Chapter

Technologies Involved in the Demulsification of Crude Oil

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Abstract

Due to the use of enhanced recovery processes that necessitate the use of a considerable amount of water, mature petroleum reservoirs generate crude oil with huge amounts of water. The majority of this water gets emulsified into crude oil during production, increasing viscosity and making flow more difficult, resulting in production, transportation, and refining operational challenges that have an influence on corporate productivity. Natural surfactants with a strong potential to create stable emulsions are naturally mixed with crude oils. Because crudes with a high amount of stable emulsion have a lower value, the stable emulsion must be adequately processed to meet industrial requirements. As a result, basic research on natural surfactants that contribute to emulsion stability is examined in order to effectively separate emulsions into oil and water. This would need a review of various emulsification methods as well as the proper formulation for effective demulsification. The petroleum industry recognizes the importance of an efficient demulsification procedure for treating emulsions. Numerous studies on the mechanisms of emulsification and demulsification have been undertaken for decades. To guarantee optimal hydrocarbon output, effective treatment is required. The present paper is to review reported works on the formation of petroleum emulsions, demulsification treatments, and characteristics of fit-for-purpose demulsifiers as well as research trends in emulsion treatment.

Keywords: crude oil, demusification, w/o emulsion, treatment

1. Introduction

Crude oil is a type of petroleum which has not been treated yet. In general, geologists agree that over millions of years crude oil was formed out of remains of small aquatic plants and animals living in ancient seas. Brontosaurus may be cast into bits for good, but petroleum is largely owed to one-cell marine organisms. Geological history of crude oils is the one most important when its characteristics are determined; therefore, crude oils in similar marine deposits can resemble each other on different continents. However, regions characterized by different deposits of the marine environment, pressure and temperature can produce a variety of crude oil, from sweet to greenish, to black, light or heavy, waxy or not.

Water is usually found in crude oil reservoirs or injected into oil production by steam. When rising through the well and passing through the valves and pumps, water and oil can blend into relatively stable dispersions of water droplets in crude oil, usually referred to as emulsions from oil fields [1]. In combination with gas and saline-forming water, crude oil is found. As the reservoir is depleted, the amount of water produced with oil is co-produced, and the number of water supplies with crude oil is increasing steadily. The simultaneous action of shear and pressure drop on the wellhead, squash, and a valve easily emulsifies these immiscible fluids. It is produced in emulsion at 90 to 95% of the world's crude oil. Due to economic reasons and pipeline corrosion, water in oil causes many trouble; before sending oil for processing, the water needs to be separated fully from petroleum. If a [2] system contains at least two intermixable phases, they are called dispersion. The formation of a dispersed system involves a dispersed phase and a continuous flow.

Two immiscible (unbeatable) liquids are mixed into emulsion. One (the scattered) fluid is scattered into the other (the continuous phase). Many emulsions are emulsions of oil/water, with dietary fats one common type of oil found in daily life. Emulsions tend to look cloudy as the many interfaces of the phases (the interface is called the boundary) dispersion light through the emulsion. Emulsions are unstable and therefore not spontaneously formed. Emulsions tend to return to the stable state of the emulsion-related phases over time. The kinetic stability of emulsions can be greatly increased by surface active substances (surfactants), so that emulsion does not change markedly during stocking years once formed [3]. The formation of an emulsion is undeniable during the extraction and transport of crude oil. The formation occurs when the heterogeneous mix flows into the pipe valves and porous rocks and endures turbulence at high or high temperatures. The principal reasons for improving emulsion are the existence of water surface-active agents, ionic compositions and pH [4].

Transporting and manufacturing companies do not receive emulsions because it is highly capable of producing a stable composition, unless well treated, leading to many problems, especially in the process of refining. During the extraction of crude oil, many fighting can be brought together for an inscription [5].

- Formation of flow lines of high pressure drops. Increased water–oil mixture pumping and transport costs via the pumps and pipes.

- Disposal of pipeline and equipment for production (due to two-phase flow and presence of chloride ions in the aqueous phase).

- Corrosion and scaling escalation (due to the salt content in the formation of water).

- Separator equipment tripping in gas/oil separator plants (GOSPs) that reduce the quality of crude oil exported.

- Reduction of the gravity of the oil API.

- Disposal of downstream catalysts for processing plants.

- Improvement of crude oil viscosity (due to small dispersed water drops).

The primary elements of crude oil may be divided into four: saturates, including waxes, aromatic materials, resins, and asphalt, known as SARA fractions. The raw oil is classified in a solvent according to its polarity and solubility. Demulsification is the division into oil and water of a crude oil emulsion. In distillated piers, heat exchangers and reboilers, emulsions can cause problems of corrosion and under deposits. Commercial processes include settling, heating, distillation, centrifuge, electrical processing, chemical therapy and filtration. In combination, this separation technology can be used to ensure optimal results.

Many of the oilfield researchers are concerned about the stability of crude oil emulsions, inventing various efficient and relevant techniques to cut it off. The demulsification process has grown in importance because the development of viscous emulsions of oil, water and clay complicate use of steam and caustic injections or combustion processes for in situ heavy oil recovery.

In the petroleum industry the origin of the emulsion from the oilfield reservoir has become a complex problem. Strengthening future requirements for the best petroleum quality requires impressive and intensive development efforts to improve emulsion demulsification mechanisms. According to [5] Kokal and Aramco (2005), Rough oil is seldom produced on its own. It usually is produced from water, which in the production process creates several complications. The water can produce two ways. The water may be produced as free, immediately settling water, or emulsion formation due to the presence of the water.

2. Classification of oil emulsions

Three main types of emulsion that are common in the petroleum industry are the emulsions of water in oil (in which the water phase is dispersed in continuous petroleum), oil in water (in the continuous water phase) and multiple emulsions (**Figure 1**). Thermodynamically unstable, but also cinemically stable, these types of emulsion may last forever or even for a long time [5]. Emulsions are divided into three classes based on their kinetic stability: loose, medium and tight emulsions. They differ in their separation rates when the loose emulsions are separated in a couple of minutes and the water is occasionally discussed as free water. In 10 minutes, medium emulsions are to be separated. Tight emulsions however take longer than days, weeks or even completely separate as such to separate.

2.1 Water-in-oil emulsions

The most significant interest was given to water-in-oil emulsions during crude oil production. These emulsions must be divided into two stages to meet the transport requirements of crude oil and must be sent to refineries. Water in

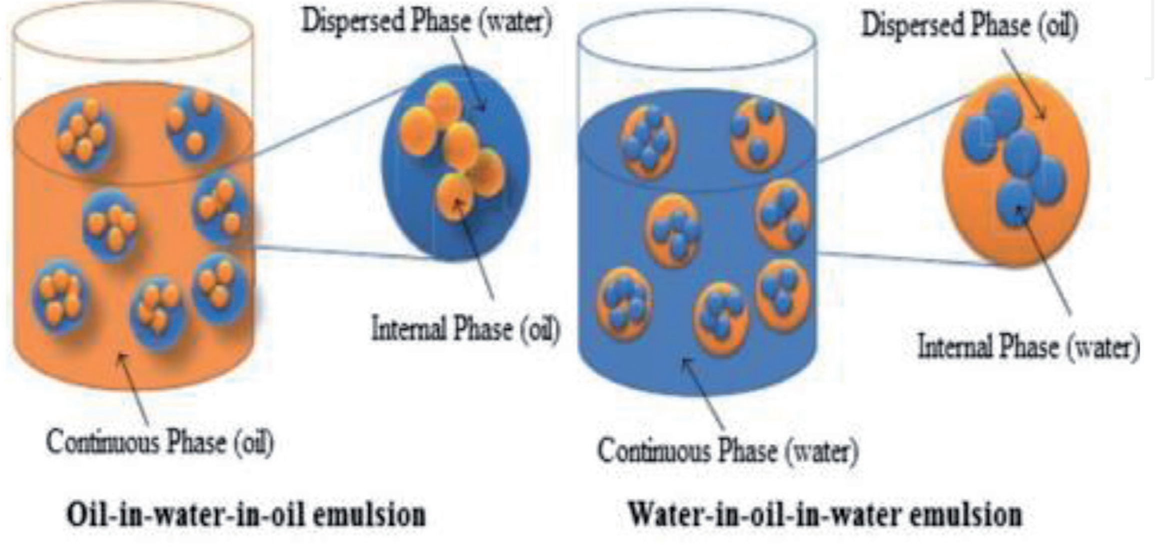

Figure 1.
Types of emulsion.

oil emulsion is commonly known as regular emulsion, often called "chocolate mousse" or "mouse" while oil in waters emulsion is referred to as reverse or reverse. Some 95% of the world's crude oil produced the emulsion water in oils. It tends to separate into the formation of water droplets throughout the continuous oil phase. During manufacturing, an adequate mixing of emulsifiers/surfactants added to the crude oil volume leads to corrosion in the pipelines and increasing transport costs and refining costs. The crude oil viscosity is one of the important parameters in transport. Droplet size distribution affects the emulsion viscosity, since the smaller the droplet size, the higher the viscosity and stability of the water-in-oil emulsions [6]. The water emulsion in oil is formed when certain raw oils are mixed with water (which has their natural salt, NaCl) and when droplets are produced of water spread through the oils. Wind or wave turbulence supplies the mixing energy required to form emulsions in the ocean.

2.2 Oil-in-water emulsions

A "reverse" emulsion is said to be the oil-in-water (O/W) emulsions. Usually O/W emulsions will be identified during the water phase of the oil droplets. In 1994 Porter disclosed that the stabilization and adsorption of an emergency surfactant is more effective in the continuous phase when the surfactant is more soluble. For the formation of O/W emulsions, it consists of two stages: water and oil. The oil phase appeared as globules at a continuous water phase and the surfactant structure (hydrophilic head and hydrophobic tail) are considered to be a soluble type for oil surfactants. Water surfactant is more effective in the case of W/O emulsions.

2.3 Multiple emulsions

The structure of several emulsions is more complicated and contains small droplets suspended in large droplets, which are continuously suspended. For example, water-in-oil-in-water emulsions include small water droplets that are suspended in larger oil droplets during a constant water period [7]. It is possible to separate multiple emulsions into two classes: water in oil and water emulsions (W/O/W), and oil in water emulsions (O/W/O). Emulsions (W/O/W) are composed of oil globules dispersed in water droplets. Meanwhile, (O/W/O) emulsions consist of water globules dispersed in oil droplets. The intermediate state of these several emulsions is when simple emulsions undergo transformations from W/O emulsions to O/W emulsions.

3. Demulsification of crude oil

Demulsification is the breakdown of the emulsion into its incompatible individual phases, particularly water and oil. In petroleum industries, the demulsification process is very important, where emulsions occur almost always either naturally or consciously (man made emulsions). Before oil refining, water is to be separated from crude oil in the petrochemical industries and refineries. Emulsion breakers are currently used in large numbers as chemical additives to break the emulsion of water in oils. In terms of technology, the resistance to and response to demulsification technologies such as thermal, mechanical, electrical or chemical emulsions of a w/o emulsion mainly depends on the physico-chemical structure of the oil they are formed from, emulsification, and aging conditions. The effort and strategies for optimizing the demulsification of w/o can therefore vary from one oil field to another [8]. The emul sions must be separated into water and oil phases in several

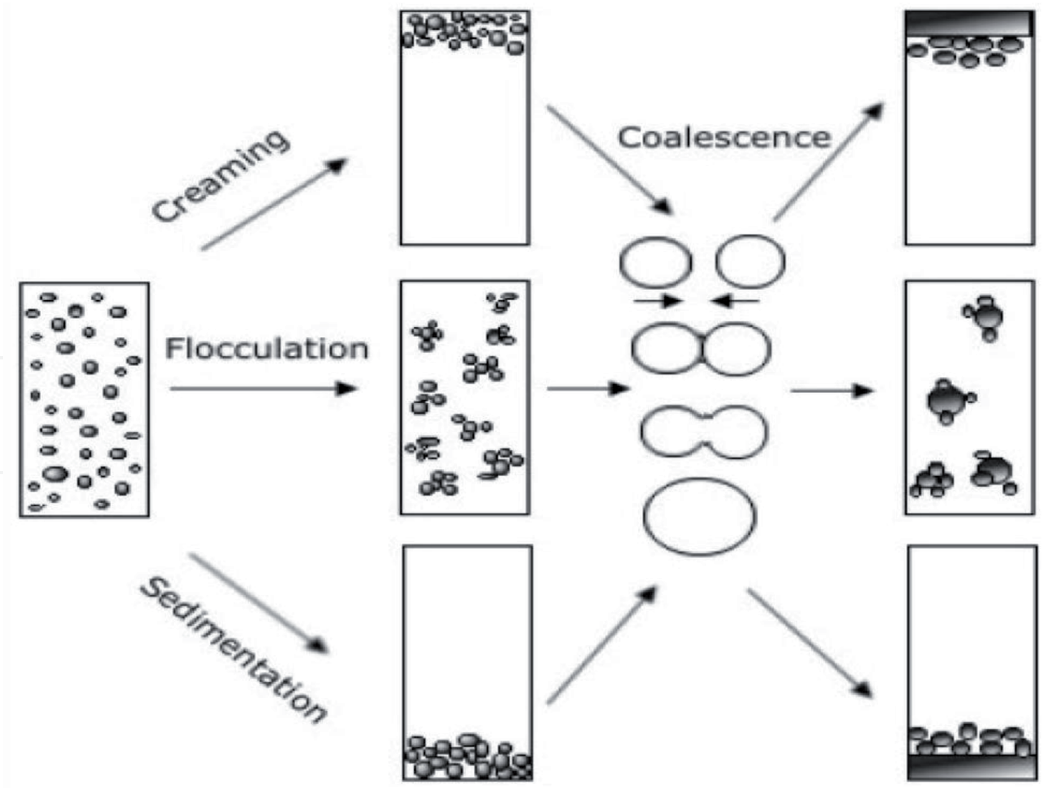

Figure 2.
Process of demulsification of crude oil.

stages during the process of demulsification. Creaming and sedimenting, flocculation, eastwald ripening, coalescence are the mechanisms involved in this process which shown in **Figure 2**.

3.1 Creaming and sedimentation

The difference in density between water and oil is responsible for both sedimentation and creaming; that is, the density of water is higher than oil. Sedimentation is an important mechanism for the demulsification of crude oil and is characterized by water droplets on the ground of the continuous oil phase of an emulsion settling. The growth of oil droplets on the water surface is instead a creaming process. Whether sedimentation or creaming takes place depends, therefore, on whether the dispersed phase is water or oil [9].

3.2 Flocculation

During flocculation the droplets of the water in crude oil emulsions are aggregated or flocculated together. The flocculation rate depends on a number of factors, such as the emulsion's water content, emulsion temperature, oil viscosity, the difference in oil/water density, and the electrostatic field [10].

3.3 Ostwald ripening

Ripening of the east forest is another process that demulsifies the crude oil. Ripening in the Eastwald is the process through which the volume drops. The process takes place as soon as in the continuous phase the dispersed phase has a finite solubility, which causes drops of varying sizes to migrate. In large fractions, faster growth generally occurs because the drops are easier to swap materials.

The solubility of oil in water or water in oil is low for heavy oil, which slows down growth processes. The decline of growth through Ostwald maturation plays a crucial part in stabilizing emulsions from oil into water [11].

3.4 Coalescence

Coalescence is a crucial step in the demulsification of crude oil and an irreversible process by which water droplets merge into or fuse into a larger process. The coalescence process often results in fewer droplets of water. The emulsion of crude oil is permanently demulsified [12]. Factors such as a high flocculation rate and lack of mechanically strong films, high interfacial tension and water cutting, low interfacial speed and high temperature are necessary for an efficient coalescence [13].

4. Techniques involved in the demulsification of crude oil

Increased temperature, centrifuge, electrical techniques, high resonance time, and chemical treatment separation increase destabilization of crude oil emulsions. The Many demulsification approaches have been found to achieve this, and numerous parameters, including the distribution of the droplet size, dosage and drainage rate, emulsion viscosity/demulsifier type and temperature [5]. The techniques like Chemical, biological, mechanical, Thermal, centrifugal, freeze/thaw, and ultrasonic membrane techniques electric and microwave demulsifications.

4.1 Chemical demulsification

One of the most important techniques of water in-oil emulsification is chemical demulsification and it is widely applied in the petroleum industries. A demulsifier is a surface-active compound so that the demulsifier moves to an oil–water interface and breaks the film rigid, which causes the water droplets to coalesce. In principle, a huge quantity of surfactants can be prepared just through the manipulation of surfactants in a commercial polymer surfactant long chain by changing accepters, compounds, amounts and sequences [14]. The basic element of the chemical demulsification mechanism of any type of emulsion is the gradual replacement of demulsifiers within the water oil film and eventually causing tremendous changes to the interface viscosity and elasticity [15]. Optimal interruption of the emulsion of crude crude oil by demulsifiers requires careful selection of the chemicals for a given emulsion, an appropriate amount of the chemicals and an appropriate mix of the chemical in an emulsion which represented by **Figure 3**. In addition, the emulsion could be resolved completely by adding heat, electric grids and coalescers [16].

In comparison with the emulsion of heavy raw oil, the surfactant formulated was found to be more effective in demulsifying the medium raw oil emulsion. This difference was attributed to the efficiency of the surfactant because the medium crude oil contains less asphalt than heavy crude oil. In a follow-up study, [17]. Examined the effect on the demulsifying efficiency of W/O emulsions of five demulsifying agents formulated from different polymer ratios. The results showed that the efficiency of water separation increased with increased molecular weight. Calcium chloride was used in demulsifiers used for the demulsification of superheavy petroleum with cationic poly(dimethylamine co-epichlorohydrine) (PDcE) and cationic polyacrylamine (CPAM) [18]. The optimum formulation of the demulsifier with a PDcE/CaCl2/CPAM ratio of 20:600:1,2 (m/m) resulted in effective separation between heavy oil emulsions of mineral oil (98.04 per cent). Contrary to the work of Tonget et al., they have been used as demulsifying medium

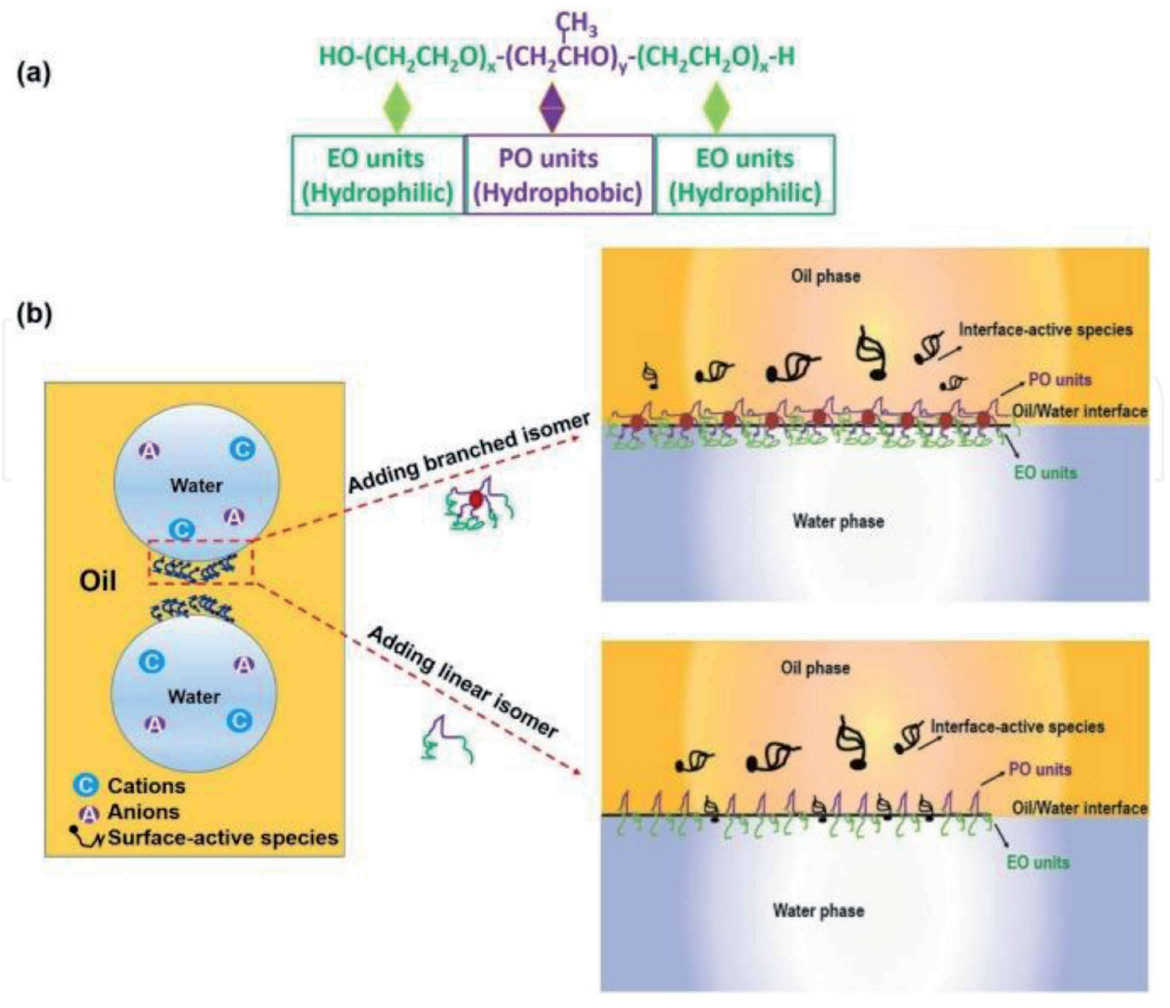

Figure 3.
Chemical Demulsification of crude oil.

for the demulsification of super-heavy crude oil as a series of ionic liquids, such as trioctyl methylammonium [TOA]+]- and ammonium salt [OCD] + [Y]—. Use from [TOA] + [Y]-species of the Ionic Liquid has achieved an efficiency in water extraction of 95 percent. An ionic demulsifier at a concentration of 900 mg/L and resulted in a dewatering efficiency of 89.5 percent. Polymers, such as alkene oxides diester, ethicellul, formulated demulsifiers [19]. Variation at polymer demulsifier concentration has often led to different degrees of demulsification efficiency, and at 97.5 percent the highest demulsification effectiveness recorded with the help of a polyester-based demulsifyer within 45 minutes of the demulsification process. Likewise, a high demulsifying efficiency of 95–99.98 percent was demonstrated in magnetic chemical demulsifiers such as magnetic graphene oxides, januus magnetic submi-cron parts, oleic acid coated magnetite nanoparticles, and alginate [20]. Based on the results of the analysis of range and the relationship between the factors and oil concentration, demulsifying dosage > flocculant dosage > set time > stirring time > intensity of movement were found and optimal conditions for demulsifi-cation-flocculation were optimized successfully. The toxicity and nonbiological degradability of chemical substances can be controlled by the use of biodemulsifiers generated by micro-organisms in the water extracted during demu lsification.

4.2 Biological demulsification

A biodemulsifier has features leading to the destabilization of the crude oil emulsion. Biodemulsifiers are environmentally friendly and do not cause secondary pollution to be used. Biodemulsifiers can function effectively under extreme conditions and can be used for different constituents of complex emulsions of crude oil. In different environments the effectiveness of each bacterial isolation varies greatly from the elements of temperature, soil properties, contaminant type and amount, and the ability to demulsify. *Pseudomona aeruginosa* MSJ isolated for the biodemulsification of W/O and O/W emulsions from oil-contaminated soil. *Alcaligenes sp*. Demulsifying (S-XJ-1) for bio-demulsification of an E/O emulsion, bacterial strain isolated from petroleum-contaminated soil. With a cell concentration of 500 mg/l they achieved 81.3% demulsifying efficiency within 24 hours. It is apparent that organisms or products such as *Alcaligenes Sp.* S-XJ-1, *Rhamnolipids*, ARN63, *Candida sphaerica* UCP 0995 and *Paenibacillus alvei* have been used as demulsifying agents, isolated from various sources of oil-contaminated environments [21].

4.3 Mechanical demulsification

A series of machines such as a free-water knock-out drum, a 2- and three-phase (low and high-pressure trap), desalting tanks and settlement tanks can be used for the mechanical demulsification of raw oil emulsions. When relative large goutlets are present in the emulsion of crude oil, the flow rate is usually reduced and gravitational forces are used to separate oil, water and small suspended goutlets. Usually, they are present in high volume desalters or separators over the shortest period of time. By concentrating oil traces on the separator, the velocity of the oil separation increases. Normally, when the mixture is very high, the oil in the separator is separated. The centrifuge is one of mechanical equipment rarely used for demulsification as the capital cost and capacity of the centrifuge is high. Emulsions sediment by gravity in a gravity deposition tank separate oil from water. The dispersed-phase droplets are reproached and coalesced when the emulsion is sediment. A centrifugal contactor can be combined with a gravity settling tank for efficient demulsification, as reported by Krebs et al.who studied the demulsification kinetics of an emulsion O/W model in a centrifugal field to imitate the force acting on emulsion droplets on O/ W separators. The study focused mainly on the growth rate of the separate oil stage and on the variation in the mean emulsion layer droplet diameter in terms of centric acceleration and time.

4.4 Thermal demulsification

The use of temperature for petroleum emulsions is referred to in thermal treatment. Conventional hot plate is used for optimal temperature in laboratory scales. In addition to the fact that some researchers have treated the emulsion by reducing the temperature to more than a point of freezing and then gradually increasing the temperature, this is called a freeze/taw method. Paraffinic petroleum emulsions could break down faster than high asphaltene oil emulsions. The emulsion could be broken slowly, but the separation rate had increased after the addition of chemicals. In fact, the chemical demulsifiers had better be placed at 10°C for viscous emulsion while the demulsifiers should be added after heating up the emulsion for the very viscous emulsion. Emulsion formed from the residues of the distillation could also be broken with moderate heating, while diesel oil did not break up at high temperatures. The viscosity also diminishes as emulsion breaks down. Chantal et al. employed the techniques of insitu emulsion burning to treat emulsions in oil spills. Their emulsion was real emulsion from the scheme. Little samples were placed in a centrifugal bottle and cooled to frost, then thawed back to certain temperatures. The volume of water removed from the emulsion was measured by the centrifugal tube scales (sample holder). It has been found that demulsifying emulsion from water into raw oil strongly depends on certain parameters, including original water, temperature freezing, freezing period as well as temperature and speed of thawing. The optimal freezing temperature for the oil sludge taken from oil used was around −40°C [22].

4.5 Electrical demulsification

The technology of electric demulsification in the industry gains wide acceptance as a technological path toward crude oil demulsification. The technological advantages include low sludge production, simple appliances and a lack of chemical agents [23]. For consumables that are in contact with crude oil emulsions during electrical demulsification, an electric current is typically applied to a dose of the in situ coagulation resulting in an in situ dose. The dose of coagulants helps to disrupt the repulsive charges of the surfactant molecule, which in turn allows oil droplets to be trapped and forms larger flowers that can be separated easily from water (**Figure 4**). The application of an electric field during electrical demulsification frequently leads to the polarization of droplets and drops can align in chains parallel to the field applied as a result of the interaction between the inducing dipoles. Though the method for adapting the technical to various emulsions with varying properties is considered a substitute for thermal and chemical demulsification.

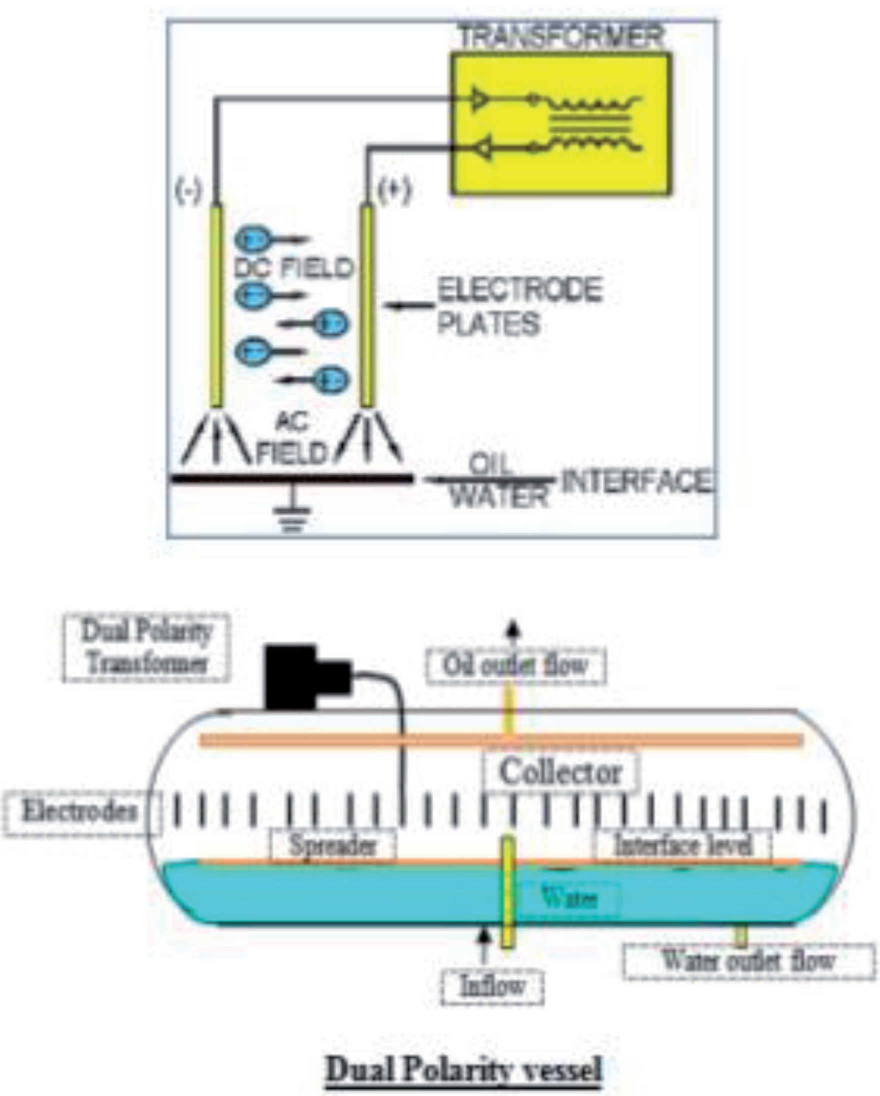

Figure 4.
Electrical Demulsification of crude oil.

With the direct current fields, the demulsification rate of W/O emulsions in direct current areas increased by the water separation rate. The authors concluded that the demulsification of raw oil emulsions was based on the magnitude and type of electrode of the electric field used [24]. Although electrical derogation has succeeded in the treatment of various industrial effluents from the manufacture of paints and oilfield-produced water for different industrial processes, the focus of research is still on increasing the efficiency of the process.

4.6 Ultrasonic demulsification

The ultrasound makes it easier to clump droplets into the crude oil, thereby making the separation of oil–water phases easier. The simplicity and effectiveness of the ultrasound demulsification used on crude oil emulsions have drawn more and more attention from research. The acoustophoresis phenomenon influences the scattered droplets in an ultrasonic standing wave field during ultrasound demulsification. The variation in density and compression of the spread droplets and the continuous phase can lead to a uniform combination of the acoustic standing wave [25]. More than one study shows that ultrasound energy is used to demulsify crude oil emulsions. The effect on the efficiency of demulsification by parameters like the input of irradiation and irradiation time, temperature and injected water. The interaction among the parameters resulted in the greatest efficiency of demulsification (99.8 percent) with an optimal capacity of 57.7 W, irradiation time of 6.2 min and temperature of 100μc. A further study focused on the effect of the demulsification of crude oil emulsion by two ultrasound irradiations - primary and secondary. The results showed that irradiance of 75 W was decreased for primary radiation and 50 W was decreased for secondary irradiation at 45 s for irradiation. The use of the low-frequency ultrasound for demulsification of crude oil emulsions is becoming increasingly important. In the absence of a chemical emulsifier, [26] studied the effect of a low frequency ultrasound on demulsification from raw oil emulsions.

4.7 Membrane demulsification

The membrane demulsification of emulsions of crude oil is based on a tendency to move the spreading phase into the continuing phase via a membrane. The use of membrane technology in the demulsification of crude oil emulsions is an economic and effective way to demulsify the emulsions of crude oil. Several studies on the application of membrane technology to demulsify raw oil emulsions have recently been published. The effect of membrane surface charge on crude oil demulsification and fouling resistance was investigated. For the demulsification process two membranes were used, PP-g-pDMAEMA and PP-g-pOEGMA. In water, the membranes showed positive and negative surface loads. In comparison with the use of PP-g-pOEGMA, the efficiency of demulsification increased by 15%. PP-g-pDMAEMA. The authors concluded that the positive charge for the membrane surface increased the demulsification of crude oil. The membrane damage was however exacerbated following demulsification [27]. The membrane has excellent stability because, after several applications, efficiency has not decreased visibly. A similar study, by [24] was carried out with a nylon membrane modified for the demulsification of emulsion from crude oil, as thermosponsive poly(N-isopropylacrylamide) (PNIOAAm). A rough structure, appropriate pore size and thermal responsiveness, the fabricated membrane is able to separate 16 different types of stabilized O / O and W / O crude oil at different temperatures. The membrane was capable of separating any type of crude oil emulsion at a temperature of approximately 25 μC. In contrast, the membrane showed high hydrophobicity and superoleophilicity at a temperature of about 45 / c which can only be used for separation.

4.8 Microwave demulsification

The microwave is known as the electromagnetic spectrum of 300 Mhz to 300 GHz. The electrical and magnetic properties of the microwave. Thus, the applied field induces a multi-polarization effect on the medium when projected to the material, according to the transmission, absorption and reflexing rules, depending on the medium properties. The width of the wave varies between 1 mm and 1 m according to the above frequency (300 MHz to 300 GHz). In addition to heating and scientific research, some frequencies, including mobile, radar and television communication, are for specific purposes reserved for the Federal Communications Committee. However, for industrial, scientific and medical purposes the frequency used the most frequently is 915 MHz and 2450 MHz, with 915 in this research. Due to its volumetric heating, the microwave is often preferred in material processing over its conventional counterpart. The heating mechanism in conventional heating takes place by diffusing the heating material from its surface into the bulk. While, in the case of microwave heating, a temperature gradient is almost invariant at different locations in the sample, an important other phenomenon is that a different material has various heating patterns because of the variation in the absorption capacity of the material, which in turn depends on dielectric properties (**Figure 5**). Emulsion was first treated by Wolf via microwave, who initially began the concept of demulsifying the microwave. The emulsion effectiveness of the microwave was shown to induce some impact on the treated emulsion as the temperature increase leads to reduced viscosity, which would increase water droplets' mobility, which can neutralize the zeta potential of the dispersed droplets in turn, and also break the link between hydrogen and molecules of surfactant water. In addition the electromagnetic wave is expected to increase the water droplets' internal pressure, which leads to reduced thickness of the film interface and charges of water droplets free to move toward each other, and downward by gravitational force [28]. The advantage of using microwave energy over its conventional counterpart is that the sample heats better than conventional heating, although local overheating may in some cases cause the sample to hotspots or heat flushes. Crude oil contains large numbers

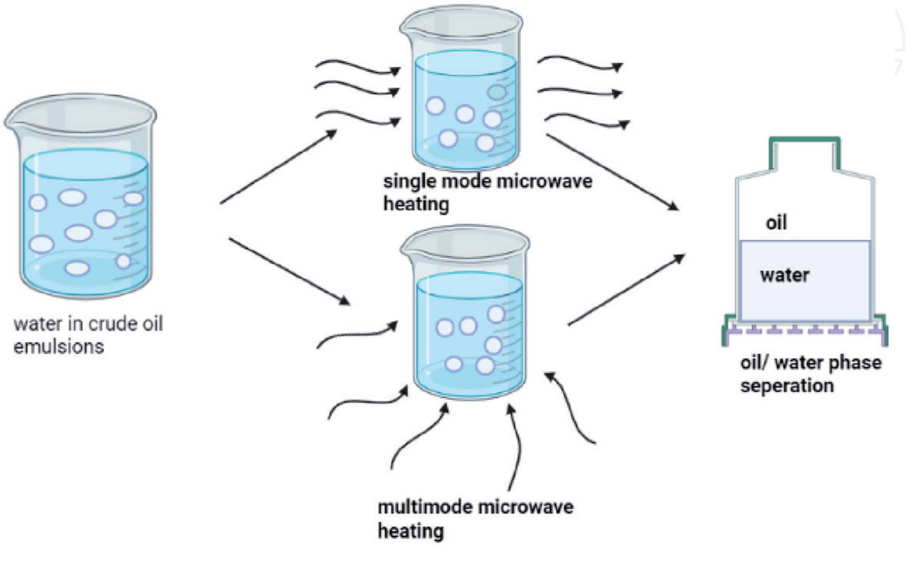

Figure 5.
Oil/ water Seperation by microwave heating.

of components with a difference of conductivity and polarity, and the main and main charge-bearing component is asphalt [29].

5. Conclusion

Demulsification by chemical, biological, mechanical, mechanical, thermal, electrical, ultrasonic, and membrane technologies of crude oil emulsions is investigated. It should be noted that each of these techniques depends on its operational parameters and interplay. In addition, the use of synergistic effects by combining one or more of the techniques discussed in the present review could achieve a more effective demulsification process. The efficiency of separation and the rate of demulsification are the main factors of interest in most demulsification techniques. During processing and transport, the occurrence of crude oil emulsions has proven problematic by increasing the cost of production and the use of chemicals that affect the environment. These facts in the petroleum sector have attracted the interest of scientists who are seeking to identify scientific ways to monitor and prevent the formation of raw oil emulsion. A positive demulsification technique therefore is not only robust and applicable to various types of emulsions, it must also be respectful of the environment with minimum environmental impacts, respect for environmental standards and regulations and at lower cost. Recent literature shows that a correct understanding of the properties and types of crude oil involved in the formation or demulsification of emulsions (O/W or W/O) will help to formulate appropriate methods for demulsifying emulsions. It is apparent from the overview of recent studies that different techniques for demulsifying raw oil emulsions vary in efficiency and effectiveness. But the effect of viscosity on the demulsification process was not taken into account by most researchers. Furthermore, most of the crude oil demulsification scenarios are based on laboratory experiments. In field cases or on-site crude oil demulsification cases, there is scarce literature. Therefore, research should be aimed at proposing, at site with real operating parameters used in crude oil treatment plants in small scale or on the pilot scale.

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