $28 < \text{API} > 33$ respectively[12].Crude oil can also be classified according to the sulfur content due to its effect on quality. There are types with low content of less than 0.5% and others with about (0.5-4%).These are the common types in the world.There are also some heavy species with high sulfur content from 4 to 7% [13].

1.2 Chemical Composition of Fuel

Fuels have historically contained significant fractions of harmful chemicals, some of which have been documented as contributing to morbidity and mortality in exposed persons. Crude oil, from which fuels have historically been refined, already contains toxic chemicals such as benzene [236]. Fuel additives including anti-knocking agents and oxygenates have historically also been a health concern [226]. Fuel composition has changed over time, primarily due to environmental and health concerns [226]. Fuel composition also depends on geographic location and fuel type (e.g., conventional versus reformulated gasoline) [227]. In the 1920s, lead was added to gasoline as an anti-knocking agent to replace added benzene because of its carcinogenicity [228]. Due to the massive release of lead to the environment and its neurotoxicity [229], lead was replaced in the 1970s by less toxic anti-knocking agents including methyl tert-butyl ether (MTBE) [230]. To reduce formation of ground-level ozone and associated adverse respiratory health effects [231], cleaner burning of fuel was

sought in the 1990s by adding oxygenates to gasoline. This was accomplished by increasing the concentrations of MTBE, which acts as an oxygenate [226]. However, MTBE accidentally released to the subsurface [232] contaminated downstream drinking water wells relatively quickly, moving almost with the speed of groundwater, because MTBE is hydrophilic and poorly biodegradable [233]. MTBE was later on identified as a potential human carcinogen [233]. In the USA, MTBE was therefore phased out in the 1990s; at the same time, refineries began supplementing fuel with ethanol as an oxygenate [234]. In current gasoline formulations, benzene, toluene, ethylbenzene, and xylene (BTEX) and particularly benzene are the most studied chemicals and are currently believed to be of greatest health concern [235].

1.3. Gasoline

Gasoline is a Volatile Organic Compounds (VOCs) with different boiling point range of (30-200) °C. The light compounds that have boiling point of less than 40 °C constitute about 10V % (202). Gasoline is a mixture of hydrocarbons C4-C12 containing double or single bonds. This petroleum part distills at a temperature of between 30 and 220 °C, which is very dangerous and can easily evaporate at room temperature and atmospheric pressure, is highly inflammable and becomes explosive when volatile gas is mixed with air. The gasoline mixture also contains a small amount of oxygen, sulfur compounds and nitrogen compounds. The hydrocarbon compounds found in gasoline can be classified as n-paraffin's, aromatic, olefins, iso-paraffins compounds and naphthenics. The relative ratios between these five groups of hydrocarbon are determined by considering the manufacturing process, engine requirements and quality standards for appropriate fuel in each country [20]. The gasoline for cars is produced in Korea by mixing straight-run gasoline reformed gasoline, cracked gasoline and methyl tributyl ether (MTBE) of refineries based on quality

standards from gasoline of the petroleum business act are alternative fuel oil and add various, such as antioxidant[21].

Through the storage period, hydrocarbons in gasoline may cause chemical or physical changes through their chemical reaction with oxygen in the air, resulting in a change in fuel quality. In addition, the oxidation of the components found in the gasoline itself also caused deterioration of fuel quality affecting the fuel quality [22].

Because of the oxidation of the fuel involved in the storage the amount of gums—a polymeric material produced by polymerization or the condensation is increased through oxidation, the olefin content is reduced the vapor pressure from the lower component of the low boiling point by evaporation the composition is changed after these changes are completed if gasoline is used as fuel for cars, gums may be deposited into the fuel supply system, consist of the fuel filter and fuel delivery line, which can cause problem at startup and reduce the performance of the vehicle[23].

Generally, the use of tin-wrapped steel containers and closed storage of gasoline for the long term some rural consumers have complained of reducing the octane numbers of gasoline stored in plastic storage containers in Korea. This is because plastic container is cheaper than tin-plated steel containers and can be easily purchased. Octane numbers are among the most important physical criteria that are evaluated because they are directly related to engine performance and power. The issue of fuel quality has been raised in gasoline, which has not been used for long in dual-fuel vehicles the use LPG (liquid petroleum gas) and gasoline at the same time. Complaints were also made about the deterioration of the quality of gasoline based on the fuel storage environment and on the deterioration of the quality of gasoline stored in plastic containers. It is reported that hydrocarbons in gasoline may be permeated with

plastic. However, the influence of adsorption on fuel quality has not been scientifically proven, resulting continued difficulties in quality control. The fuel tank is made of plastic for weight loss and its multi-layered use using high density, regrind, ethylene-vinyl alcohol (EVOH). However, the fuel tank material is not the target, storage instead of material for car parts. In this study, the difference in the quality of the long-range storage fuel of gasoline for cars traded in Korea was examined at the laboratory level. Simplified storage container currently used the study was prepared using plastic materials. During the storage period (four months), the quality of the gasoline was evaluated by measuring the main factors that represent quality characteristics, including octane number, distillation, vapor pressure, oxidation stability and ingredient component (aromatic compounds, paraffin, naphtha, and olefin) for storage containers after storage period.

1.4. Evaporation

Evaporation loss is a natural process in which part of liquid is turning to vapor and vanishing into the atmosphere. Crude oil compound from the several hydrocarbons in which some of them evaporate and could be released into the atmosphere at ambient temperature and pressure. This process causes to pollute the environment and has effects on crude oil quality. Any reduction in the loss will also have financial benefit. This makes the phenomena, crude oil evaporation loss an important issue, which should be carefully investigated and effects of various parameters be studied (202).

Evaporation is a physical process in which the molecules of a substance change from a liquid state to a gaseous state. This process occurs only on the surface between liquid and gas (the upper layers of the liquid evaporate). The causes of evaporation:

1 - Availability of assistant factors such as temperature, increasing temperatures evaporation increases and that evaporation causes economic deterioration quantities of oil lose quantities of oil lose (C6 - C1) [39,40].

2 - Environmental degradation affecting on the environment, soil and human [39, 41-43].

3 - Physical degradation of the oil itself when evaporative light hydrocarbons leaving only the heavy part, which in turn affects the quality of oil. As Iraq suffers from the evaporation of 3 million tons per year as normal as the production of Iraq 200 tons per year the Iraqi Ministry of Oil set the evaporation rate per year for every day 5% equivalent to 5 liters for 1000L (the greater the surface area evaporation increases) [44-46]. The problem of reducing the light hydrocarbon loss of oil along the way of assembly and preparation of oil fields to the consumer is a closely related problem, solving not only the environmental aspect but also the economic side. Oil losses from evaporation in Russia are between 500 and 600 tons per year, and in tropical countries the share of these losses is much higher. The reason for this is higher air temperatures in these countries compared to Russia [47-49].

1.4.1. Hydrocarbon Release During Fuel Storage and Transfer at Gas Stations

Pollution of environment is not only due to emission of hydrocarbon from the exhaust gases of vehicle, but hydrocarbons present in gasoline are also responsible factor. Transportation plays a major role in GHG (greenhouse gas) emission which is directly associated with climate change (213).

It is released into the environment from the tank of automobile when it is refueled and additionally all through transportation and storage because of

evaporation. Due to the evaporation of gasoline, organic vapor is released into the atmosphere, which causes huge energy waste and severe environmental pollution like ozone pollution. and Around 1.5 – 2% gasoline is evaporated in to the atmosphere, when it is shifted from producer to customer and around 40% of the hydrocarbons(emitted by road transport) comes from the evaporation from the fuel system of automobile with gasoline engines (214, 215, 216).

It is also observed that due to solar radiation, temperature of gasoline in fuel tank increases and evaporation takes place, which is hazardous to human health. (Petrol H. O. W ,217) explained hydrocarbon (HC) release during refueling storage of gas stations and transferring the fuel to fuel tank and its effects on human health and environment. It has been observed that the attendants on gas stations and the drivers of the vehicle are mainly surviving from the health risk because of inhaling hydrocarbon (HC) (218; 219).

During delivery, storage, and dispensing of fuel at gas stations, unburned fuel can be released to the environment in either liquid or vapor form. Fuel is a complex mixture of chemicals, several of them toxic and carcinogenic [221].

Table 2.1 shows the statistics of USA and Canada gasoline consumption, with a presumption that if a small 0.1 % of hydrocarbon (HC) is considered to be released in environment. When gasoline is evaporated, its composition and properties also varies because different components evaporate at different rate. It is a general phenomenon of the gasoline and occurs in all type of equipment fuel tanks. When gasoline is filled in tank, light component is evaporated first which is essential element for octane benefits during cold start. Because when cold start occurs these light component forms most of the air fuel mixture.

In the absence of these light components mixture becomes lean which causes higher temperature, pre ignition, detonation and finally it damage the piston (214, 215, 216).

Table 1.1. Gasoline consumption per annum (220)

Country	Consumption/Citizen	Release of hydrocarbon the atmosphere
USA	430 gallons	1.6 Liter
Canada	450 gallons	1.7 Liter

From, Table 2.2, it is clear that evaporative losses was very high in 2009 and that can be minimized by providing a proper insulation on the fuel tank. Refueling losses are outcomes of evaporation due to vapor collection in tank under solar radiation. Evaporative losses are of two types, qualitative and quantitative losses. Quantitative losses are caused by evaporation and qualitative losses are caused fluid decomposition.

Table 1.2. Gasoline outlet evaporative at gas stations in 2009 (220)

Evaporative losses	Liters
Total Evaporative losses	58,300,000
Operational losses, outlets	37,300,000
Refueling losses, vehicle	21,100,000

With a population of about 34 million, we estimated that about 1.7L of gasoline was released per capita per year in Canada from evaporative losses, without counting the liquid spills. While personal intake of this quantity of gasoline would result in serious adverse health effects, environmental dilution can decrease personal exposure. Cumulative adverse health effects could be

more pronounced in metropolitan areas where more people are exposed and where the density of gas stations is larger than in rural areas (225).

At gas stations, fuel can be released in both liquid and vapor phases during delivery, storage, and dispensing. Direct vapor release is usually associated with atmospheric pollution, while liquid spillage is commonly associated with soil and groundwater contamination. However, spilled liquid fuel also evaporates into the atmosphere. Hypothetically, hydrocarbon vapors can also condense back into liquid form; however, this appears to be unlikely due to quick dilution in a typically turbulent atmosphere. Figure 2.1 depicts how releases of unburned fuel contaminate the atmospheric, subsurface, and surface water environments (225).

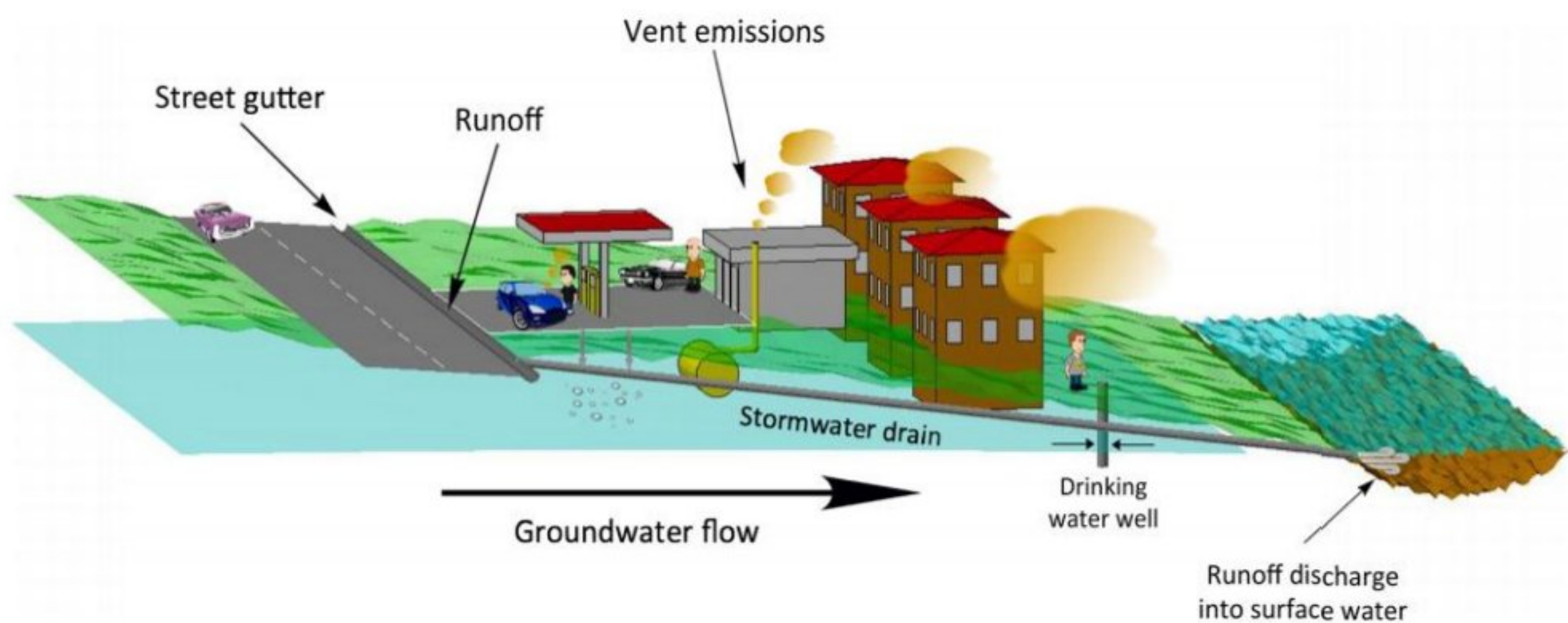


Fig. 1.1. Gas stations are consequently release pollutants to the atmosphere, the subsurface including soil and groundwater, and surface water

1.4.2. Vapor Fuel Releases

Fuel evaporative losses have received more attention than liquid fuel spills (even though they are related) [237, 238]. These losses are related to the fact that the headspace above liquid fuel in vehicle and storage tanks tends to approach thermodynamic equilibrium with the liquid. Consequently, almost

saturated gasoline vapors can be released to the atmosphere when tanks are refueled, unless a suitable vapor recovery system is in place. Since saturated gasoline vapors have a density that is three to four times larger than the one of air, i.e., 4 kg/m^3 , and the density of liquid gasoline is about 720 kg/m^3 [239], about 0.5% of liquid gasoline dispensed to a tank is released to the atmosphere if the entire headspace is in equilibrium with the liquid fuel. This is true for any type of tank, whether it is a vehicle tank, a canister, an underground storage tank (UST), or an above-storage tank. The percentage loss is less if a tank received clean air relatively recently, e.g., when the fuel level in a storage tank drops because of gasoline-fuel dispensing.

It is important to note that vapor recovery at the nozzle can cause vapor releases at the storage tank, because vapors recovered at the nozzle are typically directed into the storage tank. The storage tank, in turn, can 'breathe' and potentially release recovered vapors immediately or at a later time. A tank sucks in relatively uncontaminated air as the liquid fuel level drops in the tank due to vehicle refueling, and it releases vapors through the vent pipe into the atmosphere if the gas pressure increases and exceeds the cracking pressure of the pressure/vacuum valve, when fuel evaporates into unequilibrated gas in the headspace.

1.4.3. Light hydrocarbons in western Siberian fields

The analysis obtained from the oil treatment plants in the field work has shown that the oil treatment is largely, even in the complex automation conditions of oil and gas. Technological losses of oil in the fields occur as a result of the burning of accompanying oil gas and incandescent liquid drips, losses due to water injection to maintain reservoir pressure, as well as the losses resulting from the evaporation of oil from reservoirs.

The process of loss of quantities of oil from extraction sites falls within the range 0.4 - 0.7% weight of oil. The largest share of the treatment of oil losses occurs in evaporation from crude oil tanks due to "large and small breathing", which accounts for more than 90% of the total operational losses.

Discharging and filling the fuel tank with oil and evaporating from the atmospheric gas mixture as a result of the "big vent" entering the air and releasing a mixture of gas to the air through the breathing valve when the temperature and pressure change during the day at a constant level of oil in the tank.

It has been found that the ways to reduce the loss of hydrocarbons during the evaporation of oil in the reservoirs can be divided into three groups: preventive evaporation, reducing evaporation, accumulation of the product and evaporation of oil.

The loss of oil during storage in non-enclosed tanks is largely dependent on evaporation. The greater the amount of oil in the light parts, the more evaporation, and therefore the loss of oil. It has been shown that at the stage of storage, it is necessary to maintain lower temperature and pressure than the atmosphere [51].

As a means of combating the loss of oil stored in reservoirs, it is recommended to use floating surfaces and buoys.

Analysis shows that the use of this type of reservoir is ineffective in temperate climates. For western Siberia and oil-producing fields that contain water due to rain, the use of floating surfaces and buoys leads to significant costs.

1.4.4. Loss of light hydrocarbons in Iraqi fields

As mentioned above, losses from hydrocarbon evaporation in the tank are one of the most important problems of our time. Where the partially converted old tanks are still in use. Despite the modernization of equipment and tools, but oil losses due to evaporation from reservoirs, during transportation, and storage of oil.

These processes have a negative impact on the environment and increase the material costs of the state [39,41].

Iraq is, because of its warm climate, the loss of light hydrocarbons in the oil tank is much higher. At summer temperature up to 35 - 47 °C in winter 10 - 20 °C The loss of light hydrocarbons is given in Table 2.3 [39,41, 66].

Table 1.3.Loss of light hydrocarbons in reservoirs in Iraqi fields

Geographical Location deposit	Loss of hydrocarbons per 1000L per hour	Time of year
North of the country	4.5- 4L	In summer
	3.5-3L	In winter
The central part	5L	In summer
	3.5-3L	In winter
South of the country	8-7L	In summer
	5.5-6L	In winter

1.5. The negative effects and risks of evaporation of petroleum hydrocarbons from gas stations and large tanks on humans, the environment and the economy

Gas stations exist as part of the built environment and are widely distributed across communities. As a result, they may be surrounded by residential dwellings, businesses, and other buildings such as schools. Operation of gas stations may thus create opportunities for a variety of human populations to be exposed to vapors during station tank filling and vehicle refueling. These human populations can be broadly grouped into three groups: populations exposed occupationally as a result of employment in various capacities at the service station; those exposed as customers engaging in vehicle refueling; and those passively exposed either by residing, attending school, or working near the refueling station. The exposures to benzene and other components of refueling vapors and spills experienced by these populations vary based on a number of factors, including the size and capacity of the refueling station, spatial variation in pollutant concentrations in ambient air, climate, meteorological conditions, time spent at varying locations of the service station, changing on-site activity patterns, physiological characteristics, and the use of vapor recovery and other pollution prevention technologies.

Employees at service stations (such as pump attendants, on-site mechanics, and garage workers) are among those with greatest exposure to benzene originating from gas stations [223]. These receptors spend the most time on site (potentially reflecting approximately 40 h per week, for decades) and intermittently spend time where vapors from the pump are at their highest concentrations, with benzene concentrations measuring between 30 and 230 ppb in the breathing zone [240–241]. Gas station patrons can also be exposed to vapors when refueling and tanker truck drivers [224]. Compared to station employees, their exposures are brief and transient. A Finnish study reported a

median time spent refueling of approximately 1 min, whereas 3 min was the median duration in the USA [242, 243]. The same US study reported an average benzene personal exposure concentration at the pump of 910 ppb, with the strongest predictors of benzene levels being fuel octane grade, duration of exposure, and season [243].

Those occupying residences, businesses, and other structures neighboring gas stations can also be exposed to fuel vapors originating in the gas station, though typically at lower concentrations than those measured at the pump. While vapor concentrations will drop as the distance from the service station increases, exhaust fumes from waiting customers and fuel delivery trucks can also contribute to vapors in proximity to gas stations. A small number of studies have examined benzene concentrations at the fence line of the service station and beyond. A study published by the Canadian petroleum industry found average benzene concentrations of 146 and 461 ppb at the gas station property boundary in summer and winter, respectively [244]. A South Korean study examined outdoor and indoor benzene concentrations at numerous residences within 30 m and between 60 and 100 m of gas stations and found median outdoor benzene concentrations of 9.9 and 6.0 $\mu\text{g}/\text{m}^3$ (about 3.1 and 1.9 ppb), respectively. Median indoor concentrations at these locations were higher, reaching 13.1 and 16.5 $\mu\text{g}/\text{m}^3$ (about 4.1 and 5.2 ppb), respectively [245]. Another study found median ambient benzene levels of 1.9 ppb in houses both 100 m from a service station [246]. Yet, another study [247] found that benzene and other gasoline vapor releases from service stations can be discerned from traffic emissions as far as 75 m from service stations and that the contribution of service stations to ambient benzene is less important in areas of high traffic density. This is because vehicle exhaust is usually the most abundant volatile organic compound (VOC) in urban areas, often followed by gasoline vapor emissions from fuel handling and vehicle operation [248].

Beyond contact with surface-level gasoline vapors, fuel releases may result in other exposure pathways. Soil and groundwater contamination is common at gas stations. Drinking water wells proximate to gas stations, which in rural areas are often the only drinking water source, can become contaminated, potentially exposing well users to benzene and other chemicals [249, 250]. In addition, runoff from rain and other weather events can carry spilled hydrocarbons, which can contaminate surface waters; those using surface waters, either recreationally or for other purposes, may be exposed to these contaminants through dermal contact or incidental ingestion.

In the USA, the Environmental Protection Agency (EPA) regulates releases of benzene under the Clean Air Act as a hazardous air pollutant, and benzene is listed as number 6 on the 2005 priority list of hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act and any release greater than 10 pounds triggers a reporting requirement. Different quantitative toxicity metrics exist for benzene inhalation. The EPA Integrated Risk Information System (IRIS) has published a reference concentration of 0.03 mg/m^3 (about 9.4 ppb), corresponding to decreased lymphocyte counts [251], whereas the NIOSH recommended exposure limit (REL) is a time-weighted average concentration (for up to a 10-hour workday during a 40-hour workweek) of 0.319 mg/m^3 (about 100 ppb) [252].

While research attention has been paid to measurement of gasoline vapor constituent concentrations in air at and near service stations, less is known about the health consequences faced by those that are exposed to gasoline vapors. Of the limited literature examining these exposures, service station workers have received the greatest attention, and exposure is often assessed as a function of job title, rather than specific measurements of vapor constituent concentrations. An older study looking broadly at leukemia incidence in Portland, Oregon, found that gas station workers were at significantly increased risk for

lymphocytic leukemia [253]. A proportionate mortality ratio analysis of all deaths recorded in New Hampshire among white men from 1975 to 1985 found elevated leukemia mortality in service station workers and auto mechanics [254]. The type of leukemia was not specified. An Italian occupational cohort study of refilling attendants that examined risks among workers at smaller gas stations reported non-significant increases in mortality for non-Hodgkin's lymphoma and significantly elevated mortality for esophageal cancer in men, as well as increased brain cancer mortality in both sexes [255]. A different cohort of 19,000 service station workers in Denmark, Norway, Sweden, and Finland examined an array of cancer end points and found increased incidence for multiple sites (nasal, kidney, pharyngeal, laryngeal, and lung) among workers estimated to be occupationally exposed to benzene in the range of 0.5–1 $\mu\text{g}/\text{m}^3$ (0.16 - 0.31 ppb). Nonsignificant increased incidence was found for acute myeloid leukemia in men and for leukemia different from acute myeloid leukemia and chronic lymphocytic leukemia in women [256]. A case–control study of multiple occupations including subjects from the USA and Canada found significant increases in rates of total leukemia and acute myeloid leukemia but not acute lymphocytic leukemia in gas station attendants [257]. A 2015 review of studies examining potential relationships between benzene exposures and hematopoietic and lymphatic cancers among vehicle mechanics yielded inconclusive results, although it suggested that if an effect was to exist, it would be small and difficult to rigorously ascertain with existing epidemiologic methods [258].

Benzene is a primary chemical of concern due to its classification by the International Agency for Research on Cancer (IARC) as a Group 1 carcinogen and a Group A known human carcinogen according to the U.S. EPA (205,206). Exposure to benzene has been correlated to an increased risk of leukemia (acute myelogenous, acute lymphoblastic leukemia, and chronic myeloid leukemia),

aplastic anemia, and myelodysplastic syndrome (MDS) (207,208). Additionally, many hazardous air pollutants (HAPs) are volatile organic compounds (VOCs) and contribute to the formation of ozone and act as a factor in climate change. Ozone and climate change are implicated in affecting human health adversely (209).

It is known that contaminated groundwater can affect large numbers of people if the groundwater is used as drinking water, as was the case in Camp Lejeune (North Carolina, USA) where thousands were exposed to a range of chemicals including gasoline released [259]. A study of Pennsylvania residents residing in close proximity to a large gasoline spill found evidence of increased leukemia risks [250, 260••]. The health consequences of chronic fuel releases at gas stations that can, for example, occur due to ingestion of contaminated groundwater, fuel vapor intrusion from contaminated soil and groundwater into dwellings [261,262]. Consideration of the effects these chemicals may have on the atmosphere, air quality, and the health of people living near these facilities, particularly the sensitive populations, must also be addressed (210).

Health effects of living near gas stations are not well understood. Adverse health impacts may be expected to be higher in metropolitan areas that are densely populated. Particularly affected are residents nearby gas stations who spend significant amounts of time at home as compared to those who leave their home for work because of the longer period of exposure. Similarly affected are individuals who spend time close to a gas station, e.g., in close by businesses or in the gas station itself. Of particular concern are children who, for example, live nearby, play nearby, or attend nearby schools, because children are more vulnerable to hydrocarbon exposure [263].

The problem of reducing the light hydrocarbon loss of oil along the way of assembly and preparation of oil fields to the consumer is a closely related

problem, solving not only the environmental aspect but also the economic side. Oil losses from evaporation in Russia are between 500 and 600 tons per year, and in tropical countries the share of these losses is much higher. The reason for this is higher air temperatures in these countries compared to Russia [47-49].

Evaporation losses of oil and gasoline from tanks and other containers cannot be completely eliminated under the current level of technology used in the transportation and storage of hydrocarbons. This is the cause of both economic loss to the gasoline station owners and environmental damage from air pollution. In metropolitan areas the negative consequences of gasoline loss through evaporation are exacerbated by the high building density, the concentration of vehicles, the ever increasing transport volume [200] and turnaround at the gasoline station tanks. Also the loss of gasoline from evaporation leads to a deterioration in its quality and increases the specific consumption when a vehicle is operating due to the changes in its physicochemical characteristics: Reducing the loss of gasoline through evaporation is a critical factor in the rational use of fuel and energy resources and minimising the environmental impact.

Basically, losses through evaporation include losses from saturation of the gas space of new or reconstructed gasoline station tanks with vapor-air mixture; losses caused by the displacement of vapor-air mixture saturated with gasoline vapor from the tank during its filling and pumping; losses caused by daily fluctuations in temperature and atmospheric pressure and partial pressure of gasoline vapor in the gas space of the tank (201).

Hydrocarbon products have high demand in all world countries. this demand is growing at an average of .8% /year , because they are cheap fuels. Gasoline fuel is a most important fuel due to their high calorific value when it consumed in car engine but it classify as very high volatile organic

components (VOC) as result of it is high Reid vapor pressure (RVP). In Sudan the price of gasoline at service stations is (21) pound per gal (1 gal = 5.6lbmol of gasoline). The total estimated evaporation losses when we use different rim seal system and their total money loss due to evaporation loss (202).

Organic vapor is generated during gasoline evaporation in vehicle refueling process, which results in huge energy waste and environmental pollution. Every year, the economic loss caused by the evaporation of gasoline is billion yuan and the vapor generated by the evaporation of gasoline will cause ozone pollution (203).

According to the U.S. Environmental Protection Agency (EPA), volatile organic compound (VOC) emissions from gasoline are, as ozone precursors, VOC react with oxides of nitrogen in the presence of sunlight to form ground-level ozone. The exposure to ground-level ozone is associated with a wide variety of human health effects, agricultural crop loss, and damage to forests and ecosystems. Therefore, it is important to quantify the extent of VOC emissions from petroleum products marketing operations and implement measures to curtail these emissions (211). Because gasoline evaporation is a significant environmental problem, work was initiated at the National Alternative Fuels Laboratory (NAFL) of the University of North Dakota Energy & Environmental Research Center (EERC) to investigate evaporation rates of various gasolines and gasoline-oxygenate blends and the composition of their evaporative emissions (204).

1.6.The methods of reducing losses of petroleum products from tanks

1. Reduction of volume of gas space of tank through the use of a layer of microscopic plastic spheres, floating protective emulsions, pontoons, and floating tank roofs.

2. Storage of petroleum products under overpressure. With this method it is possible to entirely eliminate losses from small breathers and partially from large breathers. The optimal overpressure in a tank depends on the physico-chemical properties of the stored petroleum product and the environmental conditions and in each individual case must be determined by calculations.

3. Decreasing the amplitude of the oscillations in the temperature of the gas space of a tank by coloring it with beam-reflecting coatings, the use of thermal insulation, watering, and shielding of the tank.

4. Capture of the vapors of the petroleum products through the use of a gas-equalization system, gas piping of the tanks, and a system for capturing light fractions.

5. Management and technical measures, such as training highly skilled staff, storage of petroleum products at maximum possible filling of tanks; maintenance of tanks and breathing equipment in a functioning state, etc (264).

1.7. Tanks of petroleum

1.7.1. Storage tanks

Reservoirs are generally used to store crude oil and its derivatives, liquid chemicals and water. Most of the storage tanks are designed according to API specifications of the American Petroleum Institute. These reservoirs can have different sizes, ranging from 2 to 60 meters or more. The industries in which storage tanks can be found are oil production and refining, petrochemicals and chemicals, bulk storage and transport, and other industries that consume or produce liquids and vapors. But the nature of the material to be stored plays a key role in determining the quality of the tank to be used in order to maintain the specifications and quantity of the stock and its safety to reach the consumer according to the agreed specifications. These reservoirs vary in terms of

capacity and tolerance of heat and pressure. Some of the reservoirs reach more than half a million barrels, especially reservoirs used to store crude oil, sometimes reaching more than 200 ° C in some asphalt tanks and high viscosity products. Sometimes about 14 ° C especially in tanks used to store high-pressure gaseous hydrocarbons and evaporation such as propane, butane and others. So it is necessary to know the types of reservoirs and accessories and proper storage methods to be followed for each product[102-107].

1.7.2. Kind of tanks

In Iraq there are many types of tanks for the conservation of petroleum or its derivatives, depending on the type of material (evapability) and by the degree of flash. All oil tanks are built and designed on the surface of the earth, and in different geometric shapes, including cylindrical and various surfaces, for example:

1.7.2.1. Vertical cylindrical tanks with triangular ceilings [108]. Fig. (2.2.)

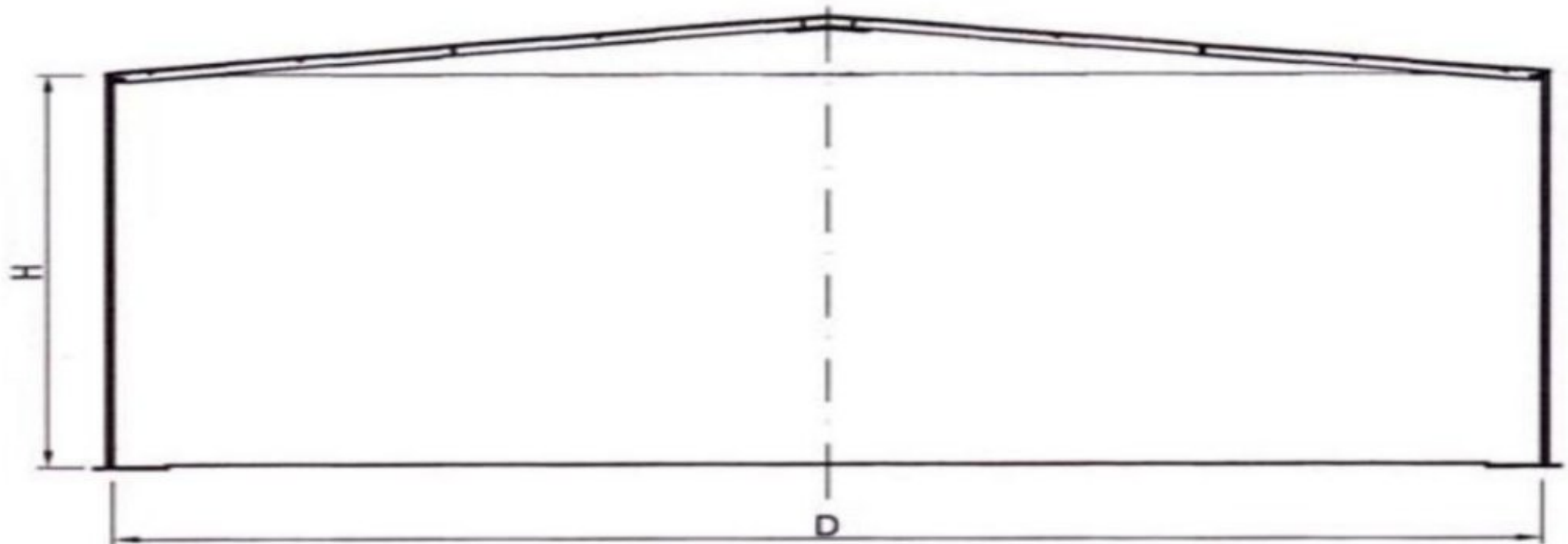


Fig.1.2. Vertical cylindrical tanks with triangular ceilings

1.7.2.2. Vertical cylindrical tanks with central column and triangular ceilings [109]. Fig. (2.3)

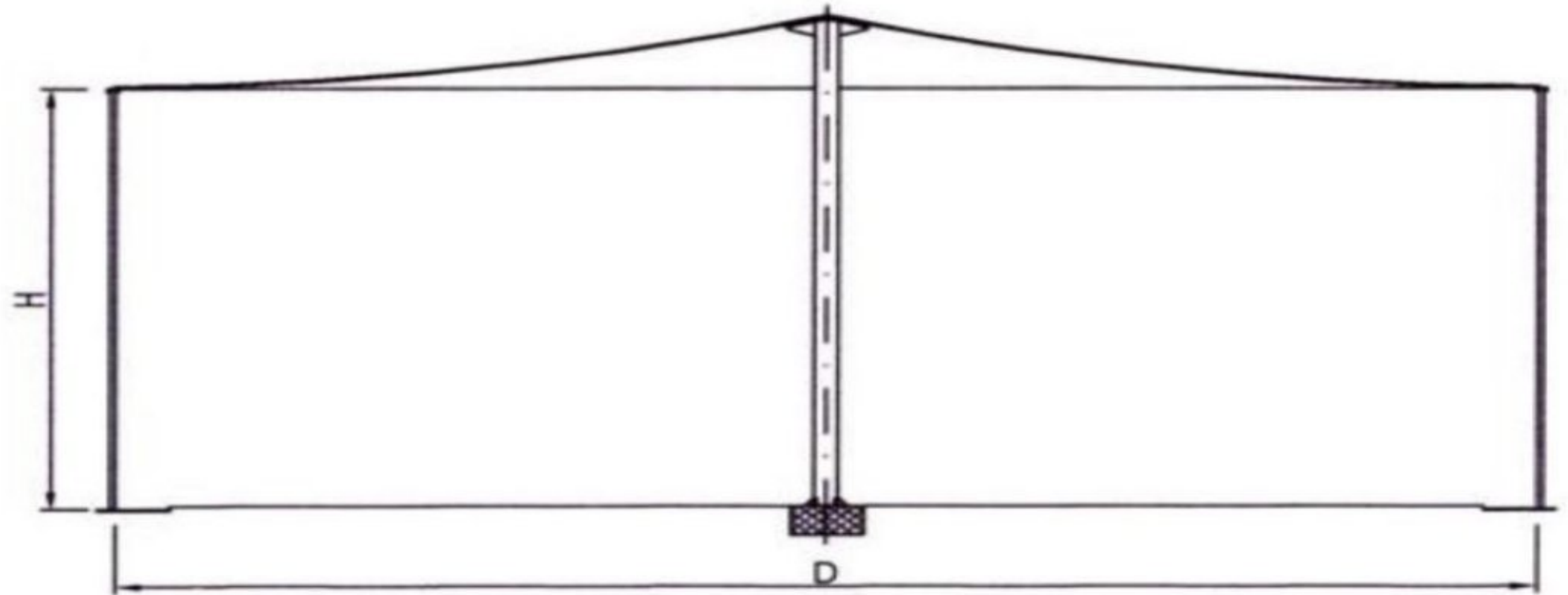


Fig.1.3. Vertical cylindrical tanks with central column and triangular ceilings

1.7.2.3. Vertical cylindrical tanks with semi-circular ceilings [110]. Fig. (2.4)

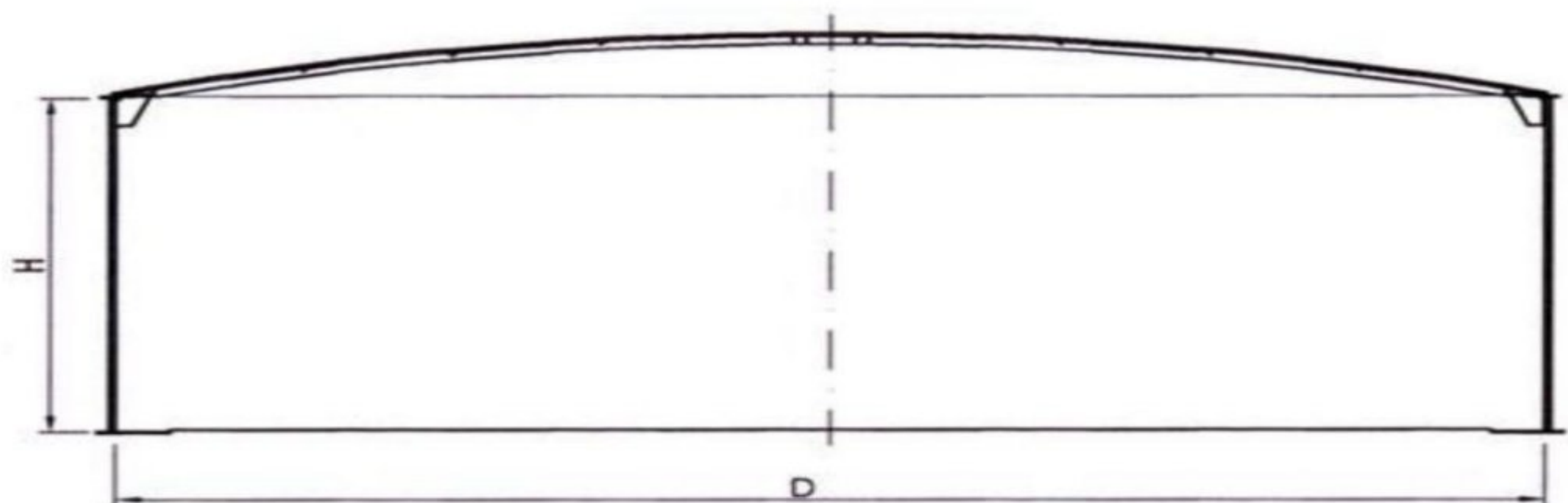


Fig.1.4. Vertical cylindrical tanks with semi-circular ceilings

1.7.2.4. Vertical cylindrical tanks with central column and semi-circular ceilings [111]. Fig. (2.5)

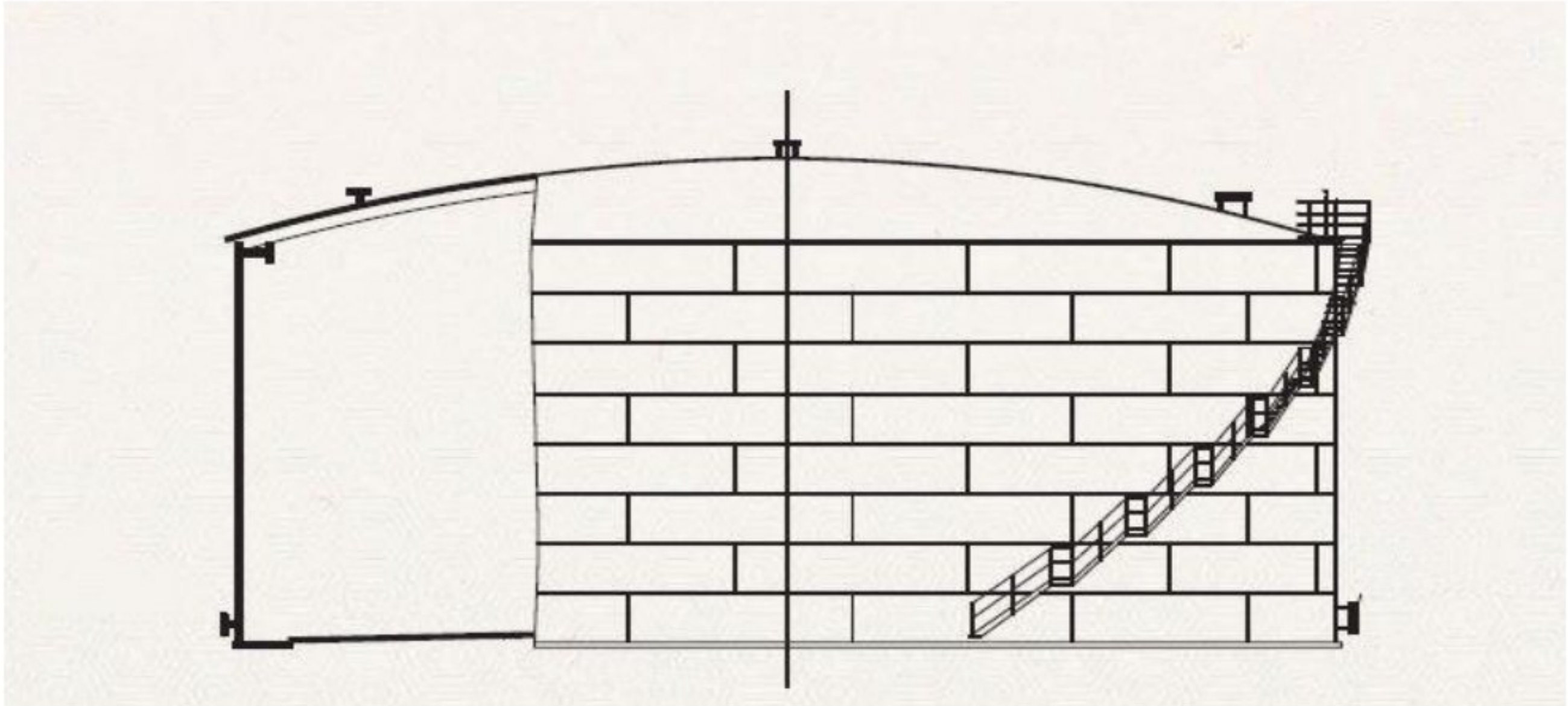


Fig. 1.5. Vertical cylindrical tanks with central column and semi-circular ceilings

1.7.2.5. Vertical cylindrical tanks with semi-circular ceilings and floating roof. Fig. (2.6)

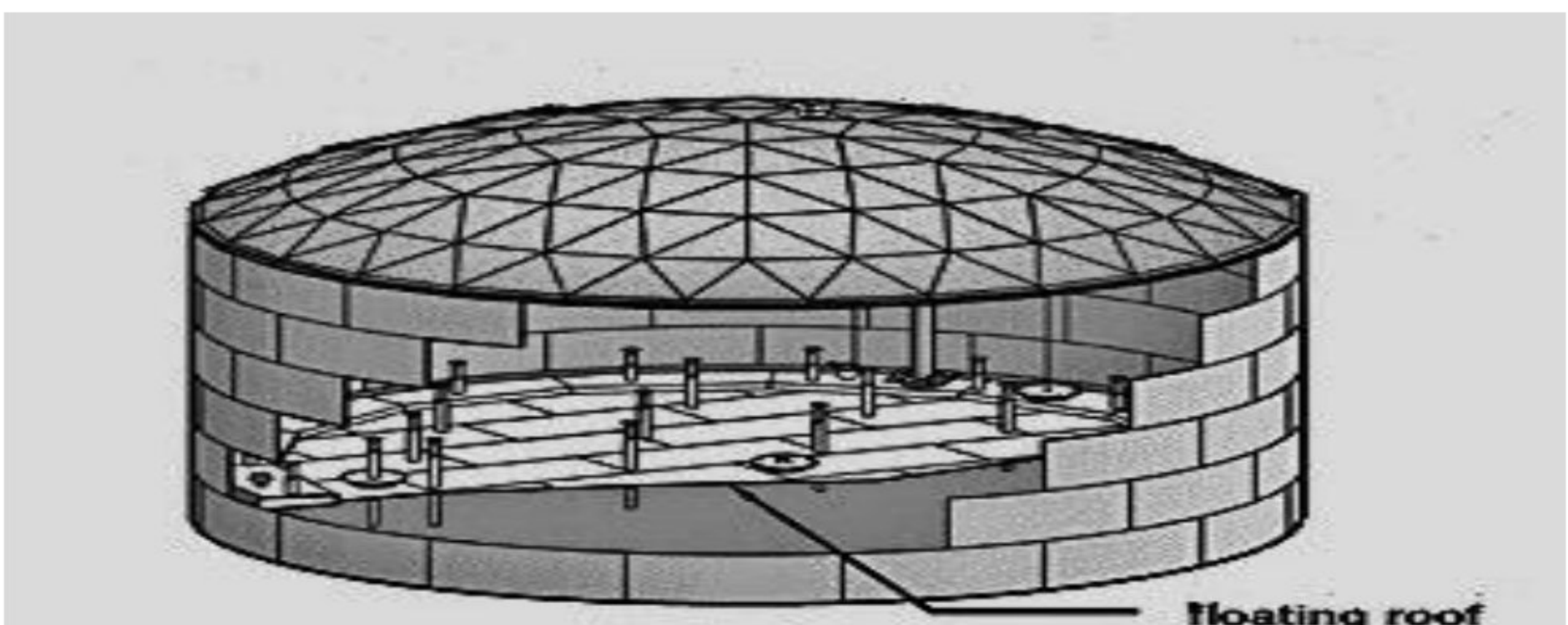


Fig. 1.6. Vertical cylindrical tanks with semi-circular ceilings and floating roof

1.7.2.6. Vertical cylindrical tanks with a central column with semi-circular and floating roof Fig. (1.7)

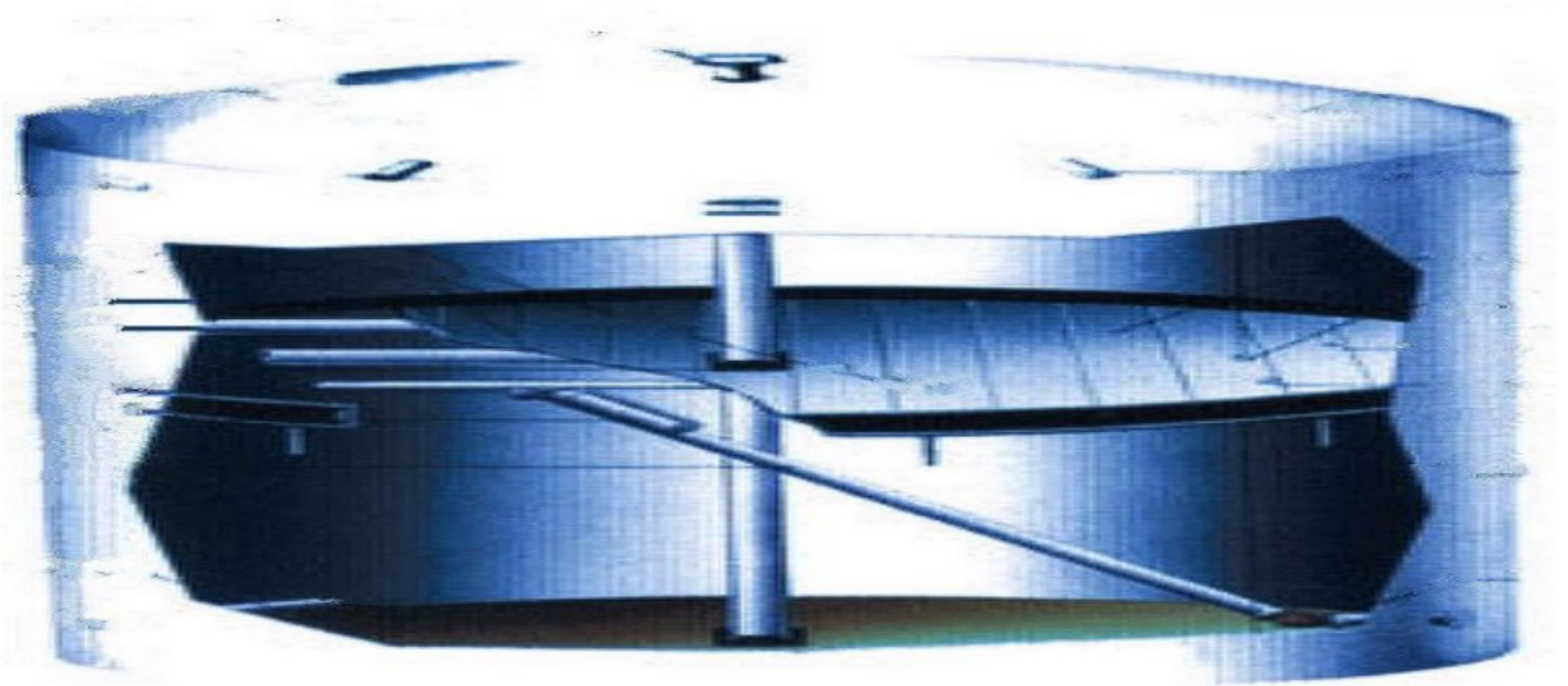


Fig. 1.7. Vertical cylindrical tanks with a central column with semi-circular and floating roof

1.7.2.7. Horizontal Cylindrical Tanks [110,111]. Fig. (1.8)

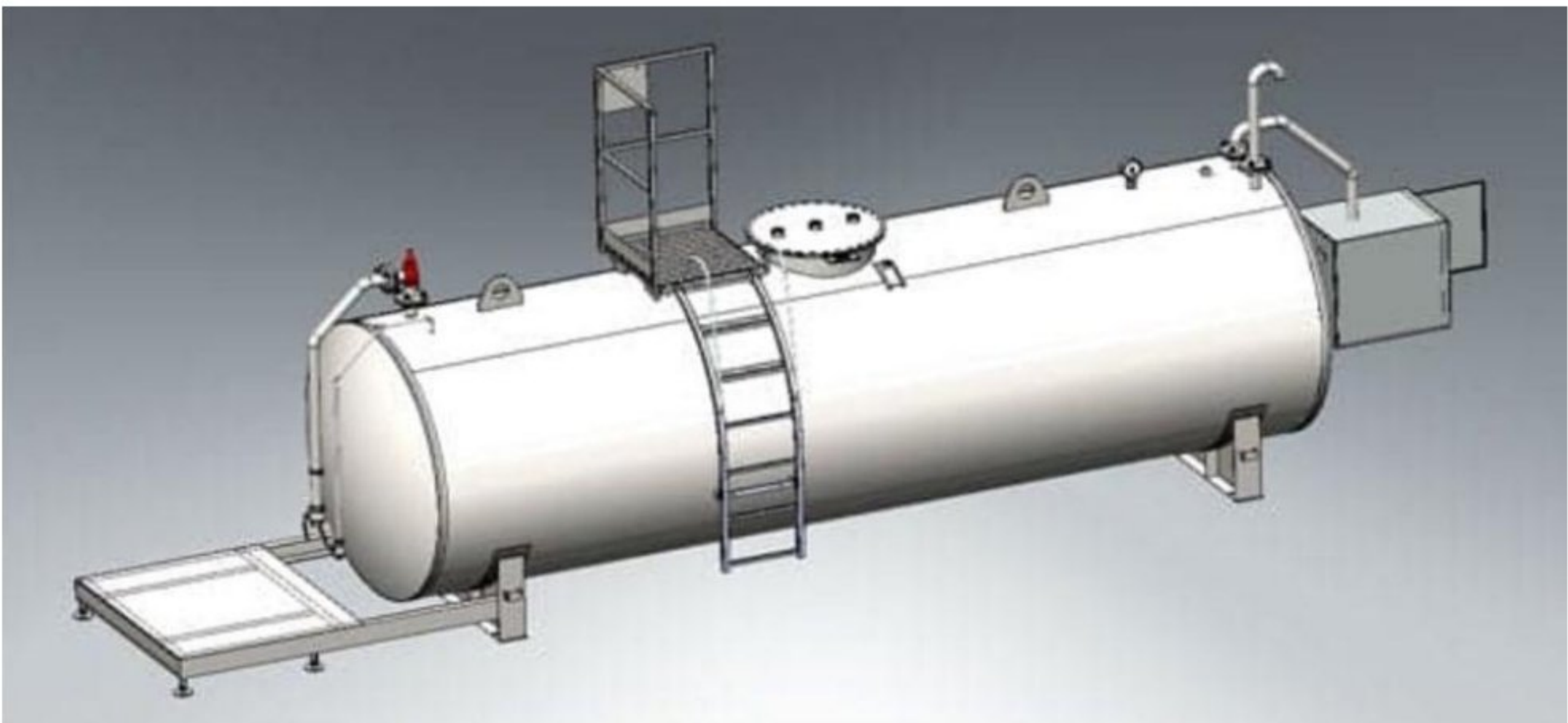


Fig. 1.8. Horizontal Cylindrical Tanks

1.7.2.8. Vertical cylindrical tanks with movable surfaces [112].Fig.(1.9)



Fig.1.9. Vertical cylindrical tanks with movable surfaces

1.7.2.9. Vertical cylindrical tanks with fixed ceilings and inside buoys. Fig. (1.10)

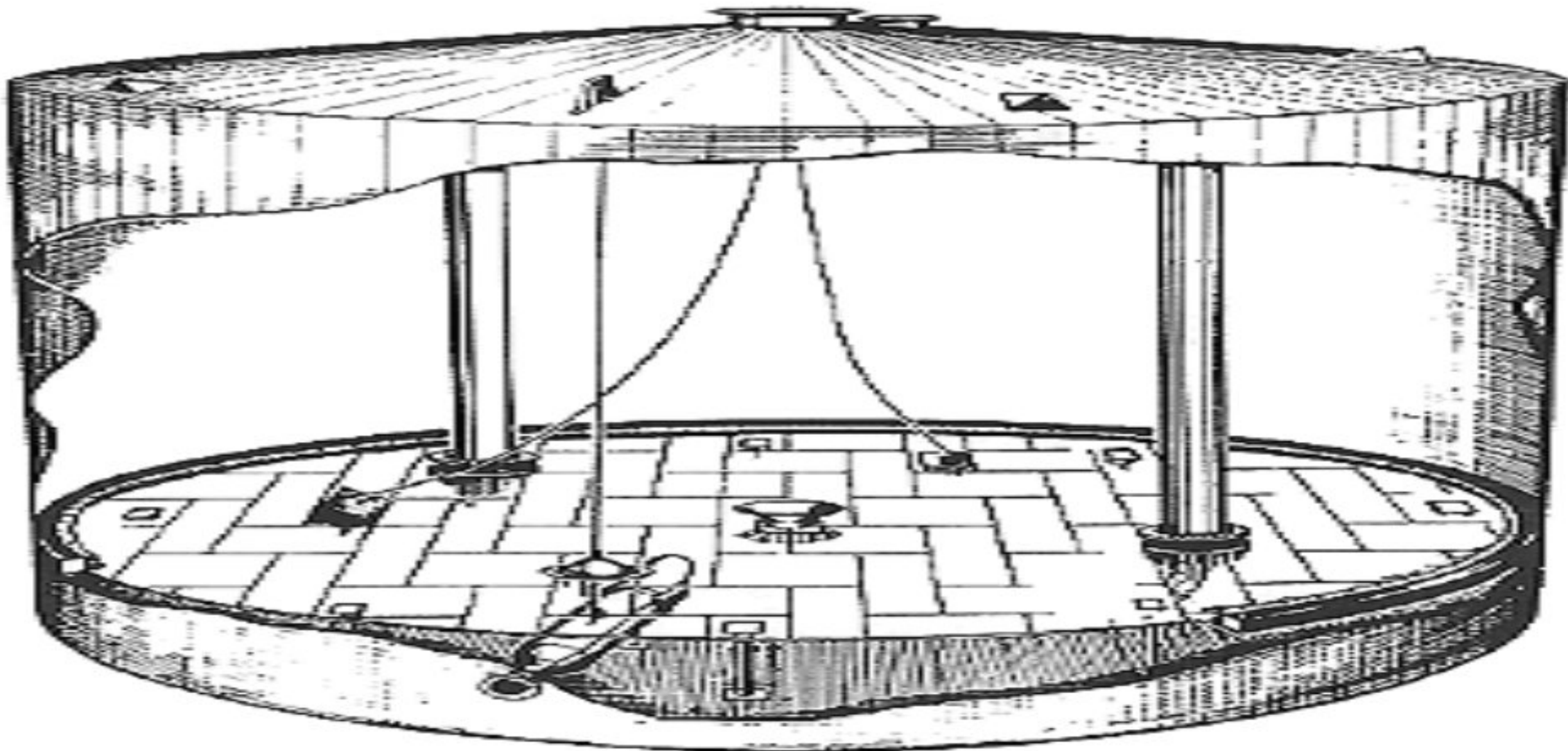


Fig. 1.10. Vertical cylindrical tanks with fixed ceilings and inside buoys

1.7.2.10. Vertical cylindrical tanks with floating balls [112]. Fig. (1.11)

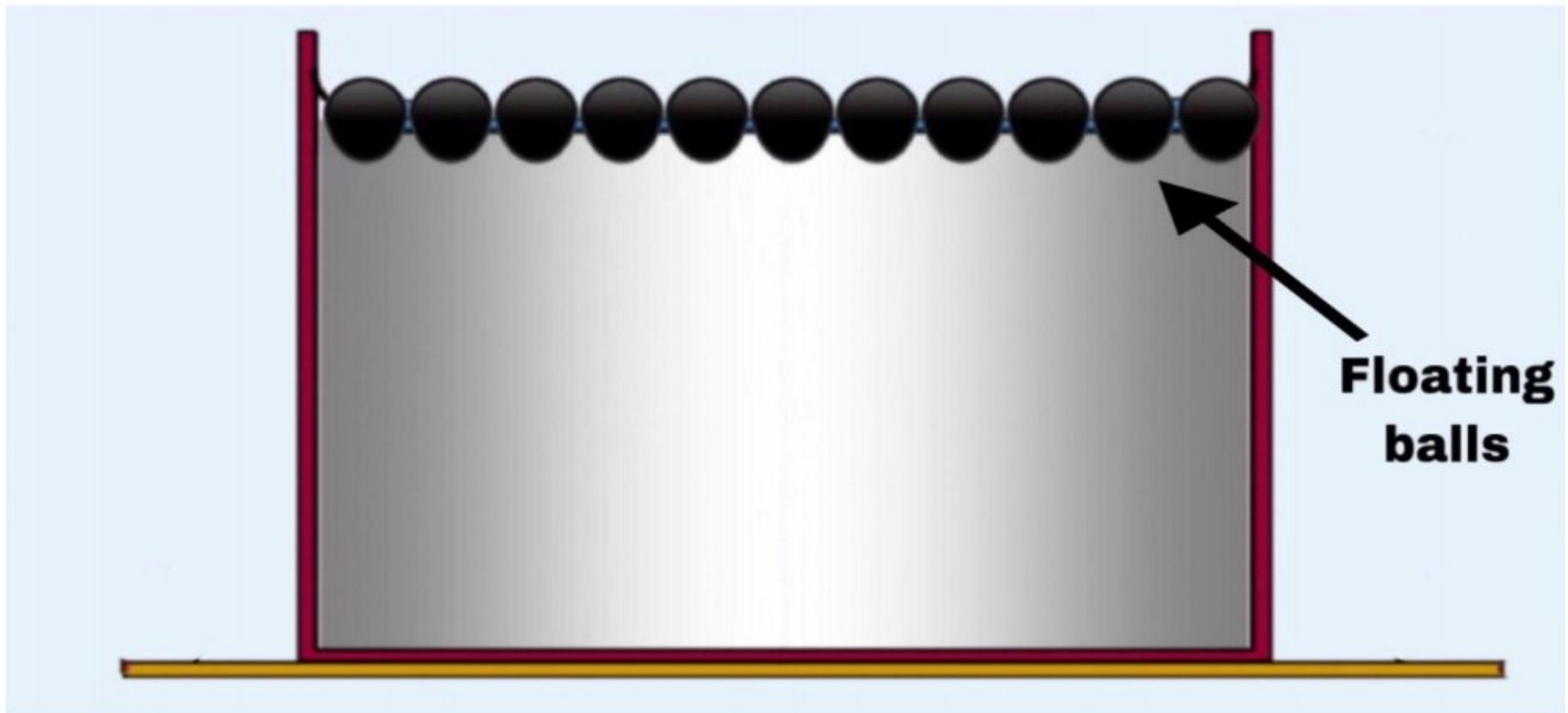


Fig. 1.11 Vertical cylindrical tanks with floating balls

1.7.2.11. Cylindrical horizontal tanks under the surface of the earth with reflectors. Fig. (1.12) and others

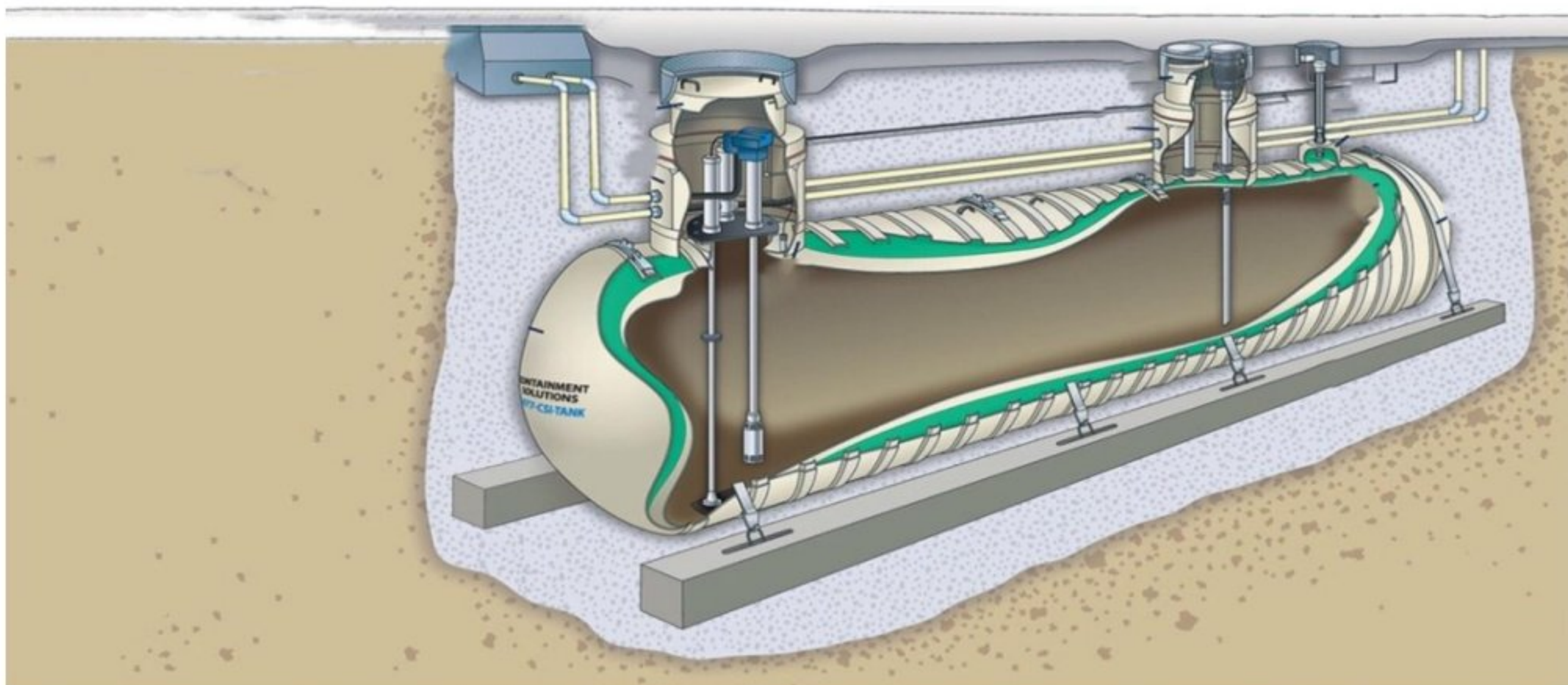


Fig. 1.12. Cylindrical horizontal tanks under the surface of the earth with reflectors

The sizes are different depending on the type of manufacturer and the purpose of building the reservoir. And all reservoirs are almost equal to the

equipment added to the tank, for example in all tanks: a slot for the sample, mechanical vent (open when emergency or pumping in the tank), and automatic vent (opens when the pressure of saturated gas to a certain degree), and other equipment (For measuring pressure, etc.)

The companies designed for these reservoirs have developed many conditions to maintain the tank's permanence, as well as avoid explosions and fires from the use of reservoirs with incorrect image, for example, should open the vent at least 3 times per month. Normally, this air (or vent) is a mixture of air saturated with liquid steam (petroleum), light hydrocarbons C1- C5 with air. The cause of evaporation is when the temperature of the air during the summer day or other (when the sun is vertical) is high, an increase in evaporation that occurs on the surfaces of oil, fill the tank with liquid steam and then increase pressure on the walls and ceiling and comes out of automatic ventilation and the same process is when pumping Quantities of oil in empty reservoirs, where they are filled with saturated steam, mixed with it increases the pressure and also come out of the reservoir.

Ventilation, which occurs at night or in cold days, is when the air temperature is low and the gas pressure in the tank is low, the air pressure outside the tank is higher than the internal pressure of the gas in the tank, so it will enter the reservoir and mix with oil vapor and increase the evaporation process. The surface of the liquid evaporates again. It is also not possible to add new technologies to these reservoirs or can not be replaced with modern tanks because they need to work, cost and time is very large. For this reason, tanks have been prepared with new specifications to preserve oil derivatives, not oil itself, forgetting that the derivatives are originally from the same crude oil.

All these reservoirs are designed for the purpose of storing oil derivatives with low flammable degrees, and they also save derivatives to 95% of

evaporation. Despite this feature, it has many disadvantages, for example: tanks with moving surfaces, not suitable for areas where the rain or snow or dust storms, and also possible to evaporate between the roofs and walls of the tank or enter the soil into the reservoir and the contamination of liquids and the cost of building this reservoir. He needs a lot of money[113-115]. The vertical cylindrical tanks with fixed ceilings and inside buoys are called buoys (or rafts). It is a disadvantage that the rafts inside the tanks can be overturned or become tilted inside the tank when there is a defect in pumping liquids. High as well as tanks with floating balls: It has disadvantages where it is possible to stick these balls on the walls of the reservoir from the inside when pumping or clouds and lose its work. As for the underground tanks, they can be corroded by the effects of dust surrounding the reservoir, and other disadvantages. Moreover, the cost of erecting and constructing these reservoirs requires very high costs, in addition to working hands and a very long time to erect them.

Leaking underground storage tanks are a major source of water contamination. Studies by the U.S. Environmental Protection Agency found that about 80% of the 1,400,000 underground gasoline storage tanks in the United States were bare steel tanks lacking corrosion protection, and that about 35% of the tanks tested leaked at an average rate of 29 L/day (265).

1.8. Objectivity of the problem

One of the main causes of losses is the lack of field techniques to collect and store oil in reservoirs. Several studies [50, 51] have shown that more than 85% of oil losses are due to evaporation. In addition to material losses, oil evaporation is often associated with deterioration in some physical and chemical properties of petroleum and leads to environmental pollution. During the evaporation of light hydrocarbons, the physical properties of petroleum change: density increases, fracture structure becomes heavier, and so on. During

evaporation, part of the air vapor mixture is expelled from the gas area. Under normal conditions in the tank, the gas area is filled with a mixture of air vapor and oils. In this regard, the development and study of ways and means to reduce the loss of light hydrocarbons in the preparation of oil for users of soil below the surface of the land is a priority of modern petroleum science and practice [52]. Therefore, it is urgent to establish effective methods to reduce oil loss from evaporation during the preparation of the oil field for transport.

1.9. The main objectives of the study

1.To analyze the main causes of the loss of light hydrocarbons in the process tanks in the field of oil preparation and determine the most effective ways to reduce losses.

2.To conduct research on the typical environment of gasoline and normal gasoline in order to determine the effect patterns of the active substances on the gasoline evaporation surface and to determine the optimum surface concentration that ensures maximum steam pressure [53-55].

3.Develop techniques to reduce the loss of light hydrocarbons in the process tanks when preparing the gasoline in a field and determine the time of the effect of the surfactant when replacing the bottom layer of the product with a fresh (not containing surface material).[53,54,56, 65-71].

4.Add organic compounds to reducing the evaporation rate of the gasoline tanks by more than 95%. at different temperatures 25, 37, 50 C.

5.This technique is more economical and can be applied to any kind of tanks.

6. It is less effort and does not require workforce and does not affect the chemical properties of gasoline and added in very small amounts (ppm) suitable

for all environmental conditions as well as preserving the environment from pollution caused by evaporation .

7.The effect of this compound can be seen when adding it once to the gasoline its effect remains more than (40) times when the replacement fuel(gasoline) with a new fuel (when pumping and withdrawals) without any addition.

Chapter Two

(Theories Used)

2: Basic theories on the use of surface-active compounds and on the quality and method of reducing hydrocarbons in gasoline tanks

2.1 Real hydrocarbon losses from gasoline tanks

Usually, losses occur in gasoline tanks at the (big breath) of the tank. When quantities of gasoline are pumped into the tanks, we assume that the amount is (V) the latter unites with the air present and saturated with real hydrocarbons inside the tank. Through the following equation, it is possible to extract the weight of the real hydrocarbon losses:

$$G = \frac{V \cdot 273 \cdot P \cdot M}{22.4 \cdot T \cdot P_0}$$

whereas:

P = pressure of hydrocarbons Pa

P₀ = atmospheric pressure Pa

T = tank temperature Kelvin

M = arithmetic mean molecular weight of hydrocarbons g/mol

It is possible, through the above equation, that the weight of hydrocarbons can be equal to the vapor pressure: - As noted as follows

When 313K = T , M = 60 , P/P₀ = 2/3 the amount of hydrocarbon lost equals 1.5 Kg/m³

Thus, when the vent opens once every 10 days in a tank of 5000m³, a quantity of fresh 4000m³ of gasoline is pumped into it. The amount of losses in gasoline for this reservoir is more than (216 tons) per

2-2 The evaporation rate of liquids can be explained by the following equation

$$W_E = k_e^{-Q/RT} \cdot S$$

whereas:

K = constant

Q = heat of liquid joules

R = general constant of gases joules/mol.K

T = actual liquid temperature K

S = liquid surface area m²

The rate of condensation of vapor on the surface of the liquid. It is explained by the following equation

$$W_k = Z \cdot P \cdot S$$

Where Z = specific value of molecular weight

P = gas pressure Pa

When the two equations are equal

$$W_E = W_K$$

$$P = \frac{k_e^{-Q/RT}}{Z}$$

When the vapor pressure does not depend on the surface area of the liquid, in this case it is known. The boiling temperature does not allow the escape of other compounds. This process is called aplosopic.

The purpose of our work is to reduce the vapor pressure at the surface of the liquid that is required.

It is known that the surface of the liquid contains self-particles.

When the substance (active compounds) is applied to the liquid surfaces, vapors will form on the surface of the liquid again.

This is most evident when compared to the aplescoscopic process when the active compound is applied to the surface which will reduce the vapor pressure and be visible.

When the value of $f(f < 1)$ the molecules of the surface-active compounds are not determined. Thus, the vapor pressure can be explained by the following equation:-

$$P = \frac{k_{fe}^{-Q/RT}}{Z}$$

Thus, the pressure will decrease

Therefore, the concentration of the active compound on the surfaces are salts, which are known to have little solubility in the liquid, and thus will reduce the elasticity of the vapor and it will be reduced for the longest possible period of work (i.e. its effect remains effective).

2-3 :- Properties and mechanics of active compounds on liquid surfaces

2-3-1 Mechanism of preparation of active compounds on surfaces

Figure (1) shows the preparation of organic compounds that have an effective effect on liquid surfaces.

Four agents have been prepared, effective compounds on surfaces

- 1- Active compound with one head
- 2- Active compound with two heads
- 3- Active compound with three heads

4- Active compound with four heads

As shown in the following figures().

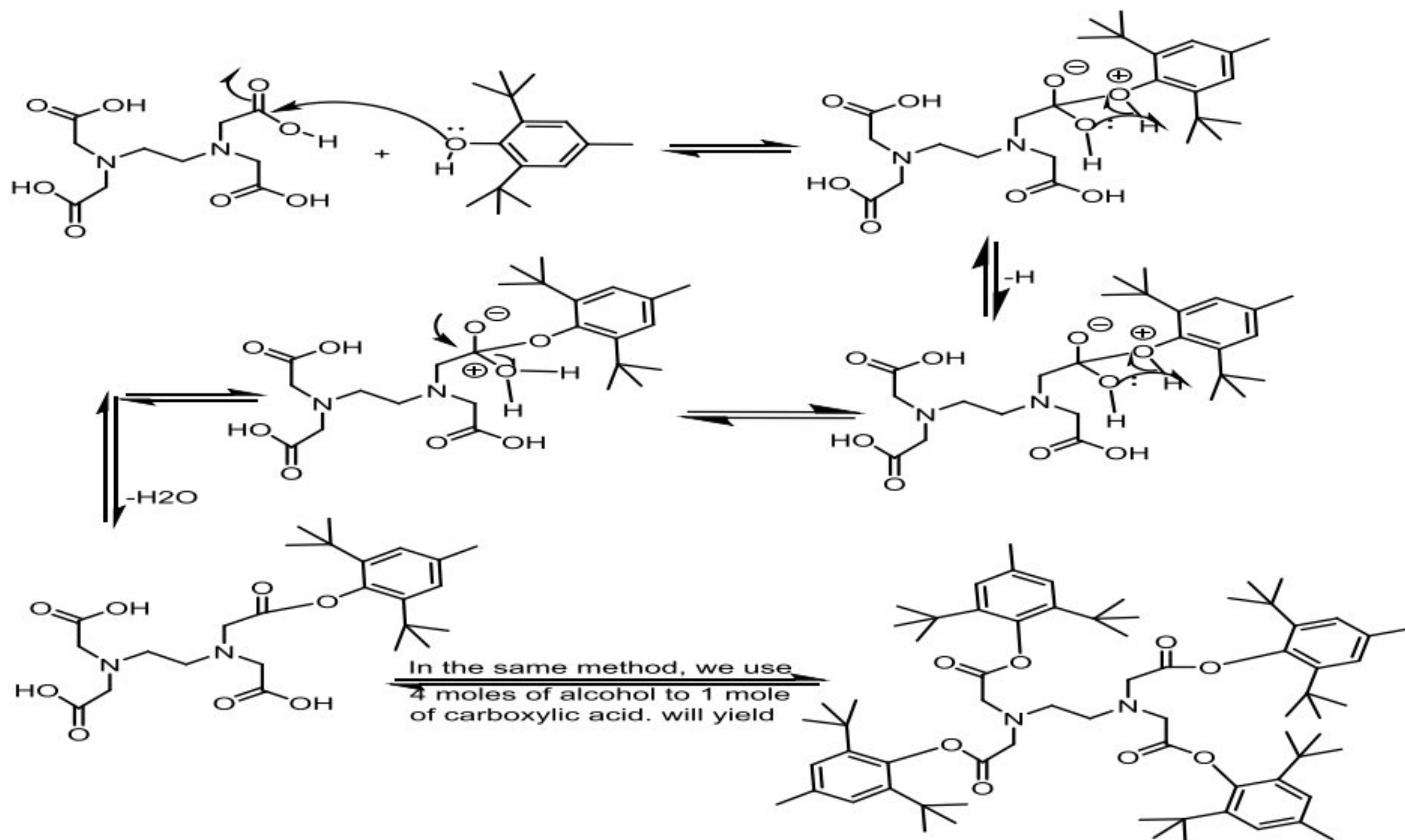


Fig. 1. Mechanism of Organic Compound Preparation

2-3-2 Mechanical properties Effectiveness of surface-active compounds in tanks

The preliminary results and the use of active compounds on the surfaces were a clear reduction in the vapor pressure of gasoline

The development of a physico-chemical technical method using active compounds on surfaces: 0 and the principle of its work until this time requires many questions. Because it is not clear to many specialists when working the active compounds on liquid surfaces. Thus, you need in-depth studies to answer many questions, is it a physical or chemical process...

Therefore, until now, the mechanism of action of the active compounds on the surfaces is not known precisely.

2-4 Brief information about the active compounds on surfaces

As it is known that the active compounds on the surfaces are chemical compounds. And the method of its introduction will depend on the surfaces (liquids), and this is a physical property.

The active compounds on the surfaces are organic compounds, and they are numerous and numerous, each according to the type of work or liquid you are working on...ect

As for how it works, it is simply that it works on the interconnection with each other to form a superficial abrasion on liquid surfaces. But how the mechanism of its work so far is not clear, and therefore it must be worked out in the future to answer the following questions

- 1- What is the suitable mechanism for adsorption between boundary phases?
- 2- Active compounds on surfaces in tanks. How can these compounds that are between the edges and the phases dissolve?

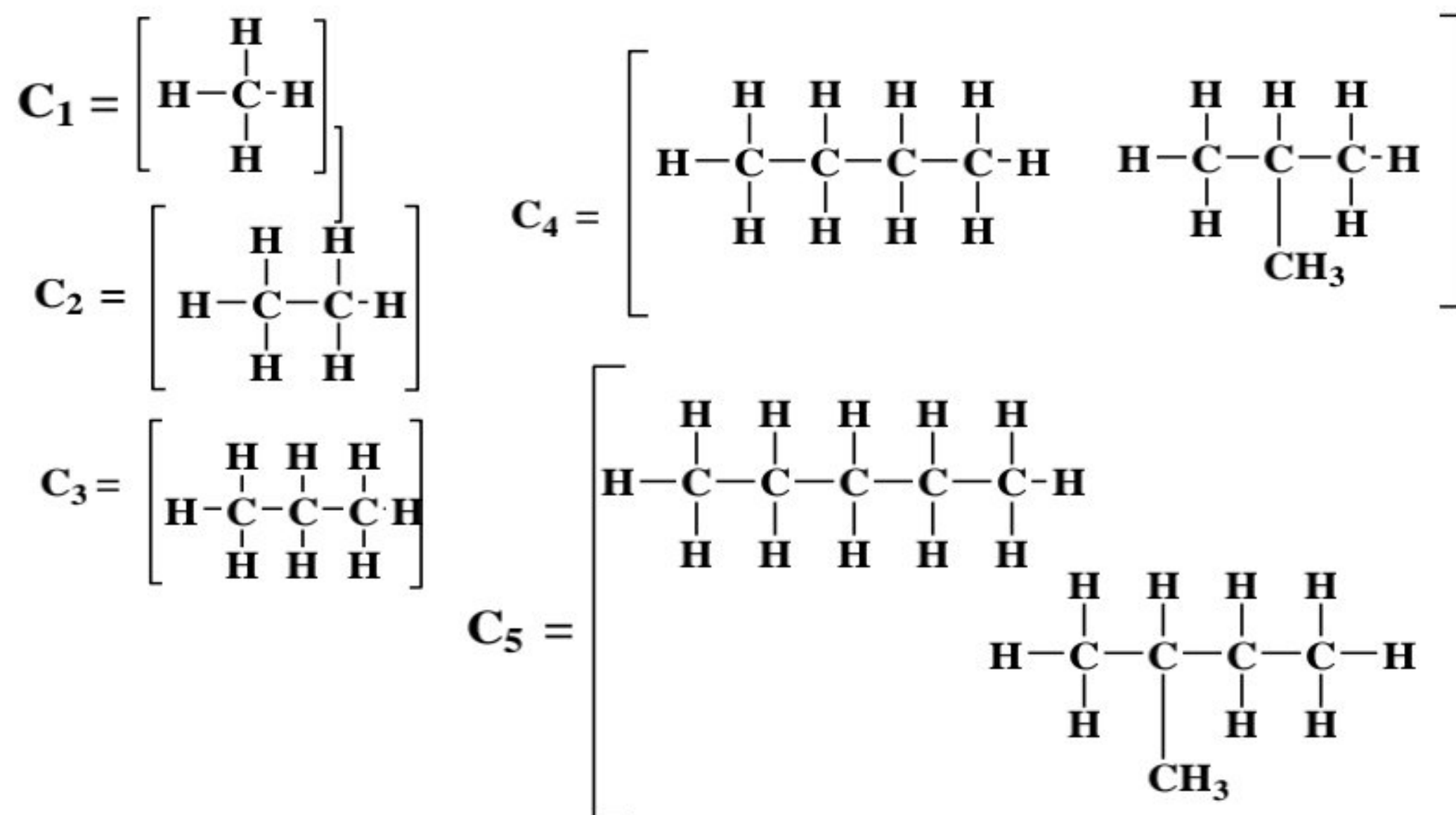
But in general, the active compounds on surfaces consist of two ends. This shows a hydrophilic end called the head, and another non-hydrophilic end called the tail, as shown in the following figure:

When it is inserted into liquid tanks, it is formed in the form shown (--)

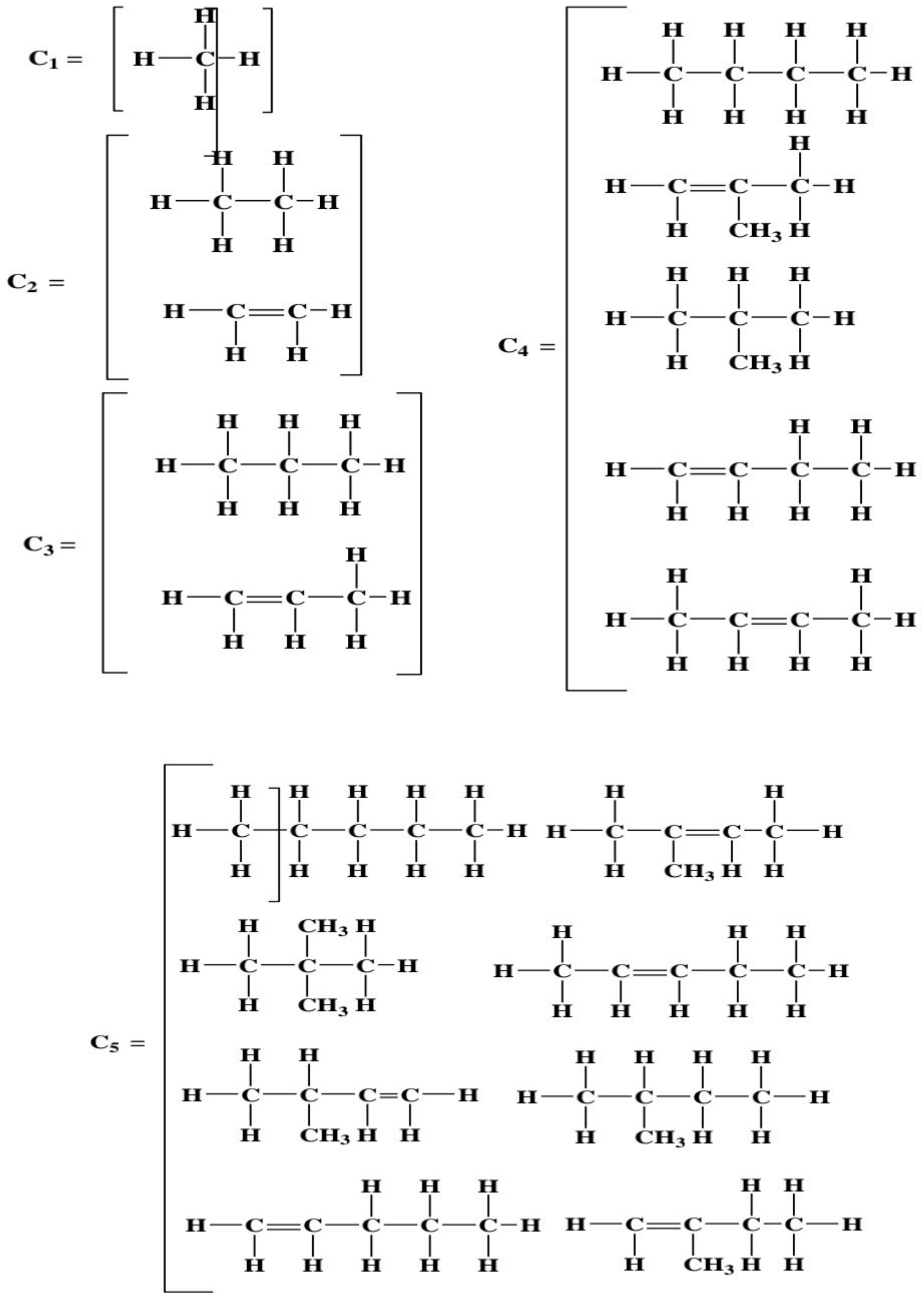
2-5 Structural formulas of real hydrocarbons in gasoline, petroleum and its derivatives

Through previous studies on diagnosing the types of real hydrocarbons that evaporate from petroleum and its derivatives from the well to consumption,

crore storage and transportation [57,55] [source of Marwan's thesis] and they are as follows:



(A) –Fig. Isomers of petroleum and benzene vapor compounds



(B)-isomers of (C1-C5) light hydrocarbons

Fig. Isomers of petroleum and benzene vapor compounds

Table (3-16) composition of gases (less than C4) soluble in petroleum, hydrocarbons low in boiling point (less than C5)

compound	% Vaporized (from oil)	% content of individual hydrocarbons					
		C ₂ H ₆	C ₃ H ₆	n-C ₄ H ₁₀	n-C ₄ H ₁₀	n-C ₅ H ₁₂	n-C ₅ H ₁₂
Less than C ₄	3,50	1,2	25,8	17,2	55,8	-	-
Less than C ₅	5,88	0,7	15,4	10,2	33,2	13,4	27,1

3-6 How to Calculations:

A- Expressing Results (Calculations)

The index of "uncorrected saturated steam pressure " (P, kPa) is corrected for changes in air pressure and saturated water vapor in the air chamber due to the difference between the initial temperature and the temperature of the water bath. The modification of rP is calculated by the formula:

$$\Delta P = \frac{(P_a - P_t)(t - 37,8)}{273 + t} - (P_{37,8} - P_t),$$

Where P_a is the atmospheric pressure at the test site, kPa. P_t is the saturated water vapor pressure at the initial air temperature, kPa. t is the initial air temperature, °C. $P_{37,8}$ saturated water vapor pressure at 37.8 ° C, kPa. The calculated correction values are listed in 0.1 kPa in Table (3-16)

(3-17)The calculated correction values are listed in 0.1 kPa

Primary air temperature °C	Correction of atmospheric pressure										
	101,3	100,0	98,7	97,3	96,0	93,3	90,7	88,0	85,3	82,7	80,0

Primary air temperature°C	Correction of atmospheric pressure											
	101,3	100,0	98,7	97,3	96,0	93,3	90,7	88,0	85,3	82,7	80,0	
0	-20,0	-19,9	-	-	-	-	-	-	-	-	-	-17,1
			19,7	19,5	19,3	18,9	18,5	18,1	17,9	17,5		
1	-19,6	-19,3	-	-	-	-	-	-	-	-	-	-16,7
			19,2	19,1	18,8	18,5	18,1	17,7	17,5	17,1		
2	-19,1	-19,0	-	-	-	-	-	-	-	-	-	-16,3
			18,8	18,5	18,4	18,0	17,7	17,3	16,9	16,7		
3	-18,7	-18,4	-	-	-	-	-	-	-	-	-	-15,9
			18,3	18,1	18,0	17,6	17,3	16,9	16,5	16,3		
4	-18,1	-18,0	-	-	-	-	-	-	-	-	-	-16,6
			17,7	17,6	17,5	17,2	16,8	16,5	16,1	15,9		
5	-17,7	-17,5	-	-	-	-	-	-	-	-	-	-15,2
			17,2	17,2	17,1	16,7	16,4	16,1	15,7	15,5		
6	-17,2	-17,1	-	-	-	-	-	-	-	-	-	-14,8
			16,9	16,8	16,7	16,3	16,0	15,7	15,3	15,1		
7	-16,8	-16,7	-	-	-	-	-	-	-	-	-	-14,4
			16,4	16,3	16,1	15,9	15,6	15,2	14,9	14,7		
8	-16,3	-16,1	-	-	-	-	-	-	-	-	-	-14,0
			16,0	15,9	15,7	15,5	15,1	14,8	14,5	14,3		
9	-15,9	-15,7	-	-	-	-	-	-	-	-	-	-13,6
			15,5	15,3	15,2	14,9	14,7	14,4	14,1	13,9		
10	-15,3	-15,2	-	-	-	-	-	-	-	-	-	-13,2
			15,1	14,9	14,8	14,5	14,3	14,0	13,7	13,5		
11	-14,8	-14,7	-	-	-	-	-	-	-	-	-	-12,8
			14,5	14,4	14,3	14,1	13,9	13,6	13,3	13,1		

Primary air temperature°C	Correction of atmospheric pressure											
	101,3	100,0	98,7	97,3	96,0	93,3	90,7	88,0	85,3	82,7	80,0	
12	-14,4	-14,3	-	-	-	-	-	-	-	-	-	-12,4
			14,1	14,0	13,9	13,6	13,3	13,2	12,9	12,7		
13	-13,9	-13,7	-	-	-	-	-	-	-	-	-	-12,0
			13,6	13,5	13,3	13,2	12,9	12,7	12,4	12,3		
14	-13,3	-13,2	-	-	-	-	-	-	-	-	-	-11,6
			13,2	13,1	12,9	12,7	12,5	12,3	12,0	11,9		
15	-13,0	-12,8	-	-	-	-	-	-	-	-	-	-11,2
			12,7	12,5	12,4	12,3	12,0	11,9	11,6	11,3		
16	-12,4	-12,3	-	-	-	-	-	-	-	-	-	-10,8
			12,1	12,1	12,0	11,7	11,6	11,3	11,2	10,9		
17	-11,9	-11,7	-	-	-	-	-	-	-	-	-	-10,4
			11,7	11,6	11,5	11,3	11,1	10,9	10,8	10,5		
18	-11,3	-11,3	-	-	-	-	-	-	-	-	-	-9,9
			11,2	11,1	11,1	10,8	10,7	10,5	10,3	10,1		
19	-10,9	-10,8	-	-	-	-	-	-	-9,9	-9,7	-	-9,5
			10,7	10,7	10,5	10,4	10,1	10,0				
20	-10,4	-10,3	-	-	-	-9,9	-9,7	-9,6	-9,3	-9,2	-	-9,1
			10,3	10,1	10,0							
21	-9,9	-9,7	-9,7	-9,6	-9,5	-9,3	-9,2	-9,1	-8,9	-8,8	-	-8,7
22	-9,3	-9,2	-9,2	-9,1	-9,1	-8,8	-8,8	-8,7	-8,4	-8,3	-	-8,1
23	-8,8	-8,8	-8,7	-8,7	-8,5	-8,4	-8,3	-8,1	-8,0	-7,9	-	-7,7
24	-8,3	-8,3	-8,1	-8,1	-8,0	-7,9	-7,7	-7,6	-7,5	-7,3	-	-7,3
25	-7,7	-7,7	-7,6	-7,6	-7,5	-7,3	-7,3	-7,2	-7,1	-6,9	-	-6,8
26	-7,2	-7,2	-7,1	-7,1	-6,9	-6,9	-6,8	-6,7	-6,5	-6,4	-	-6,4

Primary air temperature °C	Correction of atmospheric pressure										
	101,3	100,0	98,7	97,3	96,0	93,3	90,7	88,0	85,3	82,7	80,0
27	-6,7	-6,7	-6,5	-6,5	-6,4	-6,4	-6,3	-6,1	-6,1	-6,0	-5,9
28	-6,1	-6,0	-6,0	-6,0	-5,9	-5,9	-5,7	-5,6	-5,6	-5,7	-5,3
29	-5,6	-5,5	-5,5	-5,5	-5,3	-5,3	-5,2	-5,2	-5,1	-4,9	-4,9
30	-4,9	-4,9	-4,9	-4,8	-4,8	-4,8	-4,7	-4,5	-4,5	-4,4	-4,4
31	-4,4	-4,4	-4,3	-4,3	-4,3	-4,1	-4,1	-4,0	-4,0	-4,0	-4,0
32	-3,7	-3,7	-3,7	-3,7	-3,7	-3,6	-3,6	-3,5	-3,5	-3,5	-3,3
33	-3,2	-3,2	-3,2	-3,1	-3,1	-3,1	-3,1	-2,9	-2,9	-2,9	-2,8
34	-2,5	-2,5	-2,5	-2,5	-2,5	-2,4	-2,4	-2,4	-2,4	-2,3	-2,3
35	-2,0	-2,0	-2,0	-2,0	-1,9	-1,9	-1,9	-1,9	-1,9	-1,7	-1,7
36	-1,3	-1,3	-1,3	-1,3	-1,3	-1,2	-1,2	-1,2	-1,2	-1,2	-1,2
37	-0,7	-0,7	-0,7	-0,7	-0,7	-0,7	-0,7	-0,7	-0,7	-0,7	-0,5
38	0	0	0	0	0	0	0	0	0	0	0
39	+0,7	+0,7	+0,7	+0,7	+0,7	+0,7	+0,7	+0,7	+0,7	+0,7	+0,7
40	+1,3	+1,3	+1,3	+1,3	+1,3	+1,3	+1,3	+1,3	+1,3	+1,2	+1,2

The procedure for using the GSO is determined in the status criteria certificate for saturated vapor pressure. If the difference between the result obtained when the GSO test and the supported property overrides the absolute error contained in the GSO certificate, and to calculate the correction factor, we calculate the correction factor using the formula:

$$K = \frac{A_{co}}{X_{co}},$$

Where A_{co} is the symbol attribute of the standard sample, kPa.

X_{co} - Standard test sample result, kPa.

To calculate the saturated steam pressure of the test result is multiplied by the correction factor.

3-7 Treatment of experimental results and determination of the accuracy of the research method

In accordance with the requirements of GOST 1756-2000, the permissible differences in the parallel determination of saturated vapor pressure should not exceed ± 2.1 Kpa from the arithmetic mean of the comparison results. If the variance in the parallel selections exceeds ± 2.1 kPa from the arithmetic mean of the comparative results, we will make another determination and take into account the values of those two conditions that satisfy the condition indicated, and a new definition is implemented.

Example of calculating: The unsaturated saturated vapor pressure in the center of the sample (benzene), depending on the concentration (8 mg / kg K FFA) in test 1 is equal 45.5 kPa.

The initial air temperature is $t = 21$ ° C.

Atmospheric pressure - Pascal = 1 bar = 100 kPa.

In Table (3-14) we find $P = - 9.7$ kPa.

Thus, the steam pressure saturated with test fuel is $45.5 - 9.7 = 35.8$ kPa. The unsaturated saturated vapor pressure at the center of the sample (benzene), depending on the concentration (8 mg / kg FFA) in test 1 is equal 46.9 kPa. The remaining values are the same.

The saturated saturated vapor pressure is $46.9 - 9.7 = 37.2$ kPa. The arithmetic mean of the two definitions is 36.5 kPa. Variance in parallel settings is -1.4 kPa and does not exceed 2.1 kPa.

Chapter Three

practical part

3-Flow chart the path of searches:

A series of practical experiments have been conducted to reduce the steam pressure of gasoline and crude oil by using organic compounds prepared with different percentages of the mixture with high surface efficiency added with crude oil and gasoline. Fig.(2-1)flow chart illustrates the path of the searches

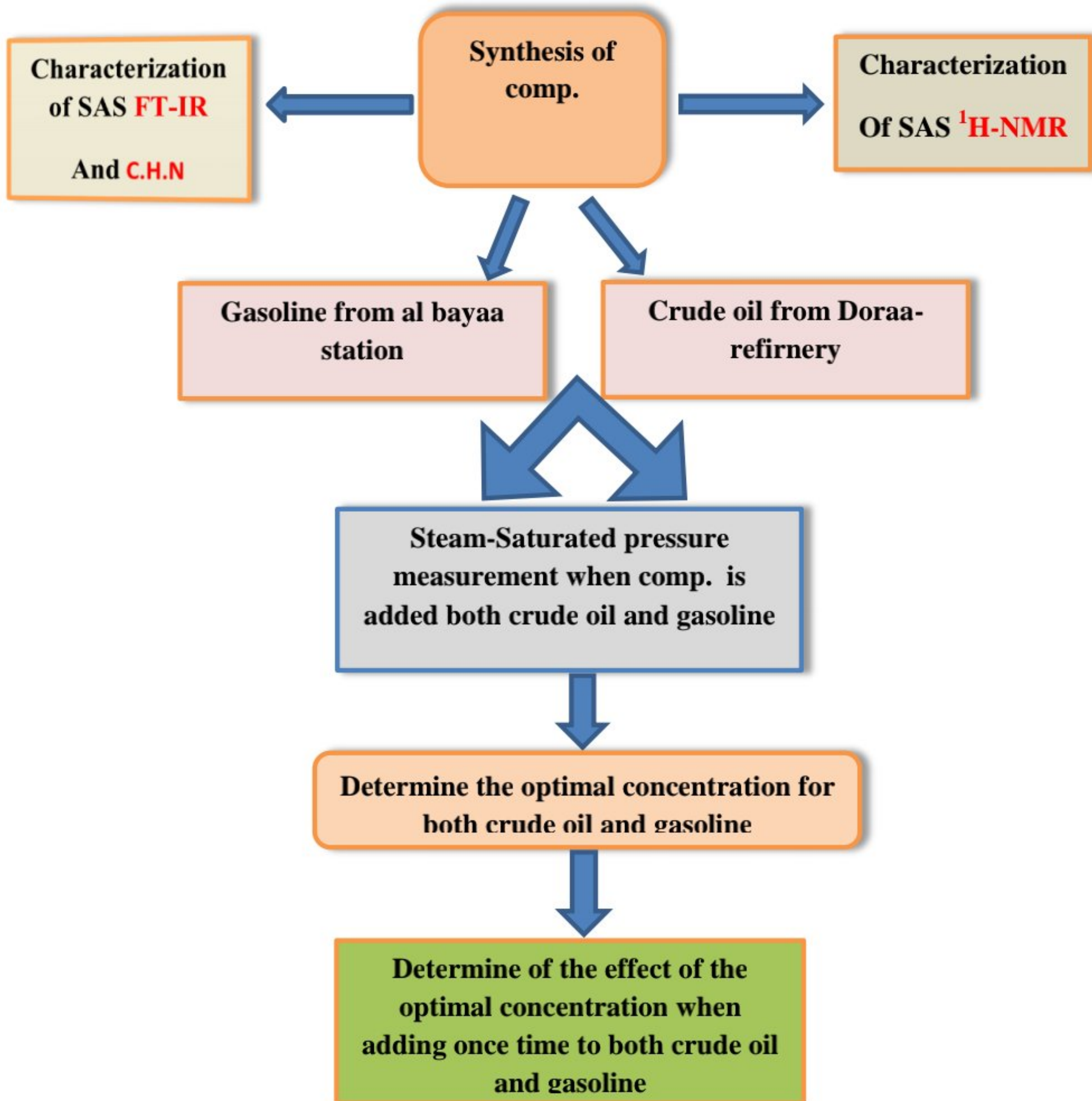


Fig. (2-1)Flow chart of path for project

3-1 chemical materials used

The chemical materials listed in table (2-1) are used

Table (2-1) chemical materials used

No	Materials	purity	Company
1	EDTA	-	-
2	BTM		
3			
4	Crude oil	--	Equipped from Doraa-referniry
5	Gasoline	--	Equipped from al Bayaa station
6	Potassium carbonate	99.9%	Flukan

3-2 Instruments and Apparatuses used

Table(2-2) Instruments and Apparatus used

No	Apparatus	company	Made
1	Thermometer	Duran	Germany
2	Sensitive	Sartorius/AG	Germany

	balance	Gottin gen	
3	Thermostic water bath	Germany Industrial corp.	Germany
4	Saturated steam pressure measuring device	-----	Made by hand
5	F-TIR	Shimadzu	Japan
6	C.H.N	EUROA	Italy

Table(2-3) some general characteristics of crude oil from Dora refinery[40,41].

Test	Result
API Gravity 15.6°C	32.1
SP.Gravity 15.6°C/15.6°C	0.8649
Density 15°C	0.8645
Sulfur content Wt.%	2.81
Kin.Viscosity Cst.	
10°C	22.1
21.1°C	12.75
37.8°C	8.03
50.0°C	6.7
Pour point°C	Below-30
R.V.P Kg/cm²	0.41
Water&Sediment Vol.%	0.1

Salt content Wt.%	0.0009
Ram. Carbon residue Wt.%	5.0
Asphaltenes content wt.%	1.93
Ash Content Wt.%	0.0110
Vanadium PPM	49.91
Nickel PPM	17.97
KUOP Characterization Factor	11.9

3-3 Experimental methods

3-3-1 synthesis of surface effective compound

Synthesis of the organic compound:

(1) mole of 2,2', 2'', 2''' - (ethane-1,2-diylbis (azanetriyl)) tetraacetic acid (EDTA) was placed in a two-necked flask and dissolved (20) mL. Distilled water. Then, a solution (consisting of (4) moles of 2,6-di-tert-butyl-4-methylphenol (TBM) dissolved in (50) mL water) was added to the beaker gradually with constant stirring until the addition was completed. Then, gradually and also, with caution, (10) ml of concentrated sulfuric acid was added. We placed the beaker in a (55 ° C) water bath with (Reflex way) for 45 minutes. Then the content of the previous beaker was poured into another beaker placed in an ice bath, and with stirring we noticed the appearance of a yellow green precipitate of product (91%). After that, the sediment was left in the laboratory atmosphere to dry for three days, from which the product was physically and chemically diagnosed. As shown below.

The general properties of the resulting compound are: The general formula of the compound ($C_{70}H_{104}N_2O_8$), its molecular weight (1101.61), the color of the product (yellowish green), and the proportions of the quantitative analytical measurement of the elements calculated theoretically and (practically) are as follows: Elemental Analysis: C, 76.32 (75.44); H, 9.52 (8.78); N, 2.54 (2.11) and the proportion of the product was (Yield = 91%).

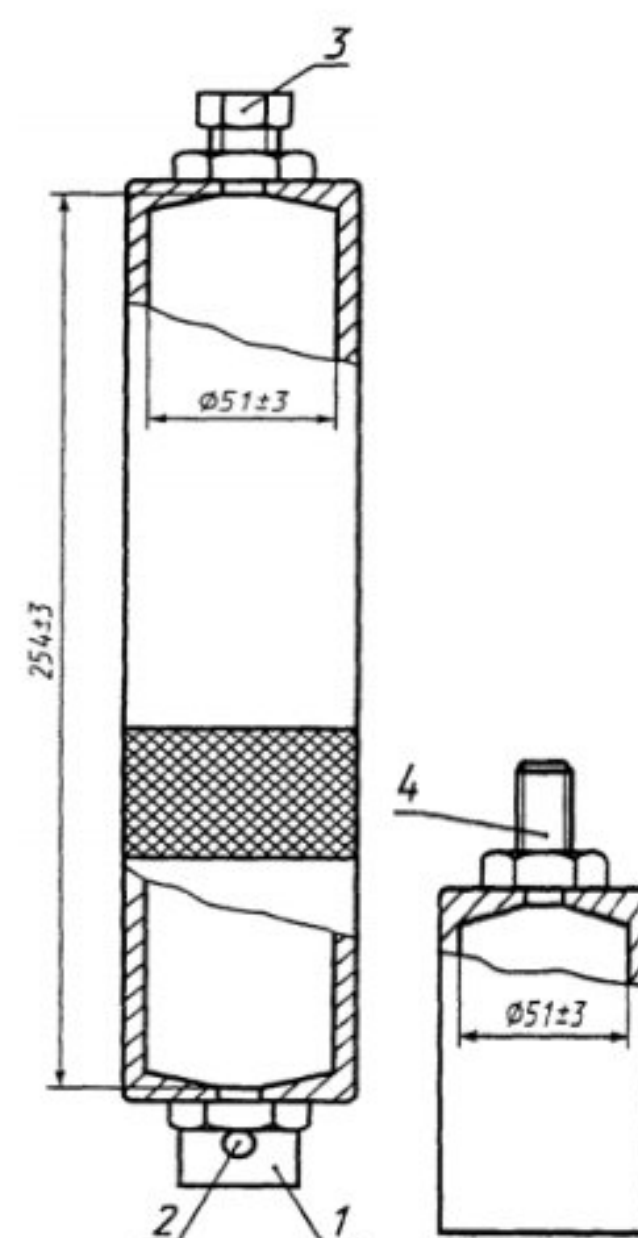
3-4 Steam pressure measurement

The saturated vapor pressure is determined according to Reid according to GOST 1756-2000. The device design appears to look in Figure(2-2)for samples with vapor pressure less than 180 kPa, a single-chamber fluid chamber (Fig. 2-3) is used.



Fig.(2-2) steam pressure measuring

Fig.(2-3)single-chamber device fluid chamber and Air chamber



Single-Chamber fluid chamber and Air chamber

- 1 - The inner diameter connects 13 mm
- 2 - Air vent
- 3 - Connect the inner diameter 5 mm
- 4 - Connecting the external diameter 13 mm pressure

3-5 Measuring the steam saturated pressure and determining the optimum concentration [10]

For benzene: Concentrations of the previously synthesized compound (0, 0.5, 1, 1.5, 2, 2.5, 3 mg / kg) were taken against benzene. At first, a quantity of benzene was taken and put (taken from one of the Iraqi filling stations, an unimproved type) and a vial was filled from a saturated pressure device and placed in the refrigerator for half an hour, after which the flask was attached to a steam saturated cap device and placed in a water bath at a temperature of 20 ° C. The meter reading was determined until installed (a meter connected to a steam-saturated pressure gauge). Then the concentration of 0.5 mg was taken and put in the same amount of benzene with new gasoline, then the vial (containing the compound and the benzene) was placed in the refrigerator for half an hour, and then it was connected with the device and was placed in a water bath at 20 ° C, and after that until the meter was installed, it was read. Thus, for the rest of the concentrations until the ideal concentration is obtained for the lowest value, the steam saturated pressure is determined. Table (1) is noted. I repeated the same previous process, but only by changing the temperature of the water bath (37 and 50 ° C). Table (1).

For oil: the same previous process for gasoline, the experiment was repeated, but here using oil (petroleum) (which was obtained from modern refinery tanks). It was found that the optimal concentration for all different temperatures is (1.5 mg / kg) against oil. Table (2).

Through the values that were set by the steam saturated pressure determining device, the values were corrected according to the correction tables as indicated in the source [17] taking into account all the conditions surrounding the reaction or during the measurement.

Table 1. Determines the pressure saturated with benzene vapor versus the concentrations of the active compound on the surface at different temperatures

The surface effective compound concentration is mg / kg	The pressure saturated with gasoline vapor kPa at a temperature		
	C°20	C°37	C°50
0	80	80.1	80.5
0,5	60	71	74
1	33.6	29.2	26
1,5	5	7.4	8
2	44	48	28
2,5	62	69	37
3	66	69	51

The optimal concentration of the oil was determined at a temperature of (20, 37, 50)⁰C, respectively, for different concentrations (0, 0.5, 1, 1.5, 2, 2.5, 3 mg / kg) of the synthesized compound and the saturated pressure was measured for each concentration, respectively. And through the measurement, it was found that the optimal concentration is (1.5 mg / kg).

Table 2. Determines the pressure saturated with oil vapor versus the concentrations of the active compound on the surface with different temperatures

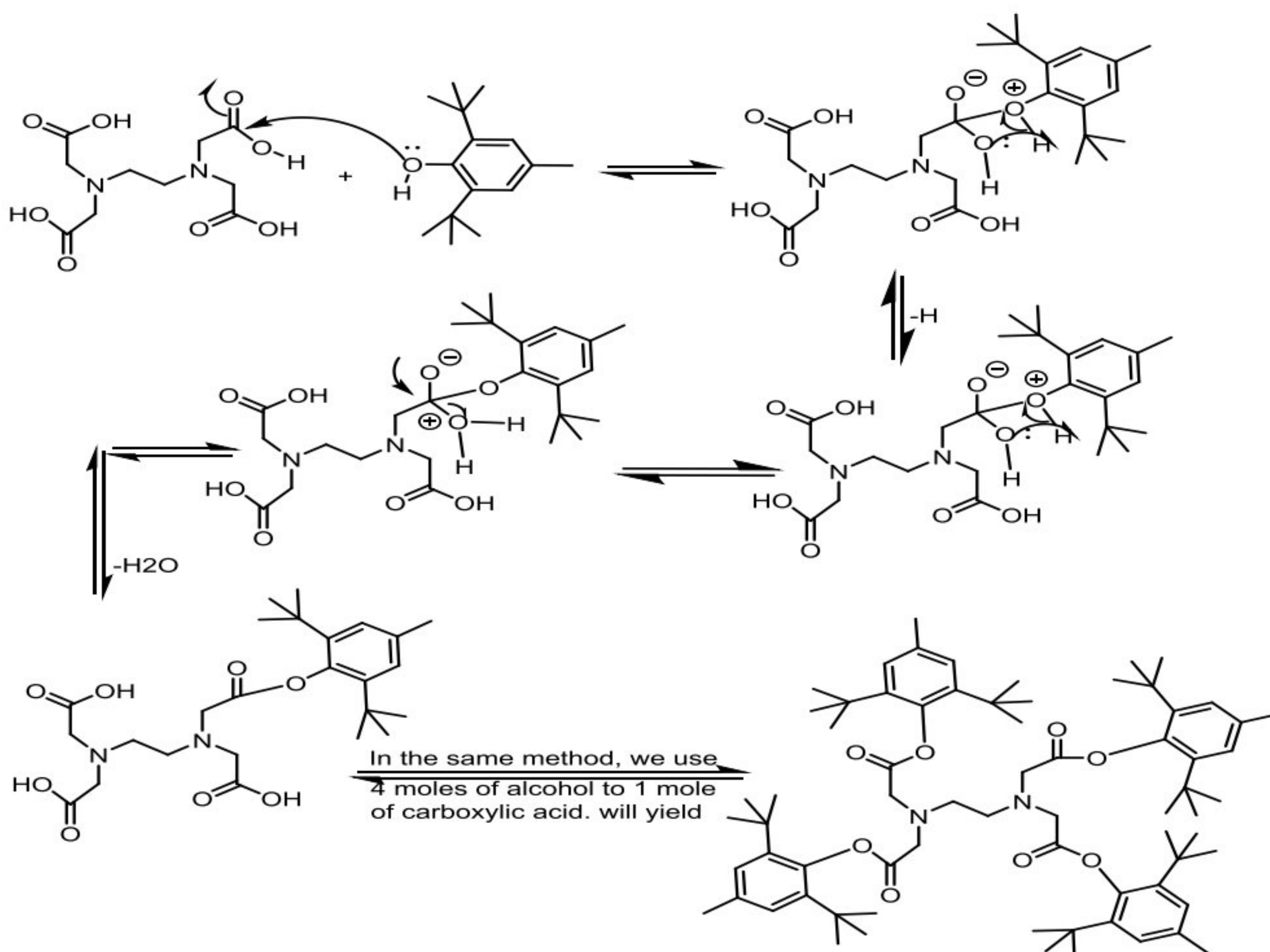
The surface effective compound concentration is mg	The pressure saturated with gasoline vapor kPa at a temperature		
	C°20	C°37	C°50
0	76	76.5	77
0,5	76	66	66
1	18	22	19
1,5	9.7	11	11.1
2	35	42	37
2,5	47	48	39
3	52	57	49

Chapter Four

4: Discussion and results

In this research, a new organic compound was synthesized, which was used for the first time as an effective compound on liquid surfaces. This is from the reaction of a 4: 1 number of moles to both (EDTA) and (TBM), respectively, the compound (tetrakis (2,6-di-tert-butyl-4-methylphenyl) 2,2', 2', 2'', '' - (ethane-1,2-diylbis (azanetriyl) tetraacetate) was produced respectively. And as shown in the following reaction mechanism. Scheme (1):

The synthetic formulation of the compound was also confirmed by diagnosing the resulting compound with FT.IR spectrum., $^1\text{H.NMR}$, $^{13}\text{C.NMR}$, D.NMR and CHN gave the spectroscopic values corresponding to the structural formula of the resulting compound as follows: Tab.(3, 4. and 5).



Scheme 1. Mechanism of preparing the organic compound

The FT.IR spectrum gave a stretch beam (1641 cm^{-1}) belonging to the group C = O, a spectral beam at the site (1232 cm^{-1}) belonging to the group C-O, and a beam (1283 cm^{-1}) belonging to group -O- and a folding beam (3469 cm^{-1}) It belongs to the NC group, and a beam at the site (2252 cm^{-1}) belongs to the group N (C)₃ and a spectral beam ($1596, 1557\text{ cm}^{-1}$) belongs to the C = C aromatic and an in situ beam (3090 cm^{-1}) belongs to the C-C aromatic group and a beam stretch package (2551 cm^{-1}) belongs to the -C-C group, and bundle ($832, 755, 660\text{ cm}^{-1}$) belongs to the aromatic CH, the stretch package (1327 cm^{-1}) belongs to group (CH₃)₃, and the stretch package (2979 cm^{-1}) belongs to for the C-Haliphatic group. Figure 1. Tab. 3.

The ¹H.NMR spectrum gave an in situ beam (2.50 ppm) belonging to the CH group back to the late C (CH₃)₃ environment, an in situ beam (3.21 ppm) belonging to the CH group for the ph-CH₃ environment and a binary beam in situ (4.64-4.83 ppm). It belongs to the CH group, which we return to the N-CH₂-CH₂ environment, and the in situ package (7.31-7.11 ppm) belongs to the CH group which returns to the N-CH₂ environment and the in situ package (8.59 ppm) belongs to the CH group which we return to the ph aromatic environment. Figure 2. Tab. 4.

Give the ¹³C NMR spectrum to the compound: an in situ beam (23.96 ppm) belonging to the ph-C group carbon, an in situ beam (32.80 ppm) belonging to the ph-C group (C) 3 carbon and an in situ beam (43.53 ppm) belonging to a group - ph-C-O, on-site package (49.20 ppm) belonging to NC group, on-site package (56.17 ppm) belonging to NC3 group, and in-site package ((119.43), (130.41), (148.10), (149.56) ppm) belong to Carbon The C=C aromatic group and the in situ bundle (161.66 ppm) belong to the C =O carbonyl group O. Figure 3. Tab. 5.

Also, the D.NMR spectrum gave identical positioning of the beams, converging to each other, the spectrum of ¹H.NMR with ¹³C.NMR, which is identical to the proposed structural formula as well as the C.H.N spectrum: as shown in Fig.(٤) .

Table 3. Spectrum FT.IR for synthesized compound.

Faction group/ beam cm^{-1}			
N C_3 /2252 cm^{-1}	$\text{C}=\text{C}$ arom./1596, 1557 cm^{-1}	$-\text{O}-$ /1283 cm^{-1}	$\text{C}-\text{O}$ /1232 cm^{-1}
$(\text{CH}_3)_3$ /1327 cm^{-1}	$\text{C}-\text{C}$ arom./ 3090 cm^{-1}	CH /2979 cm^{-1}	$\text{C}-\text{C}$ /2551 cm^{-1}
$\text{C}=\text{O}$ /1641 cm^{-1}	CH arom. /832, 755, 660 cm^{-1}	$\text{N}-\text{C}$ / 3469 cm^{-1}	

Table 4. Spectrum ^1H .NMR for synthesized compound.

Proton ^1H / beam ppm			
$\text{N}-\text{CH}_2-\text{CH}_2$ /4.64-4.83 ppm	$\text{ph}-\text{CH}_3$ / 3.21 ppm	$\text{C}(\text{CH}_3)_3$ /3.21 ppm	CH Aro. /8.59 ppm
$\text{N}-\text{CH}_2$ /7.31-7.11 ppm			

Table 5. Spectrum ^{13}C .NMR for synthesized compound.

Carbon ^{13}C / beam ppm		
$\text{N}-\text{C}$ /49.20 ppm	$\text{ph}-\text{C}-\text{O}$ /43.53 ppm	$\text{C}(\text{CH}_3)_3$ /32.80 ppm
$\text{N}(\text{C})_3$ /56.17 ppm	$\text{C}=\text{C}$ arom. /((119.43), (130.41), (148.10), (149.56) ppm	

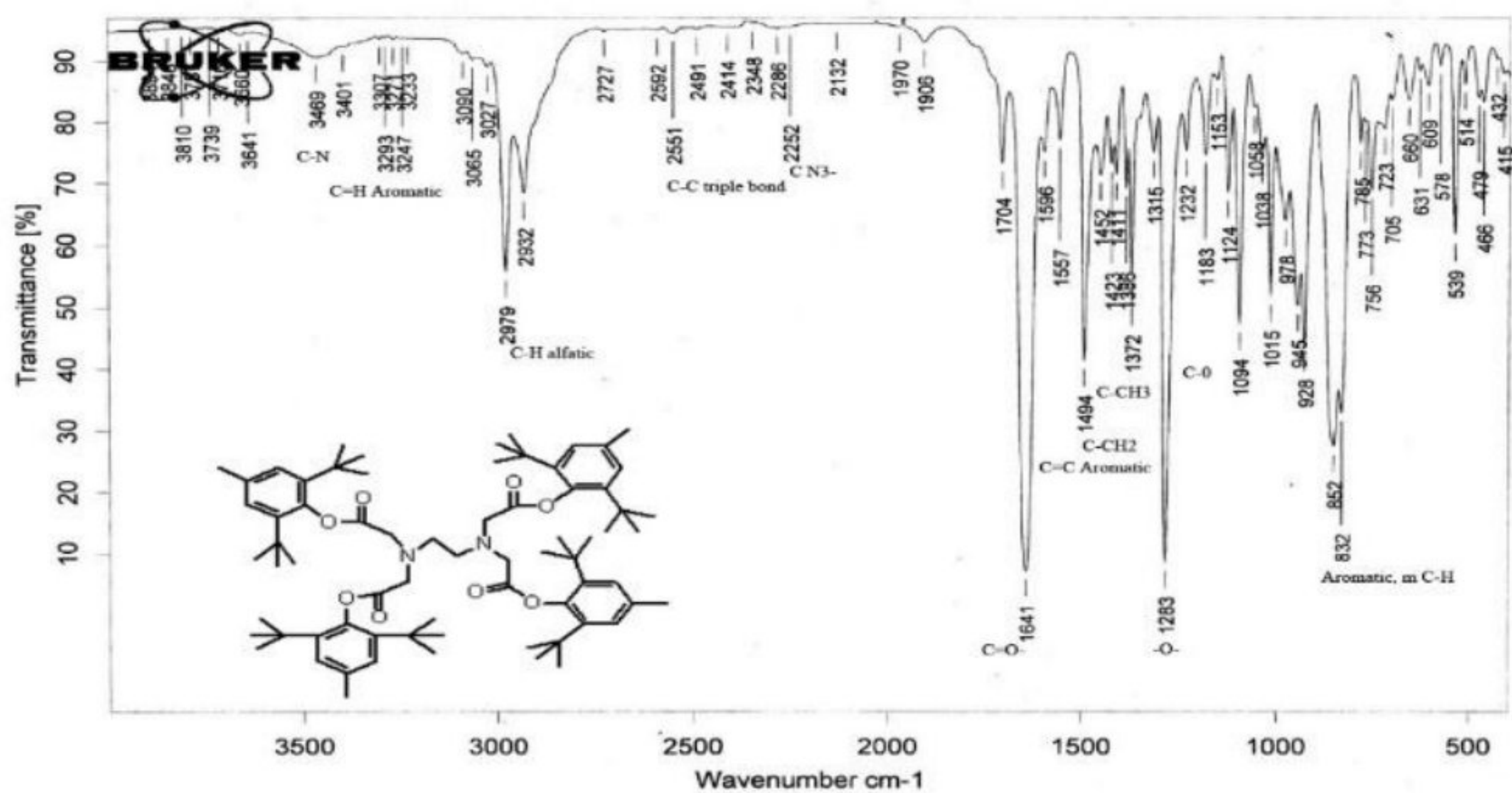


Figure 1. FT-IR spectrum of the prepared compound.

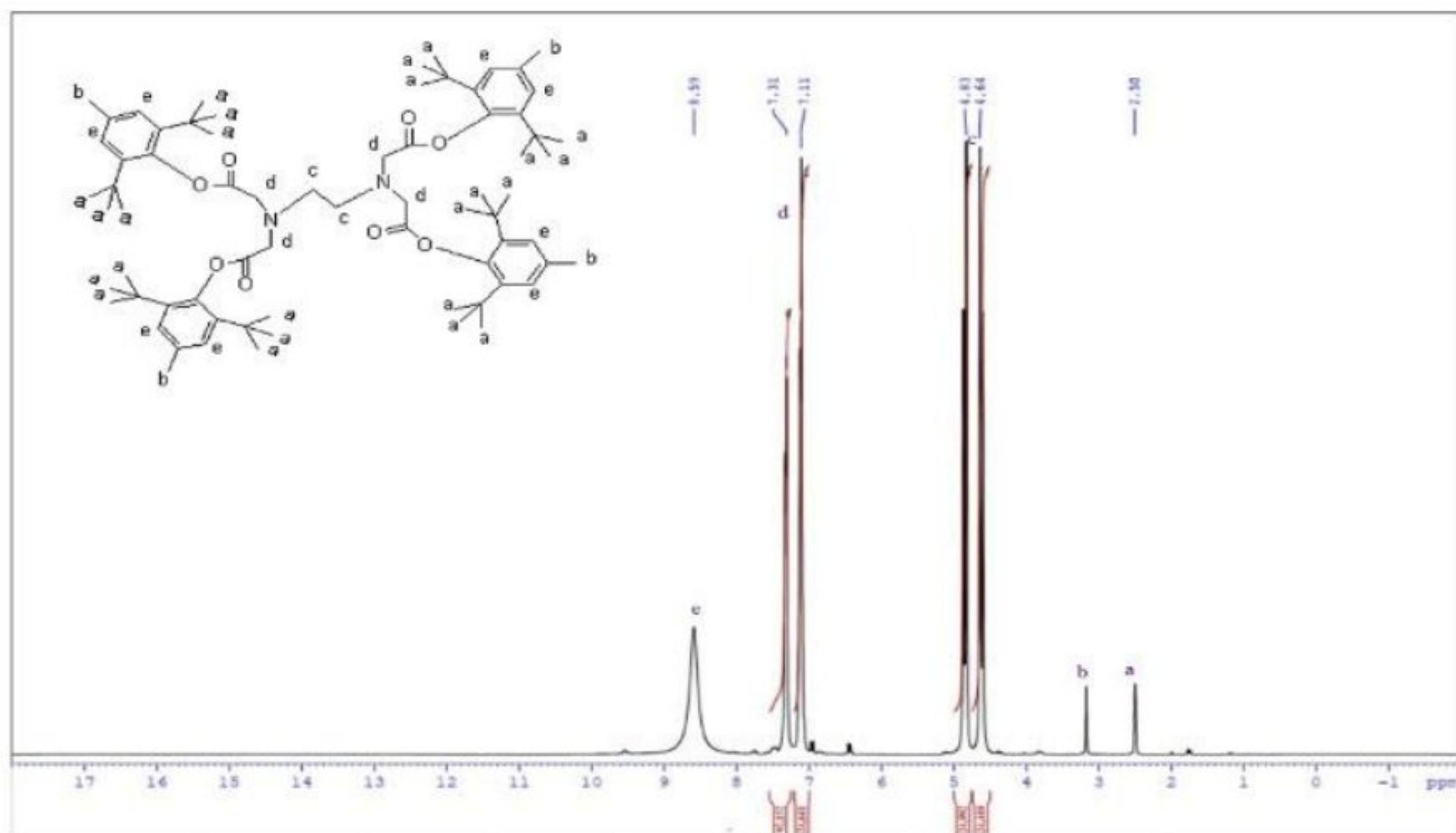


Figure 2. ¹H-NMR spectrum of the prepared compound.

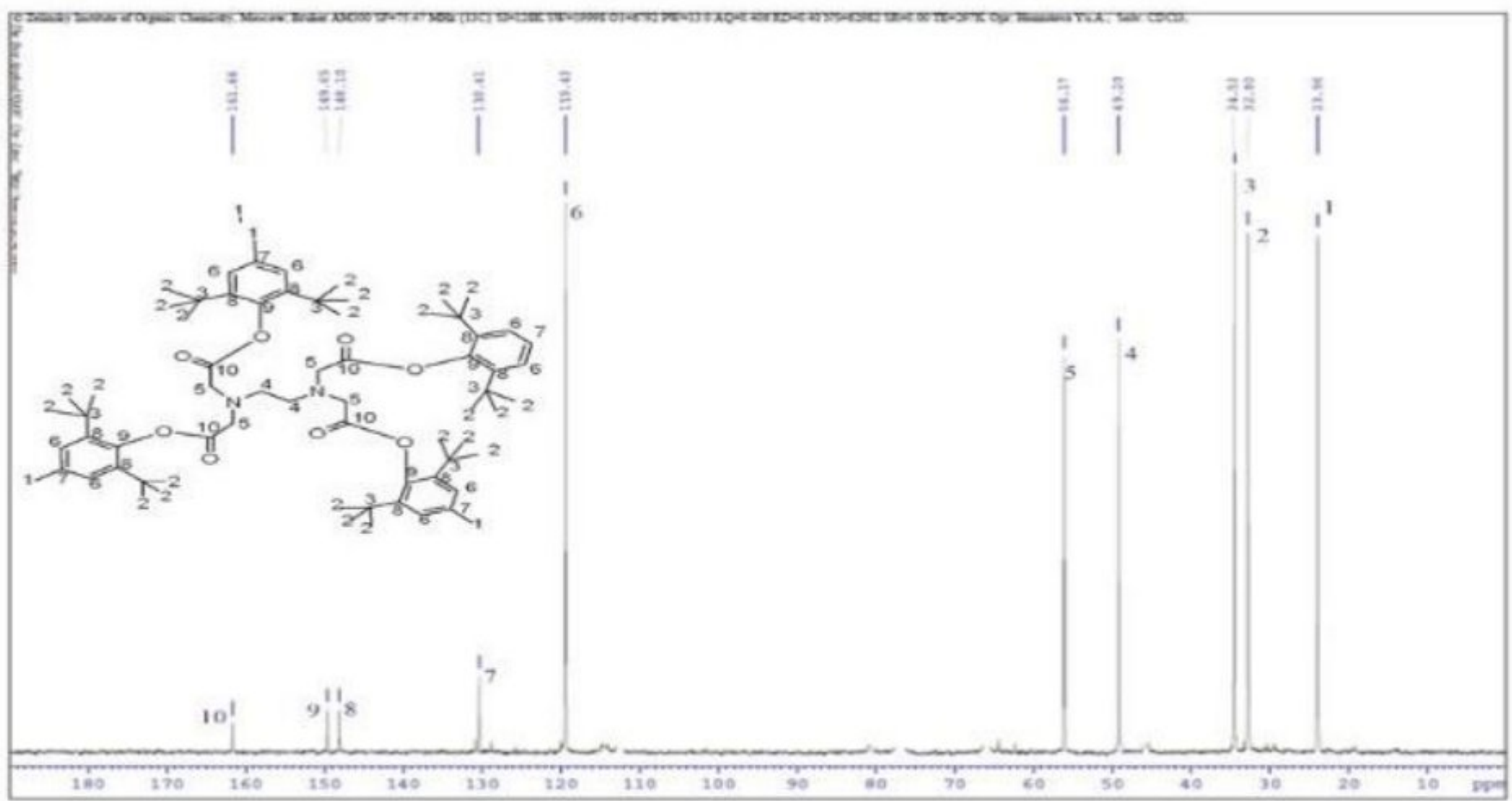


Figure 3. ^{13}C .NMR spectrum of the prepared compound.

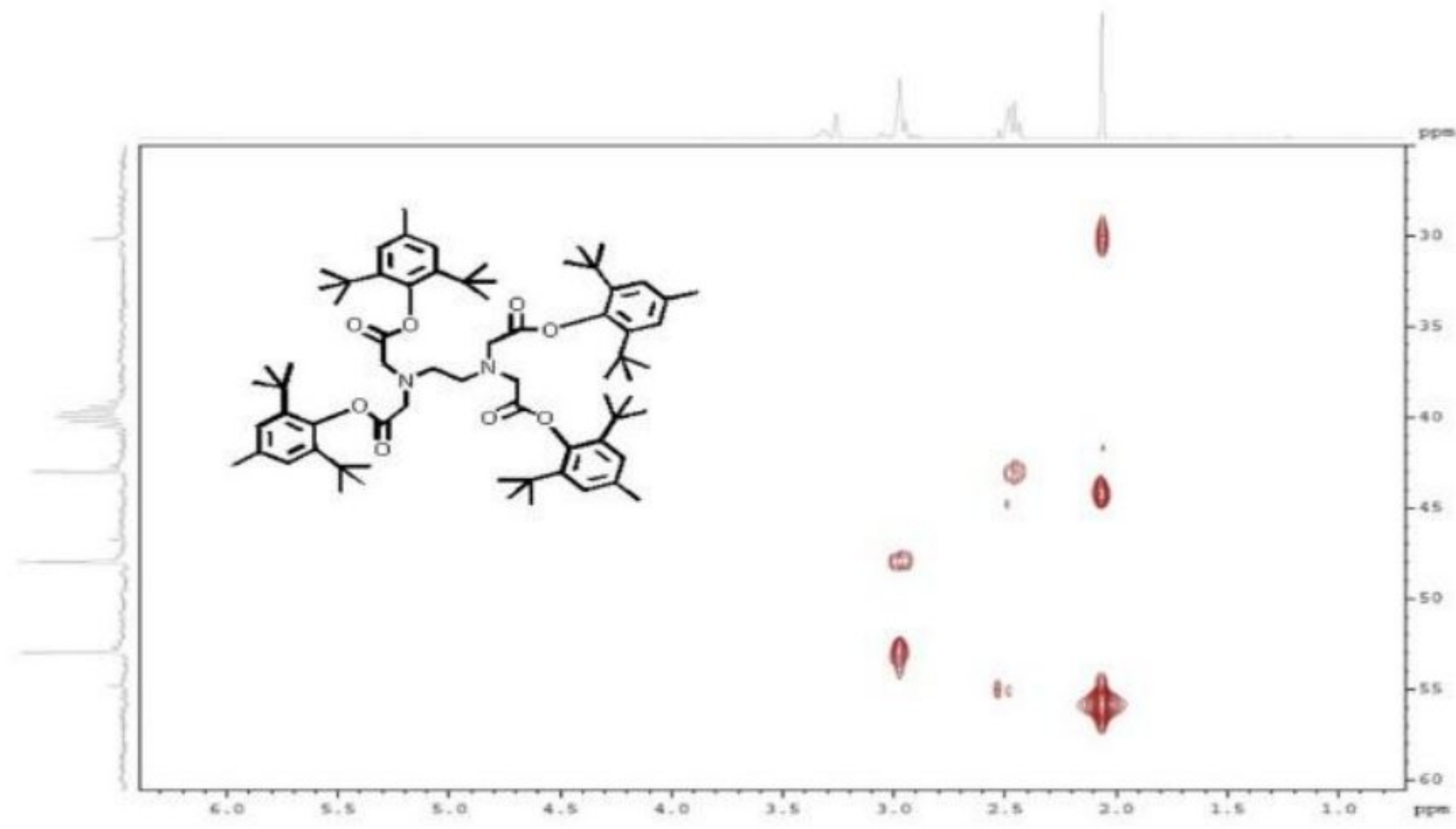


Figure 4.D. NMR spectrum of the prepared compound.

The synthetic compound test for reducing the evaporation ratios of gasoline and oil

Different concentrations of mg / kg were taken not to determine the optimal concentration versus measuring the steam saturated pressure of gasoline. So that the concentrations of the synthesized compound (0, 1, 1.5, 2, 2.5, 3 mg / kg) were taken against benzene and using different temperatures (20, 37, 50 degrees Celsius). The optimal concentration was determined to be (1.5 g / kg of the synthesized compound versus benzene). (Table (1) and Figures (5-7)).

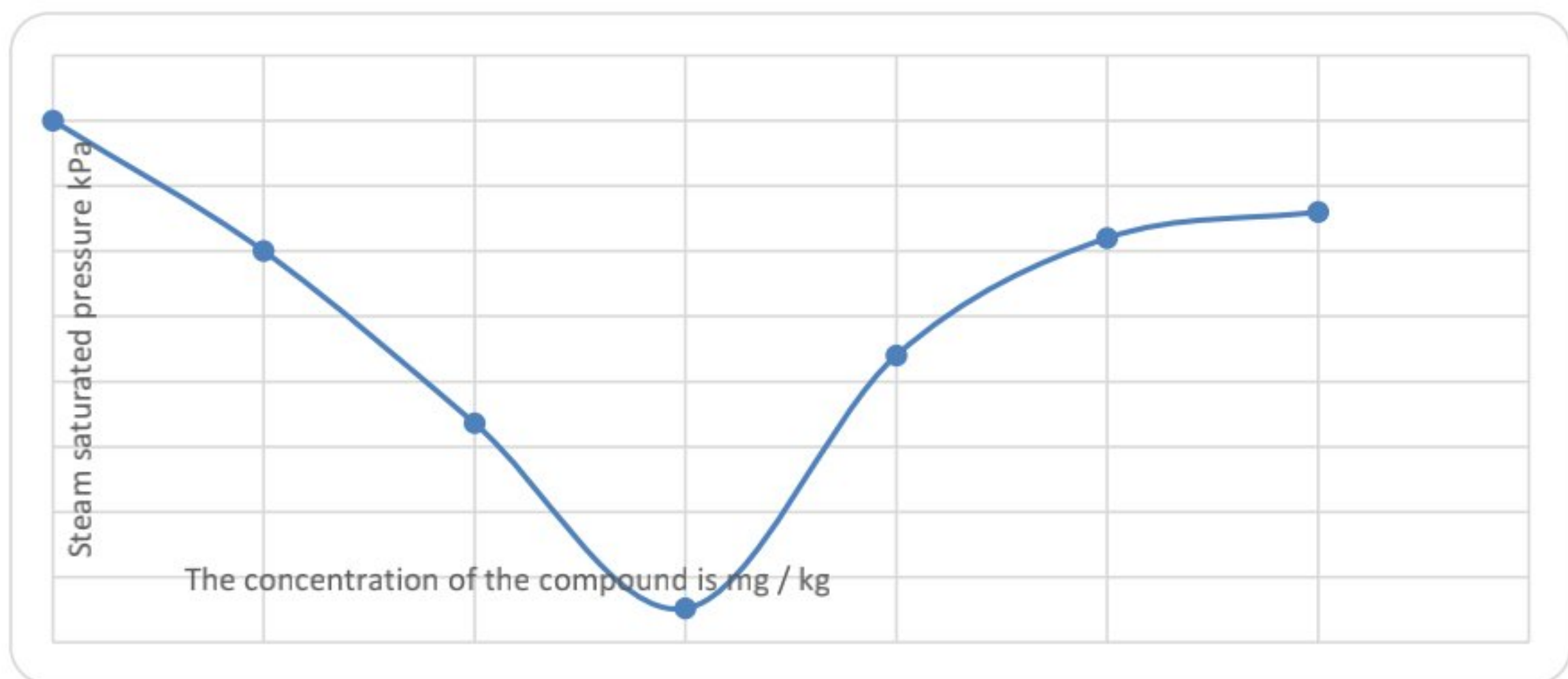
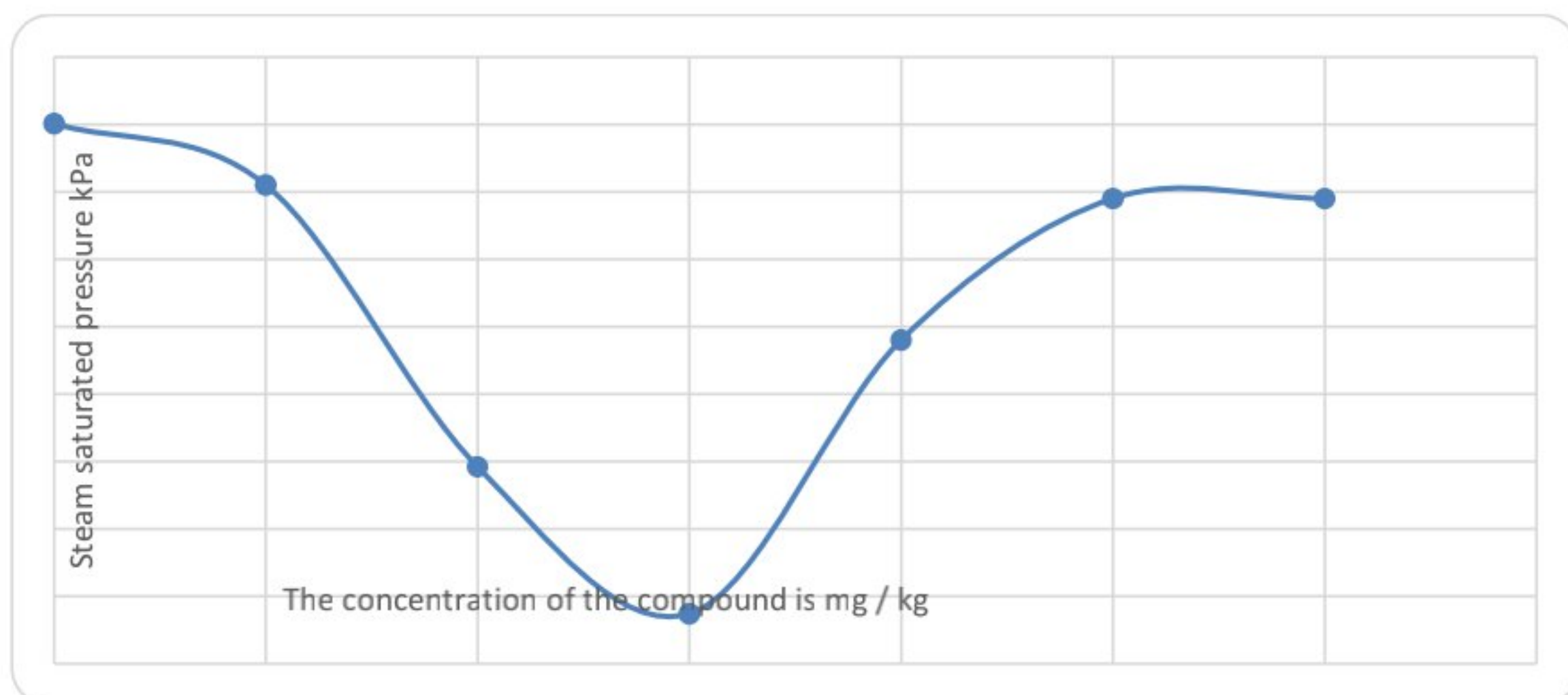


Figure 5. The pressure saturated with gasoline vapor versus the concentrations of the compound prepared at a temperature of 20 °



C.Figure 6. The pressure saturated with gasoline vapor versus the concentrations of the compound prepared at a temperature of 37 ° C.

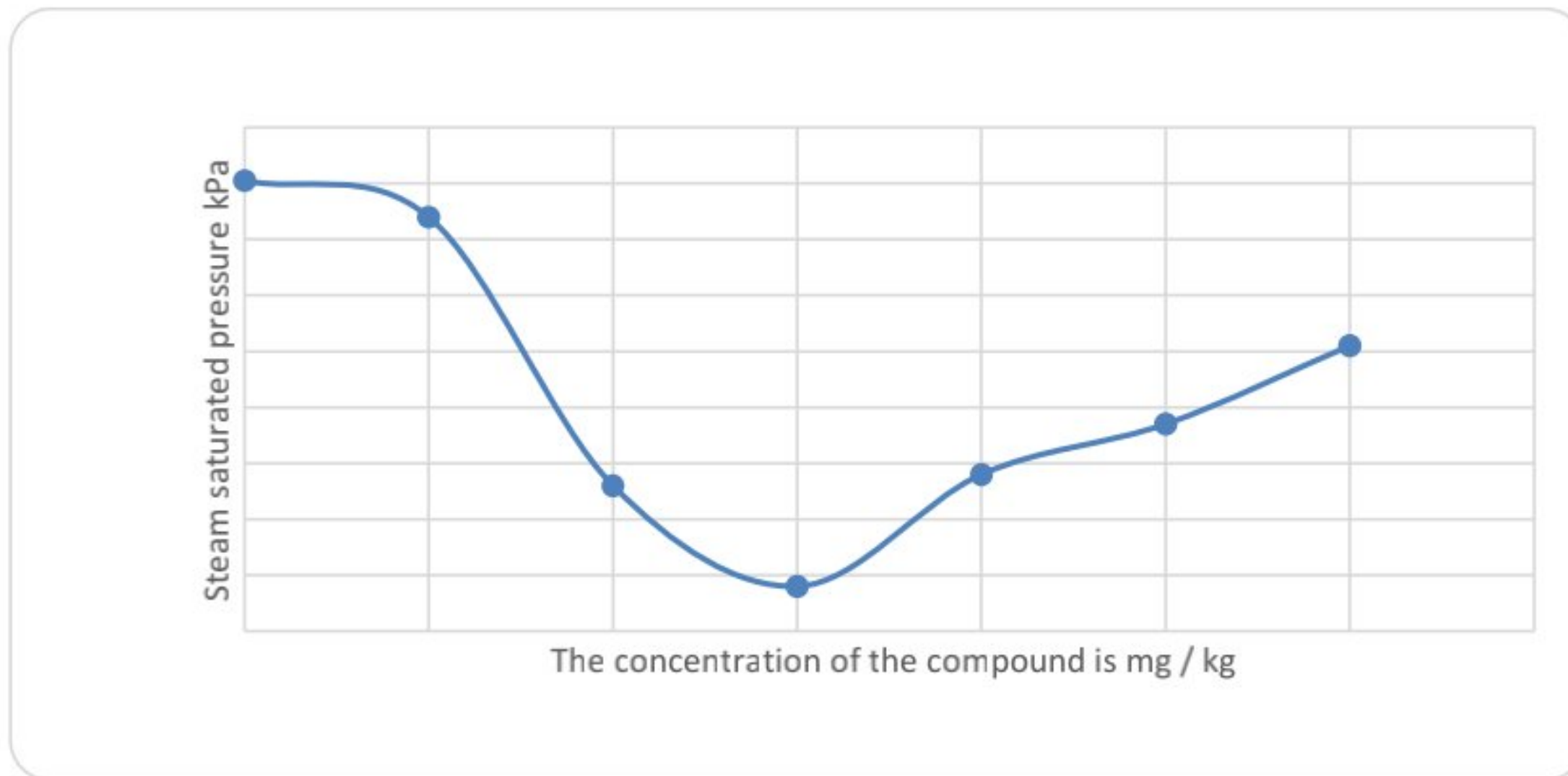
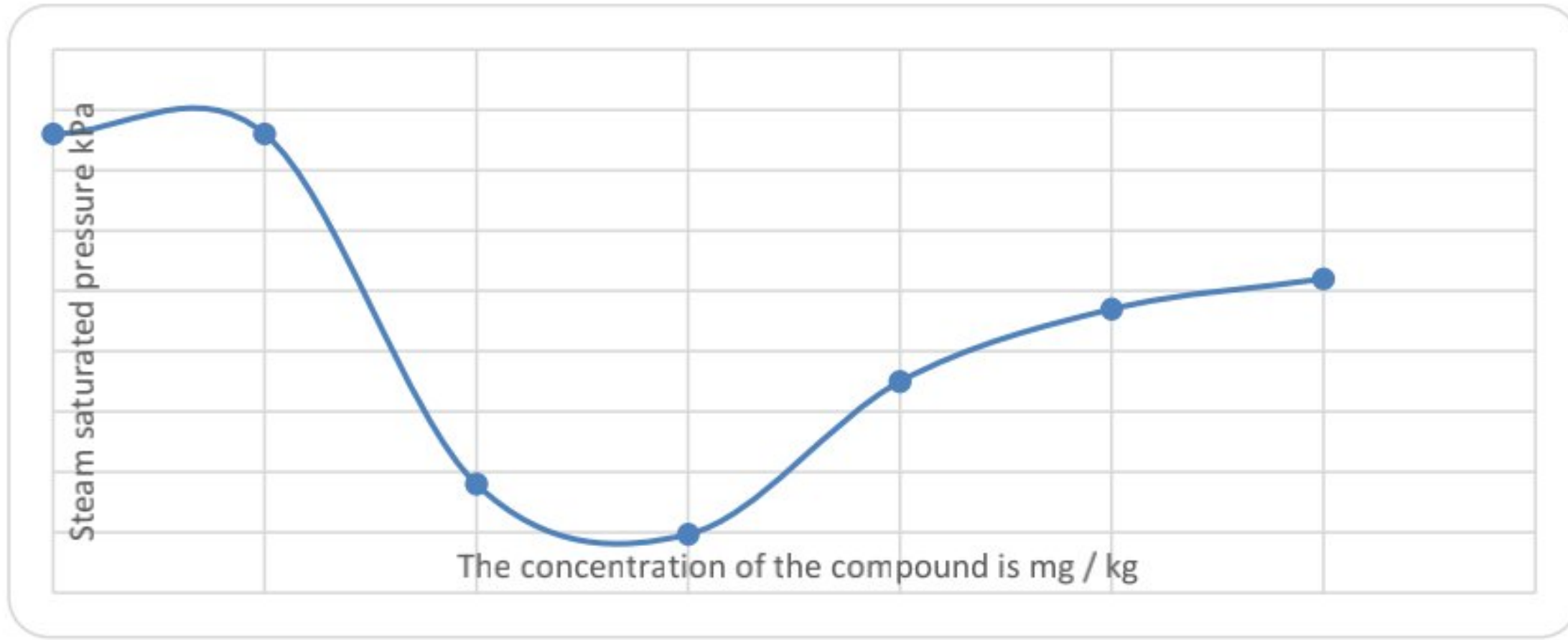


Figure 7. The pressure saturated with gasoline vapor versus the concentrations of the compound prepared at a temperature of 50 °

The reason that led to the reduction of the evaporation ratios, which gave percentages of the prepared compound versus the gasoline (95, 92.5, 91.5%) for the temperature degrees (20, 37, 50 C⁰) respectively, is the high effectiveness of the compound in making the surface tension of the benzene liquid restricted preventing from Light hydrocarbon fragmentation.

In the same way, the optimal concentration of the synthesized compound was determined against the measurement of the steam saturated pressure of the oil, so that the concentrations of the synthesis compound (0, 1.1, 1.5, 2, 2.5, 3 mg / kg) were taken against the oil and using different temperatures (20, 37, 50 ° C) The optimal concentration was determined (1.5 g / kg of the prepared compound versus the oil), (Table (2) and Figures (8-10)).



C. Figure 8. The pressure saturated with oil vapor versus the concentrations of the compound prepared at a temperature of 20 ° C.

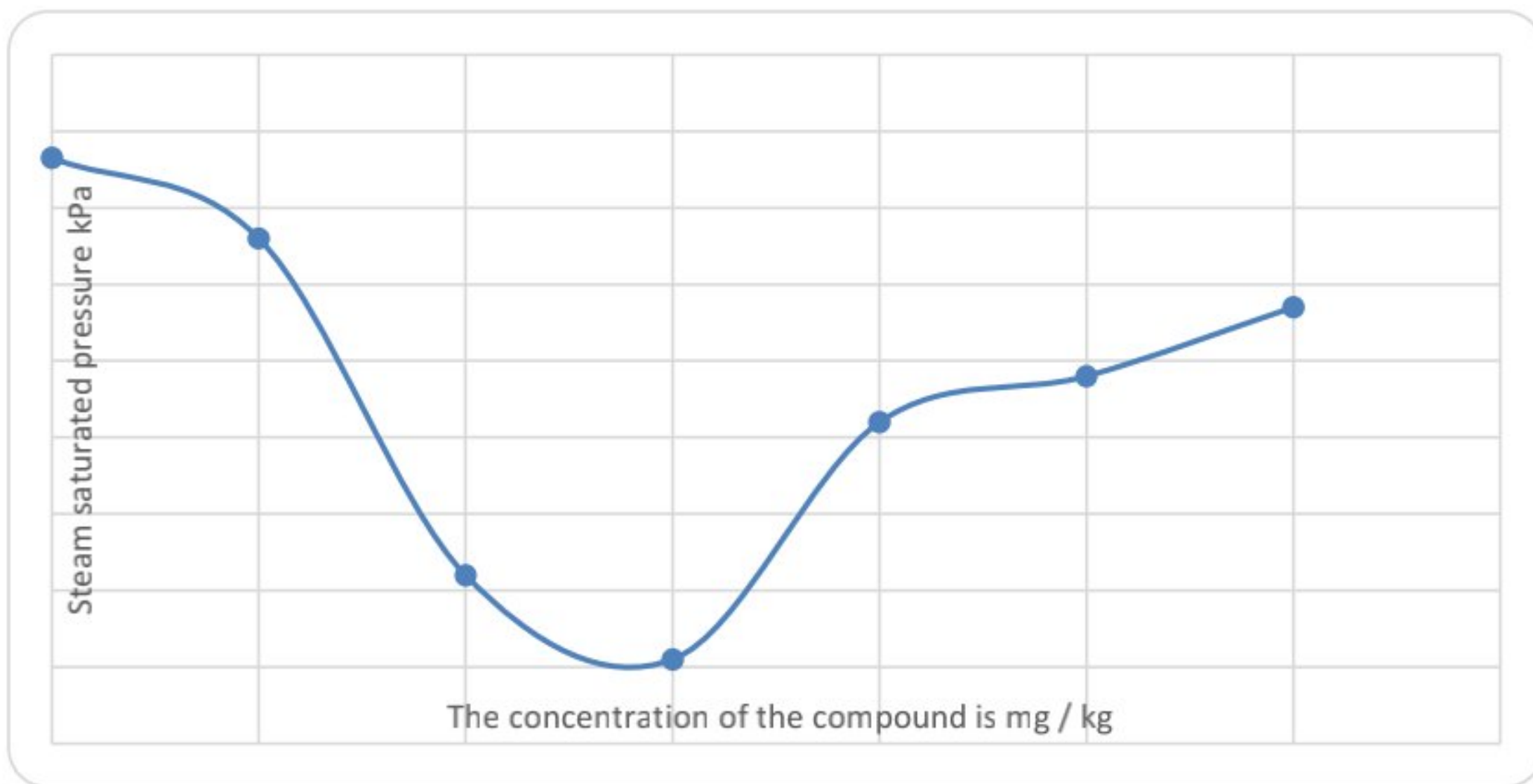


Figure 9. The pressure saturated with oil vapor versus the concentrations of the compound prepared at a temperature of 37 ° C.

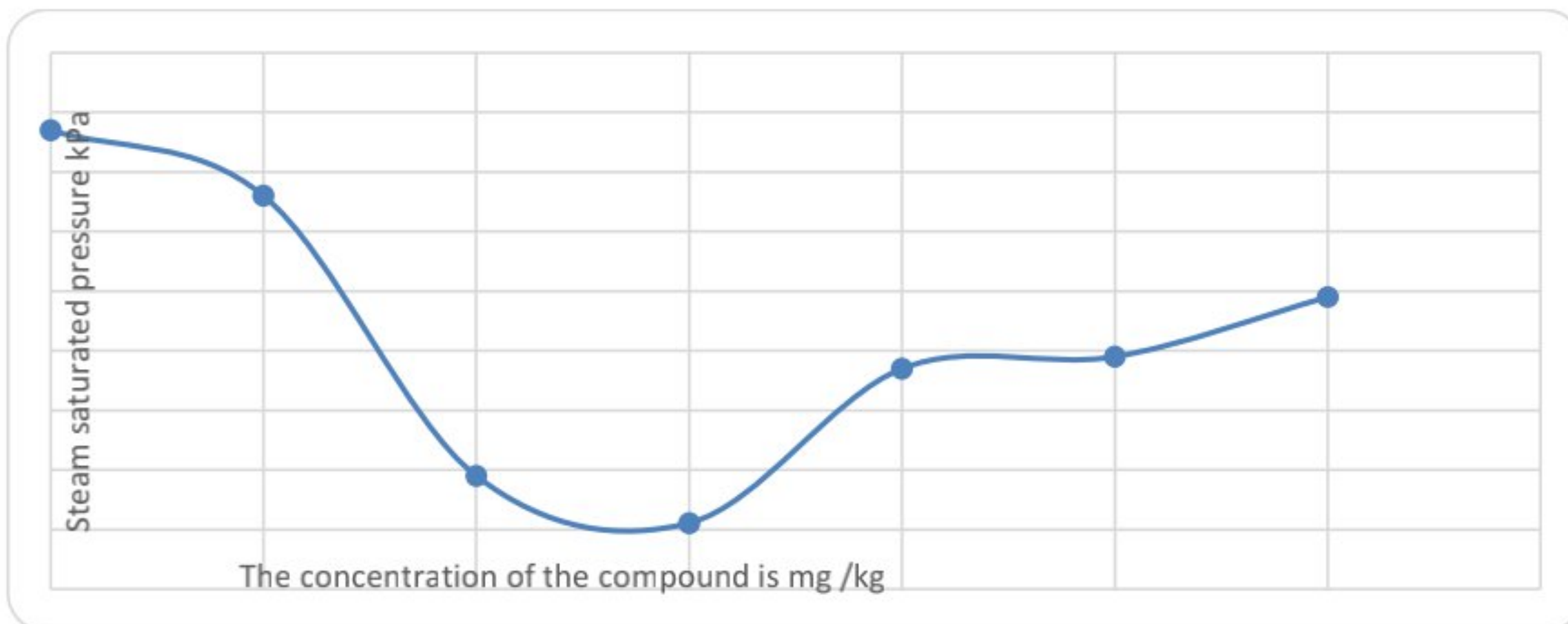


Figure 10. The pressure saturated with oil vapor versus the concentrations of the compound prepared at a temperature of 50 ° C.

The evaporation ratios were reduced, which gave percentages of the prepared compound versus the oil (87.2, 86.0, 85.6%) to the temperature degrees (20, 37, 50 C⁰) respectively. It is the high effectiveness of the compound in making the surface tension of the oil liquid restricted, preventing light hydrocarbons from escaping.

As for the reason for the equal optimum concentration, for oil and gasoline. For the compound created when the saturated pressure of gasoline and oil is determined, all hydrocarbons that always evaporate are light hydrocarbons (C₁-C₆) themselves escaping from gasoline and oil.

Accounts

- 1- This method is the first of its kind. It can be used for oil and gasoline tanks in Iraq and all over the world without any mechanical additions to old and modern tanks.
- 2- The compound can be used by reducing the evaporation rates in very excellent quantities for gasoline and oil tanks and petroleum products. Due to the quantities used are mg per kg (ppm).
- 3- The raw materials used in the synthesis of the compound are (TBM and ETDA) which are materials originally extracted from petroleum. So it does not affect the properties of gasoline and oil.
- 4- The prepared compound does not harm human health. Because the used materials are now used in the preparation of bathroom soap.
- 5- The use of these compounds is very common because they are handy and cheap.
- 6- The use of this compound will significantly and significantly reduce environmental pollution, in addition to recovering the quantities of evaporated oil estimated in millions of tons and dollars.

Recommendations

We recommend using this compound to preserve the environment and live in a healthy environment, as well as to keep oil and gasoline products from deterioration through evaporation processes.

Reference

- 1- M.M. Farhan, M.M Al-Jumialy, and other. Development of a new method for reducing the loss of light hydrocarbons at breather valve of oil tanks, alsever, Energy Procedia (2017), vol.141, p. 471-478.
- 2- M.M. Farhan, N.V Korzun. Reducing the loss of light hydrocarbons from oil and gasoline. Jou, Proceedings of universities. Oil and Gas, 95-98,(2011).
- 3- M. Hilpert, B. Adria Mora, Jian Ni , Ana M. Rule & Keeve E. Nachman. Hydrocarbon Release During Fuel Storage and Transfer at Gas Stations: Environmental and Health Effects. AIR POLLUTION AND HEALTH (JD KAUFMAN AND SD ADAR, SECTION EDITORS)DOI 10.1007/s40572-015-0074-8. Curr Envir Health Rpt 2:412–422. (2015).
- 4- M.M. Farhan, R.Z Magaril, Reducing the loss of light hydrocarbons during large breaths of oil reservoirs. Proceedings of higher educational institutions. Oil and Gas,83-84. ,(2011).
- 5- M.M Farhan, N.V Korzun. Influence of surfactants on gasoline vapor pressure. Proceedings of higher educational institutions. Oil and Gas, 113-115. ,(2012).
- 6- M.M Farhan, R.Z Magaril. REDUCING LOSSES WITH LARGE BREATHING OIL RESERVOIRS. Oil and Gas of Western Siberia, 217-219. (2011).
- 7- M.M Farhan. A New Method for Preparing an Organic Compound to Reduce the Loses of the Vaporized Hydrocarbons from Gasoline and Petroleum. IAPE '19, Oxford, United Kingdom. online (2019).
- 8- M.M. Farhan, R.MG. DEVELOPMENT OF A METHOD FOR REDUCING THE ELASTICITY OF OIL VAPORS. Proceedings of universities. Oil and Gas 2, (2013,) 75-79.

- 9- R. MagarilZ. Reducing gasoline loss from evaporation by the introduction of a surface-active fuel additive *Ural Federal University, Russia*. WIT Transactions on The Built Environment, Vol 146, © 2015 WIT Press doi:10.2495/UT1501811loss/ www.witpress.com, ISSN 1743-3509 (on-line). Urban Transport XXI 233-242. .(2015).
- 10- M.M Farhan, R.A Najem, T.AJ Mandeel. Preparation of new organic compounds and the study of its characteristics to reduce the evaporation rate from gasoline tanks. AIP Conference Proceedings 2213, (1), 0202 16.(2020).
- 11- M.M Farhan, N.V.K, R.Z Magaril. Reducing air pollution by gasoline vapors. Scientific. Conf. (environmental control system). Ekaterinburg 2, 126-128. (2012).
- 12- M.M. Farhan, K.N.V., Effect of surface active agents on the elasticity of gasoline vapors. Proceedings of universities. Oil and Gas 4, 113-115. (2012).
- 13- Patented, R.Z. Magaril M.M. Farhan, way to reduce the loss of light hydrocarbons from oil, R.F., no: 2490315.(2012).
- 14- Patented, R.Z. Magaril M.M. Farhan, way to reduce the loss of light hydrocarbons from oil, Ru., no: 2458973. (2013).
- 15- MM Farhan, NV Korzun. REDUCTION OF LIGHT HYDROCARBONS LOSSES FROM OIL AND GASOLINE. Proceedings of higher educational institutions. Oil and Gas, 98-102. ,(2012).**
- 16- M.M. Farhan. A REVIEW OF THE METHOD OF REDUCTION SLIGHT HYDROCARBONS. Coll. Proceedings of the Fifth Intern. Scientific. Conf. (environmental ..).89-92. (2011).**
- 17- M.M Farhan Farhan.DEVELOPMENT OF TECHNOLOGY TO REDUCE LUNG LOSSES OIL FRACTIONS IN RESERVOIRS OF PRODUCTION SYSTEMS COLLECTION AND PREPARATION. PhD**

thesis / Russian Federation - University of Ufa and Tyumen Oil and Gas. P.113. (2015).

- 18- Akland, G. G. (1993). Exposure of the general population to gasoline. *Environmental health perspectives*, 101(suppl 6), 27-32.
- 19- Alhaj, M. B. E., Alzubair, M. B. A., & A Gadir, W. M. A. (2014). Evaluation and Control of Evaporation Losses from Gasoline Internal Floating Roof Tanks (Doctoral dissertation, Sudan University of Science and Technology).
- 20- AL-janabi, R. A. N. (2019). Synthesis and Characterization of Organic Compounds and Studying It's Ability to Reduce the Evaporation Ratio of The Light Hydrocarbons from Crude Oil Tanks. (Master dissertation, The Iraqi Ministry of Higher Education and Scientific Research, University of Anbar, College of Science, Department of Chemistry). Available mail for this references is: randa.chemist@gmail.com .
- 21- Al-Shamae S.K., (1980). The place of the oil industry in Iraq. **Dar al-rashid. Baghdad - Iraq**, - 285 p.
- 22- Andersson, K., and Eklund, J. (2012). Work Environment. Lean Agriculture, Chamberlain, A. Working & Standing Losses: Understanding Tank Emissions Inside and Out. Available: <https://info.era-environmental.com/blog/bid/72134/working-standing-losses-understanding-tank-emissionsinside-out>, Vol. 3, No. 2, pp. 661 – 666. May 28, (2018).
- 23- Aulich T. R., He X. M., Grisanti A. A., Knudson C. L. (1994). Gasoline evaporation ethanol and nonethanol blends. *Journal of the Air & Waste Management Association*, 44(8), 1004–1009. DOI: 10.1080/10473289.1994.10467294.
- 24- Aulich, T. R., He, X., Grisanti, A. A., & Knudson, C. L. (1994). Gasoline evaporation–ethanol and nonethanol blends. *Air & waste*, 44(8), 1004-1009.

- 25-** Blinov I.G., Gerasimov V.V., Korshak A.A. (1990). **Novoselov V.F., Sedelev Yu.A.** Promising methods for reducing the loss of petroleum products from evaporation in tanks. M: Ts NIITE neftekhim. - 125 p.
- 26-** Board, O. S., & National Research Council. (2005). Oil spill dispersants: efficacy and effects. National Academies Press.
- 27-** Boehm, P. D., Douglas, G. S., Burns, W. A., Mankiewicz, P. J., Page, D. S., & Bence, A. E. (1997). Application of petroleum hydrocarbon chemical fingerprinting and allocation techniques after the Exxon Valdez oil spill. *Marine Pollution Bulletin*, 34(8), 599-613.
- 28-** Caprino, L., & Togna, G. I. (1998). Potential health effects of gasoline and its constituents: A review of current literature (1990-1997) on toxicological data. *Environmental Health Perspectives*, 106(3), 115-125.
- 29-** Centers for Disease Control and Prevention (**CDC**). (2015). Facts about benzene. Available from: <http://www.bt.cdc.gov/agent/benzene/basics/facts.asp>.
- 30-** Chang, J. I., & Lin, C. C. (2006). A study of storage tank accidents. *Journal of loss prevention in the process industries*, 19(1), 51-59.
- 31-** de Oliveira, F. S., Teixeira, L. S. G., Araujo, M. C. U., & Korn, M. (2004). Screening analysis to detect adulterations in Brazilian gasoline samples using distillation curves. *Fuel*, 83(7-8), 917-923.
- 32-** Dickson, U. J., & Udoessien, E. I. (2012). PHYSICOCHEMICAL STUDIES OF NIGERIA'S CRUDE OIL BLENDS. *Petroleum & Coal*, 54(3).
- 33-** Donaldson, S. G., Miller, G. C., & Miller, W. W. (1992). Remediation of gasoline-contaminated soil by passive volatilization (Vol. 21, No. 1, pp. 94-102). American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America.

- 34-** Duarte-Davidson, R., Courage, C., Rushton, L., & Levy, L. (2001). Benzene in the environment: an assessment of the potential risks to the health of the population. *Occupational and environmental medicine*, 58(1), 2-13.
- 35-** Edokpolo, B., Yu, Q. J., & Connell, D. (2015). Health risk assessment for exposure to benzene in petroleum refinery environments. *International journal of environmental research and public health*, 12(1), 595-610.
- 36-** Egeghy, P. P., Tornero-Velez, R., & Rappaport, S. M. (2000). Environmental and biological monitoring of benzene during self-service automobile refueling. *Environmental Health Perspectives*, 108(12), 1195-1202.
- 37-** EIA, U. (2006). *Eliminating MTBE in Gasoline in 2006*. Washington, DC: US Energy Information Administration.
- 38-** EIA, U. (2015). National ambient air quality standards for ozone; Final rule. *Fed. Regist.*, 80(206), 65-292.
- 39-** Farhan M.M. (2012). Reduction of air pollution by gasoline fumes / Korzun N.V., Magaril RZ // Sat. Proceedings of the Sixth correspondence intern. scientific conf. (environmental safety management system). Yekaterinburg, Volume 2, - with.P. 126-128. Available mail for this references is: mw_mw_888@yahoo.com .
- 40-** Farhan M.M., Karnaukhov M.L. (2014). Development of a method for reducing the loss of light hydrocarbons from the OTF (oil preparation unit) // New technologies for the oil and gas region. Collection of papers international scientific-practical conference of students, graduate students and young scientists section 'Modeling and management of the processes of extraction and transport of oil and gas' -21- April 25, - with. P. 121-128. Available mail for this references is: mw_mw_888@yahoo.com .
- 41-** Farhan, F.M.M. (2015). Development of technology for reducing the loss of light fractions of oil in reservoirs of field gathering and preparation

systems (Doctoral dissertation, Ufa State Oil Engineering University). Available mail for this references is: mw_mw_888@yahoo.com , Or from (ФАРХАН РАЗРАБОТКА ТЕХНОЛОГИИ СНИЖЕНИЯ ПОТЕРЬ ЛЕГКИХ ФРАКЦИЙ НЕФТИ В РЕЗЕРВУАРАХ СИСТЕМ ПРОМЫСЛОВОГО СБОРА И ПОДГОТОВКИ - Автореферат (x-pdf.ru)).

- 42-** Farhan, M. M., & Younus, A. A. (2019). A New Method for Preparing an Organic Compound to Reduce the Loses of the Vaporized Hydrocarbons from Gasoline and Petroleum. **IAPE '19, Oxford, United Kingdom**. Measurement, 587(12.26), 71-50.
- 43-** Farhan, M. M., Al-Jumialy, M. M., Al-Muhammadi, A. D., & Ismail, A. S. (2017). Development of a new method for reducing the loss of light hydrocarbons at breather valve of oil tanks. Energy Procedia, 141, 471-478.
- 44-** Farhan, M.M. (2011). Reduction of losses during large breathing of oil tanks. Ed. Magaril RZ. Oil and Gas of Western Siberia: Materials of the International scientific-technical. Dedicated to the 55th Anniversary of Tyumen state oil and Gas University.- Tyumen: **Tyumen state oil and Gas University**:217-220. Available mail for this references is: mw_mw_888@yahoo.com .
- 45-** Farhan, M.M. Reduction of losses during large breathing of oil tanks. Ed. Magaril, R.Z. Oil and Gas of Western Siberia: Materials of the International Scientific-technical. Dedicated to the 55th Anniversary of Tyumen State Oil and Gas University. - Tyumen: Tyumen State Oil and Gas University. 2011: 217-220. Available mail for this references is: mw_mw_888@yahoo.com .
- 46-** Farzaneh-Gord, M., Nabati, A., & Niazmand, H. (2011). Solar radiation effects on evaporative losses of floating roof storage tanks. International Journal of Oil, Gas and Coal Technology, 4(2), 134-155.

- 47- Farzaneh-Gord, M., Nabati, A., & Niazmand, H. (2011). Solar radiation effects on evaporative losses of floating roof storage tanks. *International Journal of Oil, Gas and Coal Technology*, 4(2), 134-155.
- 48- Garg, M. O., Kamei, W., Singal, S. K., Aggarwal, U. C., & Sharma, Y. K. (2011). Measurement and Estimation of Gasoline Fuel Vapour Losses from Retail Outlets (No. 2011-26-0117). SAE Technical Paper.
- 49- Grandjean, P., & Landrigan, P. J. (2006). Developmental neurotoxicity of industrial chemicals. *The Lancet*, 368(9553), 2167-2178.
- 50- Hamlat, M. S., Djeflal, S., & Kadi, H. (2001). Assessment of radiation exposures from naturally occurring radioactive materials in the oil and gas industry. *Applied Radiation and Isotopes*, 55(1), 141-146.
- 51- Hildebrand, M. S., Noll, G. G., & Hand, B. (2017). Above Ground Bulk Storage Tank Emergencies. Jones & Bartlett Learning. **Jones and Bartlett Learning, US.**
- 52- Hilpert, M., Mora, B. A., Ni, J., Rule, A. M., & Nachman, K. E. (2015). Hydrocarbon release during fuel storage and transfer at gas stations: environmental and health effects. *Current Environmental Health Reports*, 2(4), 412-422.
- 53- Hobson, G. D., & Pohl, W. (1973). *Modern petroleum technology*.
- 54- Hotz, P., & Lauwerys, R. R. (1997). Hematopoietic and lymphatic malignancies in vehicle mechanics. *Critical Reviews in toxicology*, 27(5), 443-494.
- 55- Irigaray, P., Newby, J. A., Clapp, R., Hardell, L., Howard, V., Montagnier, L., ... & Belpomme, D. (2007). Lifestyle-related factors and environmental agents causing cancer: an overview. *Biomedicine & Pharmacotherapy*, 61(10), 640-658.
- 56- Javelaud, B., Vian, L., Molle, R., Allain, P., Allemand, B., Andre, B., ... & Viver, D. (1998). Benzene exposure in car mechanics and road tanker

- drivers. *International archives of occupational and environmental health*, 71(4), 277-283.
- 57-** Jeon, C. H., Park, C. K., Na, B. K., & Kim, J. K. (2017). Properties of gasoline stored in various containers. *Energies*, 10(9), 1307.
- 58-** Jo, W. K., & Moon, K. C. (1999). Housewives' exposure to volatile organic compounds relative to proximity to roadside service stations. *Atmospheric Environment*, 33(18), 2921-2928.
- 59-** Jo, W. K., & Oh, J. W. (2001). Exposure to methyl tertiary butyl ether and benzene in close proximity to service stations. *Journal of the Air & Waste Management Association*, 51(8), 1122-1128.
- 60-** Jurušs M., Seile E. (2017). Application of loss rates for petroleum products due to natural wastage in customs procedures, *Procedia Engineering*, 178, 377–383. DOI: 10.1016/j.proeng.2017.01.069.
- 61-** Karakitsios, S. P., Papaloukas, C. L., Kassomenos, P. A., & Pilidis, G. A. (2007). Assessment and prediction of exposure to benzene of filling station employees. *Atmospheric Environment*, 41(40), 9555-9569.
- 62-** Korshak A.A., Blinov I.G., Novoselov V.F. (1991). Systems for capturing light fractions of oil and oil products from tanks: Study Guide. Ufa .: Izd. Ufim oil Institura. - 245 s.
- 63-** Korshak, A.A. (2006). Resource-saving methods and technologies for the transportation and storage of petroleum and products. Ufa: Design Polygraph. Service. 2006, 191, p5.
- 64-** Lagorio, S., Forastiere, F., Iavarone, I., Rapiti, E., Vanacore, N., Perucci, C. A., & Carere, A. (1994). Mortality of filling station attendants. *Scandinavian journal of work, environment & health*, 331-338.

- 65-** Lahiri, A. K. (2017). Material Selection and Performance in Oil and Gas Industry. In Applied Metallurgy and Corrosion Control (pp. 269-347). Springer, Singapore.
- 66-** Lynge, E., Andersen, A., Nilsson, R., Barlow, L., Pukkala, E., Nordlinder, R., ... & Riise, T. (1997). Risk of cancer and exposure to gasoline vapors. *American journal of epidemiology*, 145(5), 449-458.
- 67-** Lyons, W. C., & Plisga, G. J. (2011). Standard handbook of petroleum and natural gas engineering. Elsevier. **GUF Professional Publishing.**
- 68-** Magaril, E. (2015). Reducing gasoline loss from evaporation by the introduction of a surface-active fuel additive. **Ural Federal University, Russia.** Urban Transport XXI. WIT Transactions on The Built Environment, Vol 146, 2015 WIT Press. P. 233-242.
- 69-** Magaril, E. R., Magaril R. Z. (2015). Reducation of gasoline evaporation through the introduction of a surfactant fuel additive. Jornal article – scientific article language: Russian. UDC: 43.013.3:665.733:665.7.038. Magazine: Transport Ural Publisher: Ural State University of Transport (Ekaterinburg). Number: 3(46) Pages: 93-97.
- 70-** Magaril, E. R., Magaril, R. Z., & Bamburov, V. G. (2014). Specific features of combustion in gasoline-driven internal combustion engines. *Combustion, Explosion, and Shock Waves*, 50(1), 75-79.
- 71-** Majid M.S. (1998). Oil, Iraqi Ministry of Oil / Department of Information. 7th series, Baghdad - Iraq. - № 7. - 62 p.
- 72-** Min, K. I., Yim, E. S., Jung, C. S., Kim, J. K., & Na, B. K. (2013). Study on the characterization of oxidative degradation of automotive gasoline. *Korean Chemical Engineering Research*, 51(2), 250-256.
- 73-** Morton, W., & Marjanovic, D. (1984). Leukemia incidence by occupation in the Portland-Vancouver metropolitan area. *American journal of industrial medicine*, 6(3), 185-205.

- 74-** Nadim, F., Zack, P., Hoag, G. E., & Liu, S. (2001). United States experience with gasoline additives. *Energy Policy*, 29(1), 1-5.
- 75-** National Research Council. (2009). Contaminated water supplies at Camp Lejeune: Assessing potential health effects.
- 76-** Needleman, H. L. (2000). The removal of lead from gasoline: historical and personal reflections. *Environmental Research*, 84(1), 20-35.
- 77-** Nelson, W. L. (2018). *Petroleum refinery engineering*. McGraw-Hill.
- 78-** Okamoto, K., Watanabe, N., Hagimoto, Y., Miwa, K., & Ohtani, H. (2009). Changes in evaporation rate and vapor pressure of gasoline with progress of evaporation. *Fire Safety Journal*, 44(5), 756-763.
- 79-** Panel, B. R. (1999). *Achieving Clean Air and Clean Water. The Report of the Blue Ribbon Panel on Oxygenates in Gasoline*, 85.
- 80-** Patel, A. S., Talbott, E. O., Zborowski, J. V., Rycheck, J. A., Dell, D., Xu, X., & Schwerha, J. (2004). Risk of cancer as a result of community exposure to gasoline vapors.
- 81-** Periago, J. F., Zambudio, A., & Prado, C. (1997). Evaluation of environmental levels of aromatic hydrocarbons in gasoline service stations by gas chromatography. *Journal of Chromatography A*, 778(1-2), 263-268.
- 82-** Petrol H. O. W., In C., Tanks E. (2010). *Fuel News Petrol Life in Vehicle Tanks*, 1–2. Statistics Canada. (2009). *Gasoline Evaporative Losses from Retail Gasoline Outlets Across Canada, 2009*, (613).
- 83-** Rich, A. L., & Orimoloye, H. T. (2016). Elevated atmospheric levels of benzene and benzene-related compounds from unconventional shale extraction and processing: human health concern for residential communities. *Environmental health insights*, 10, EHI-S33314.
- 84-** Sanders, P. F., & Hers, I. (2006). Vapor intrusion in homes over gasoline-contaminated ground water in Stafford, New Jersey. *Groundwater Monitoring & Remediation*, 26(1), 63-72.

- 85-** Sarilov, M. Y., Liskov, P. A., & Zhmak, M. D. (2019). Efficient Methods of Reducing Losses of Petroleum Products from Tanks. *Chemical and Petroleum Engineering*, 55(3), 230-238.
- 86-** Schnatter, A. R., Glass, D. C., Tang, G., Irons, R. D., & Rushton, L. (2012). Myelodysplastic syndrome and benzene exposure among petroleum workers: an international pooled analysis. *Journal of the National Cancer Institute*, 104(22), 1724-1737.
- 87-** Schwartz, E. (1987). Proportionate mortality ratio analysis of automobile mechanics and gasoline service station workers in New Hampshire. *American journal of industrial medicine*, 12(1), 91-99.
- 88-** Sharov, M., Levashev, A., & Mikhailov, A. (2014). The Irkutsk transportation master plan solutions for public transport system development. *WIT Transactions on Ecology and the Environment*, 190, Volume 1, WIT Press: UK, pp. 651-660.
- 89-** Smith, M. T. (2010). Advances in understanding benzene health effects and susceptibility. *Annual review of public health*, 31, 133-148.
- 90-** Speight, J. G. (2004). Petroleum Asphaltenes-Part 1: Asphaltenes, resins and the structure of petroleum. *Oil & gas science and technology, Revue IFP energies Nouvelles*, V. 59(5), 467-477.
- 91-** Squillace, P. J., Pankow, J. F., Korte, N. E., & Zogorski, J. S. (1997). Review of the environmental behavior and fate of methyl tert-butyl ether. *Environmental Toxicology and Chemistry: An International Journal*, 16(9), 1836-1844.
- 92-** Statistics Canada. (2009). Gasoline Evaporative Losses from Retail Gasoline Outlets Across Canada, 2009, (613).
- 93-** Statistics Canada. (2012). Gasoline evaporative losses from retail gasoline outlets across Canada 2009. *Environment Accounts and Statistics Analytical and Technical Paper Series*.

- 94-** Talbott, E. O., Xu, X., Youk, A. O., Rager, J. R., Stragand, J. A., & Malek, A. M. (2011). Risk of leukemia as a result of community exposure to gasoline vapors: a follow-up study. *Environmental research*, 111(4), 597-602.
- 95-** Terrés, I. M. M., Miñarro, M. D., Ferradas, E. G., Caracena, A. B., & Rico, J. B. (2010). Assessing the impact of petrol stations on their immediate surroundings. *Journal of environmental management*, 91(12), 2754-2762.
- 96-** Terry, P. D., Shore, D. L., Rauscher, G. H., & Sandler, D. P. (2005). Occupation, hobbies, and acute leukemia in adults. *Leukemia research*, 29(10), 1117-1130.
- 97-** The Ministry of Energy of the Russian Federation. (2012). Technological losses of raw hydrocarbons during production, technologically related to the adopted scheme and technology of field development, orders of December 30, 2011 No. 637 and March 15, 2012 No. 107. for (2011 – 2012).
- 98-** Thomas, V. M. (1995). The elimination of lead in gasoline. *Annual Review of Energy and the Environment*, 20(1), 301-324.
- 99-** Tronov, V., P., Krivonozhkin, A., B., Kalinina, L., M. (1989). Kateeva, Kh. H. The effect of gas recirculation on the loss of petroleum hydrocarbons from tanks. M.; Nedra, **Oil industry**. - № 9.
- 100-** U.S. Environmental Protection Agency (**U.S. EPA**). (2015). Fuel oxygenates (MTBE, TBA, and ethanol).
- 101-** Vainiotalo, S., Peltonen, Y., Ruonakangas, A., & Pfäffli, P. (1999). Customer exposure to MTBE, TAME, C6 alkyl methyl ethers, and benzene during gasoline refueling. *Environmental health perspectives*, 107(2), 133-140.
- 102-** van Wijngaarden, E., & Stewart, P. A. (2003). Critical literature review of determinants and levels of occupational benzene exposure for United

States community-based case-control studies. *Applied occupational and environmental hygiene*, 18(9), 678-693.\

- 103-** Wallace, L. A. (1989). The exposure of the general population to benzene. *Cell biology and toxicology*, 5(3), 297-314.
- 104-** Wang, Z., Hollebone, B. P., Fingas, M., Fieldhouse, B., Sigouin, L., Landriault, M., ... & Weaver, J. W. (2003). Characteristics of spilled oils, fuels, and petroleum products: 1. Composition and properties of selected oils. United States Environmental Protection Agency.
- 105-** Watson, J. G., Chow, J. C., & Fujita, E. M. (2001). Review of volatile organic compound source apportionment by chemical mass balance. *Atmospheric Environment*, 35(9), 1567-1584.
- 106-** Weaver, J. W., Exum, L. R., & Prieto, L. M. (2010). Gasoline composition regulations affecting LUST sites (pp. 1-37). US Environmental Protective Agency, Office of Research and Development Washington, DC 20460, 2010. Report No.: EPA 600/R-10/001.
- 107-** Wongwises, S., Rattanaprayura, I., & Chanchaona, S. (1997). An evaluation of evaporative emissions of gasoline from storage sites and service stations. *Science & Technology Asia*, 1-17.
- 108-** XXI, U. T. (2015). Reducing gasoline loss from evaporation by the introduction of a surface-active fuel additive. *Urban Transport XXI*, 146, 233.
- 109-** Yang, X., Liu, H., Cui, H., Man, H., Fu, M., Hao, J., & He, K. (2015). Vehicular volatile organic compounds losses due to refueling and diurnal process in China: 2010–2050. *Journal of Environmental Sciences*, 33, 88-96.
- 110-** Zhan N., Gao Z., Deng Y. (2018). Diffusion of vehicle exhaust pollutants in typical street canyons, 36(3), 835– 839.

- 111-** Zhou, Y., Li, C., Huijbregts, M. A., & Mumtaz, M. M. (2015). Carcinogenic air toxics exposure and their cancer-related health impacts in the United States. *PloS one*, 10(10), e0140013.
- 112-** Zhu, L., Chen, J., Liu, Y., Geng, R., & Yu, J. (2012). Experimental analysis of the evaporation process for gasoline. *Journal of Loss prevention in the process Industries*, 25(6), 916-92

المخلص:

تم استخدام طريقة جديدة لتقليل تبخر السوائل (البنزين والبتروول) عن طريق تحضير مركب جديد من المركبات الفعالة على أسطح السوائل ، والذي تم تصنيعه من تفاعل EDTA مع TBM بنسب ١ : ٤ والنتيجة تم تشخيصه طيفياً عن طريق طيف FTIR ، 1H.NMR ، 13 درجة مئوية. NMR و CHN و DMNR. والتي أكدت وأثبتت الصيغة المقترحة للمركبات الناتجة وهي (2) tetrakis (2،6-di-tert-butyl-4-methylphenyl) ethane-1،2-diybis (azanetriyl) ((2-diybis (azanetriyl) ربااعي الأسيئات. ومن خلال استخدام المركب السابق ، نجحت عملية تقليل معدلات تبخر الهيدروكربونات الخفيفة ، ومن خلال ذلك ، بأخذ تركيزات معينة من المركب المحضر أعلاه ، في تحديد وتقليل معدلات تبخر الهيدروكربونات المتطايرة من عمل البنزين والزيوت أثناء التخزين والنقل وعند درجات حرارة مختلفة (٢٠ ، ٣٧ ، ٥٠ ، درجة مئوية) لتحديد التركيز الأمثل عن طريق تحديد أقل ضغط مشبع بالبخار للتركيز المقابل ، وهو (١.٥ مجم / كجم) للمركب المحضر. مقابل البنزين والبتروول ، وقدرت نسب الاختزال (٩٥ ، ٩٢.٥ ، ٩١.٥٪) للبنزين والزيوت (٨٧.٢ ، ٨٦.٠ ، ٨٥.٦٪) ، على التوالي للدرجات الحرارية المختلفة (٢٠ ، ٣٧ ، ٥٠ درجة مئوية).



جمهورية العراق
وزارة التعليم العالي والبحث العلمي
كلية العلوم التطبيقية / هيت
قسم البيئة

تطوير طريقة جديدة للحفاظ على البيئة من تلوث أبخرة الهيدروكربونات الخفيفة من خزانات النفط والبنزين دون إضافة معدات

بحث تقم به:

**فرحان محمد فرحان، حسين ضياء كريم، إبراهيم محمود عبد الحسن، ارشد
محمود، هند جمال**

الى مجلس قسم البيئة وهو احدى متطلبات نيل شهادة البكالوريوس في
علوم البيئة

بإشراف

ا.م.د. مروان محمد فرحان

٢٠٢١م

١٤٤٢هـ