International Science and Technology Journal
المجلة الدولية للعلوم والتقنية

Volume 35 العدد
Part 1 المجلد
October 2024 اكتوبر

المجلة الدولية للعلوم والتقنية
International Science and Technology Journal
ISTJ

تم استلام الورقة بتاريخ: 6 / 10/2024م وتم نشرها على الموقع بتاريخ: 30/ 10/2024م

Optimization of Demulsifier Effectiveness DMO86416 for Water Separation from Crude Oil
"A Case Study in Amal Field, Libya"

http://www.doi.org/10.62341/akho1849

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Abstract

Crude oil, a vital natural resource composed of a complex mixture of hydrocarbons, is essential for producing fuels like gasoline and diesel. However, the formation of oil-water emulsions presents significant challenges in oil production, particularly in Libya, leading to increased processing costs and equipment corrosion. This study focuses on a novel chemical demulsification approach implemented in the AMAL field of the Harouge company, utilising the demulsifier DMO86416 to effectively separate water from crude oil. Systematic adjustments in operational parameters, including temperature, mixing time, andchemical concentration, were optimized to enhance product quality and reduce costs. Notably, the application of DMO86416 resulted in a remarkable 46% reduction in chemical consumption at Station 3, decreasing from 1.12 barrels to 0.52 barrels per thousand barrels of oil. Improvements in separation efficiency were observed across multiple stations, underscoring the significance of this work in optimising oil production processes and minimizing environmental impact.

Keywords: Crude oil, chemical demulsification, oil/water, DMO86416.

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تحسين فعالية مادة إزالة الاستحلاب DMO86416 لفصل الماء عن النفط الخام: دراسة حالة في حقل أمال، ليبيا

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الملخص

النفط الخام، وهو مورد طبيعي حيوي يتكون من خليط معقد من الهيدروكربونات، ضروري لإنتاج الوقود مثل البنزين والديزل. ومع ذلك، فإن تكوين المستحلبات النفطية المائية يمثل تحديات كبيرة في إنتاج النفط، لا سيما في ليبيا، مما يؤدي إلى زيادة تكاليف المعالجة وتآكل المعدات. تركز هذه الدراسة على إزالة المستحلبات الكيميائية وتم تطبيقها في حقل أمل التابع لشركة الهروج، باستخدام مادة إزالة المستحلبات DMO86416 لفصل الماء عن النفط الخام بشكل فعال. تم تحسين التعديلات المعايير التشغيلية، بما في ذلك درجة الحرارة ووقت الخلط وتركيز المواد الكيميائية، لتعزيز جودة المنتج وتقليل التكاليف. من الجدير بالذكر أن أستخدام DMO86416 أدى إلى تقليص استهلاك المواد الكيميائية بنسبة 46% في المحطة (3) ، حيث انخفض من 1.12 برميل إلى 0.52 برميل لكل ألف برميل من النفط. تمت ملاحظة تحسينات في كفاءة الفصل عبر عدة محطات، مما يبرز أهمية هذا العمل في تحسين عمليات إنتاج النفط وتقليل التأثير البيئي.

الكلمات المفتاحية: النفط الخام ، ازالة المستحلب كيميائياً ، النفط / الماء، DMO86416.

1. Introduction

Geologists believe that crude oil, which is untreated petroleum, formed over millions of years from the remains of tiny aquatic organisms that lived in ancient oceans. While larger fossilized

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creatures like dinosaurs often get attention, these microscopic organisms are key to petroleum's formation. The geological history of the rocks that create crude oil is vital for understanding its properties, which is why similar marine deposits on different continents can produce crude oils with comparable characteristics. Different geological conditions, such as the type of marine deposits, pressure, and temperature, can lead to various crude oil types, each with unique traits in flavor, color, density, and wax content.Crude oil reservoirs usually contain water, either naturally or from steam injection during production. As oil moves up through production wells and interacts with valves and pumps, it can mix with water to form emulsions, which are stable mixtures [1].Emulsions account for about 90 to 95% of global crude oilproduction. However, the presence of water in oil creates significant challenges for profitability and pipeline safety, making it essential to completely separate water from oil before processing [2].Typically, emulsions consist of oil and water, and their multiple surfaces scatter light, giving them a cloudy appearance. Although emulsions are generally unstable and tend to separate over time [3], they often remain intact due to the addition of surfactants, which can stabilize them and prevent significant changes during storage. The formation of emulsions occurs primarily during the extraction and transportation of crude oil, driven by turbulent flow and variations in temperature and pressure in pipelines and porous rocks. Factors such as water content, surfactants, ionic composition, and pH levels significantly affect emulsion stability [4]. Consequently, transportation and processing companies typically avoid handling emulsions unless they are properly treated, as their instability can lead to operational issues. The challenges posed by emulsions in crude oil production are multifaceted; they can result in pressure drops that hinder flow, increase costs associated with the extraction and transportation of water-oil mixtures, and cause damage to pipelines and equipment due to two-phase flow and corrosive agents like chlorine ions. Additionally, high salt content in formation water can lead to corrosion and scaling, while quality issues in crude oil may arise from malfunctions in separation equipment, ultimately impacting

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API gravity and complicating catalyst removal in processing plants. The increased viscosity of crude oil due to dispersed water droplets further complicates effective transportation and processing, underscoring the various challenges that emulsions present in crude oil production.

The main components of crude oil can be categorized into four groups known as SARA fractions: saturates including (fats, aromatics, resins, and asphaltenes). The oil's polarity and stability help determine its classification. Demulsification is the process of separating oil from water. Emulsions can create significant problems in distillation, heat exchange, and reboiler operations due to corrosion and deposits. Various industrial techniques for demulsification include heating, distillation, centrifugation, electrical processing, chemical treatment, and settling, often used together for optimal results.

Researchers in the oil industry are focusing on improving methods for removing water from crude oil emulsions. The rise of viscous emulsions containing oil, water, and clay complicates heavy oil recovery techniques like steam injections. This issue has become increasingly important, especially as the demand for high-quality oil continues to grow [5].water often accompanies crude oil production, complicating the process further. This water can either settle quickly or contribute to the formation of emulsions.

This study concentrated on optimizing the formulation of the demulsifier DMO86416 for the efficient separation of water from crude oil emulsions at Libya's AMAL field. We conducted a thorough analysis of the chemical demulsification process, assessing its efficacy prior to and during optimization. We sought to diminish chemical usage and improve separation efficiency by examining the effects of DMO86416 on multiple operational parameters. The results show significant improvements in the demulsification process, particularly at Station(3), where thechemical usage dropped by 46%, from 1.12 barrels to 0.52 barrels per thousand barrels of oil. Furthermore, we noted improved separation efficiency at various stations, suggesting that the optimized formulation of DMO86416 enhances the overall quality of crude oil while simultaneously mitigating environmental impacts by decreasing waste and operational expenses. Our findings indicate that this optimized demulsifier has the capacity toaddress the issues of emulsion stability and processing efficiency in the oil sector, therefore promoting more sustainable productionpractices.

2. Classification of Oil Emulsions

In the oil industry, emulsions are classified into three main types: water-in-oil where (water droplets are dispersed in oil), oil-in-water where (oil droplets are dispersed in water), and multipleemulsions (which contain both types) as shown in Figure (1). However, these emulsions are thermodynamically unstable

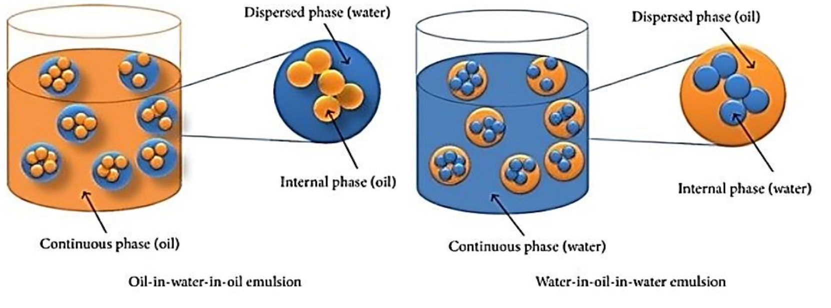

Figure 1. Types of emulsion

2.1 Water-in-oil emulsions

The demarcation of water-in-oil emulsions into dual phases for conveyance to refineries is essential in crude oil extraction. These emulsions are commonly termed standard emulsions or chocolate mousse. Water-in-oil emulsions account for approximately 95% of global crude oil consumption. In these emulsions, water droplets develop within the continuous oil phase. Inadequate blending of emulsifiers or surfactants with crude oil may result in pipeline damage, thereby elevating transportation and refining expenses. The droplet size in the emulsion affects the viscosity of crude oil, impacting its transportability; smaller droplets result in increased viscosity and enhanced stability. The combination of specific oils with saline water (sodium chloride) leads to the creation of water droplets and a water-in-oil emulsion [6]. In the ocean, wind and wave turbulence supply the energy required to generate these emulsions.

2.2 Oil-in-water emulsions

Oil-in-water (O/W) emulsions are referred to as reverse emulsions. O/W emulsions are typically identified, the presence of oil dropletsdispersed in water.

In 1994, Porter revealed that the stabilization and adsorption of an emergency surfactant are more efficient in the continuous phase when its solubility is higher. The creation of O/W emulsions consists of two phases: the aqueous phase and the oily phase. The oil phase appears as globules in a continuous water phase, whereas the surfactant structure, comprising a hydrophilic head and a hydrophobic tail, is classified as a soluble type for oil surfactants. Water surfactant has greater efficacy in the context of W/O emulsions.

2.3 Multiple emulsions

Numerous emulsions possess a more intricate structure, featuring small droplets perpetually suspended within larger droplets. Water-in-oil emulsions consist of minute water droplets floating within larger oil droplets during a continuous water phase [7]. Multiple emulsions can be categorised into two types: water-in-oil (W/O) and oil-in-water (O/W) emulsions. Emulsions (W/O/W) consist of oil globules distributed within water droplets. O/W/O emulsions comprise water globules suspended within oil droplets. The transitional phase of these emulsions occurs when simple emulsions convert from water-in-oil (W/O) to oil-in-water (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 usually 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 emulsions must be separated into water and oil phases in several stages during the process of demulsification. Creaming and sedimenting, flocculation, eastwald ripening, and coalescence are the mechanisms involved in this process which shown in Figure (2).

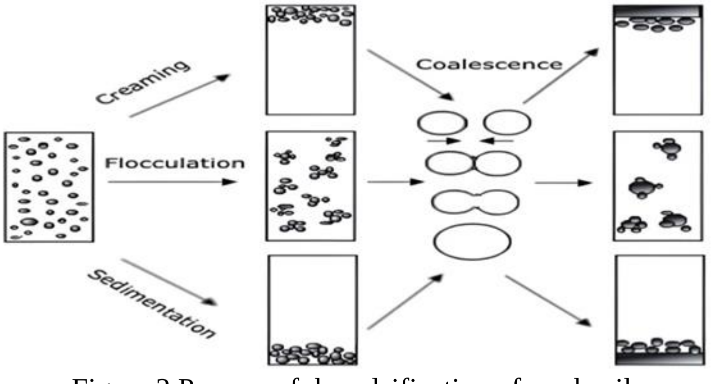

Figure 2.Process of demulsification of crude oil

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

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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 the demulsification of crude oil

The techniques for extracting emulsions from crude oil include chemical, biological, mechanical, thermal, electrical, ultrasonic, membrane, and microwave-assisted methods. This study will execute the elimination of chemical emulsions.

4.1 Chemical demulsification.

The petroleum industry actively employs chemical demulsification, an essential technique for resolving water-in-oil emulsification. A demulsifier is a surfactant that moves to the oil-water interface, weakens the film's rigidity, and promotes the coalescence of water droplets. A considerable extent of surface area is accessible. Polymers can produce various surfactants.

The surfactant's elongated chain increases its effectiveness in reducing interfacial tension and facilitating the coalescence of water droplets.[14].Demulsification in any emulsion entails the gradual substitution of demulsifiers within the water-oil interface. This induces significant alterations in the viscosity and elasticity of the contact [15]. Optimal termination of the emulsion Furthermore, the integration of heat, electrical grids, and coalescers could completely eradicate the emulsion [16].As shown in Figure (3)Proportions in water-in-oil emulsions. Increased molecular weight improved water separation. Calcium chloride, cationic poly(dimethylamine co-epichlorohydrine) (PDcE), and cationic polyacrylamine (CPAM)[17].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 ofmineral oil (98.04%). We employed trioctylmethy lammonium(TOA)+ and ammonium salt (OCD)+ [Y] to extract water fromhighly viscous crude oil. We successfully extracted 95% of the water, which surpasses the results reported by Tonget et al [18]

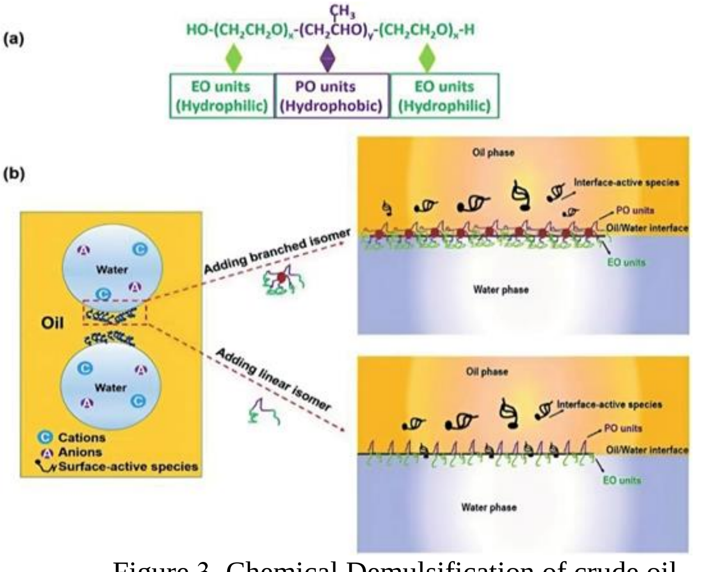

Figure 3. Chemical Demulsification of crude oil

An ionic demulsifier at a concentration of 900 mg/L attained a water extraction efficiency of 89.5 percent. Polymers comprise alkene oxide diester, ethylcellulose, and demulsifiers [19]. The

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concentration of polymer demulsifiers significantly influences their efficacy in emulsifier removal. A polyester-based demulsifier operates effectively 97.5% of the time within 45 minutes. Alginate, Janus magnetic submicron particles, magnetic graphene oxides, and oleic acid-coated magnetite nanoparticles are some of the magnetic chemical demulsifiers that can get rid of up to 99.98**%**of contaminants [20]. An analysis of the parameters and their link with oil content revealed the following order of significance: Demulsifying dosage, flocculant quantity, stirring time, and agitation intensity are essential parameters for optimizing demulsification-flocculation conditions. Biodemulsifiers produced by microorganisms in demulsified water reduce the toxicity and non-biodegradability of chemical compounds.

The current study on the optimisation of the demulsifier formulation DMO86416 for separating water from crude oil emulsions in the Amal Field, Libya, highlights key aspects related to existing literature. Emulsions primarily form due to shear mixing during production and the presence of natural surfactants in crude oil, such as asphaltenes and resins. This aligns with findings by Sjoblom et al. and Ramalho et al., who emphasise the challenges of emulsification due to the immiscibility of oil and water and the significant role of natural surfactants. Additionally, high-boiling polar fractions have been noted as major contributors to emulsion stability [21].In terms of the surfactant role, the study identifies asphaltenes and resins as critical components that stabilise emulsions by forming interfacial films around water droplets. This observation is supported by Daaou et al. and Groezin and Mullins, who provide insights into the molecular characteristics of asphaltenes, confirming their importance in emulsion stability [22]. The concept of micelles formed by these compounds is further corroborated by Leontaritis and Mansoori [23].The current research suggests that the asphaltene-resin ratio in crude oil influences not only the stability of emulsions but also the type of interfacial film formed. This parallels findings from Strassner and Borba, who similarly link the asphaltene-resin ratio to emulsion stability [24]. Additionally, environmental factors such as pH, salinity, and

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temperature are discussed by Poteau et al. and Fortuny et al., affirming their significant impact on the demulsification process [25].Furthermore, the study aligns with findings that pH levels and salinity affect emulsion stability, particularly for Algerian crude oil. Daaou et al. demonstrate that neutral pH is more effective for stabilising emulsions, while Fortuny et al. indicate that high water content can increase the demulsification rate unless countered by high pH and salinity. Moradi et al. highlight that lower ionic strength enhances emulsion stability[26].The focus on chemical demulsification using DMO86416 reflects a broader industry trend towards optimising chemical treatments to enhance separation efficiency. Numerous studies emphasise chemical treatment as a viable method for demulsification, noting that additives like demulsifiers cansignificantly improve separation efficiency, as indicated by various authors, including Ramalho et al [27].

5. Case Study: Chemical Demulsification in the Amal Field

5.1 Amal field location

The Amal conventional oil field recovered 93.21% of its total recoverable reserves, with peak production in 1970. The peak production was approximately 212.99 thousand bpd of crude oil and condensate. Based on economic assumptions, production will continue until the field reaches its economic limit in 2032. The field currently accounts for approximately 1% of the country’s daily output.The field is expected to recover 80.68 Million Barrelsof Oil Equivalent (Mmboe), comprised of 80.68Million Barrels (Mmbbl) of crude oil & condensate. Amal conventional oil field reserves accounts 0.02% of total remaining reserves of producing conventional oil fields globally.The productions separators are in parallel operation also test separator operating in parallel with the production separator. Currently only one production separator is in service in Stations (7), (1) and (5). One of the two production separators available in each of Station (3) and (4) are currently under maintenance. The production and test separators are 3-phase. The oil and water outlet lines of the test separator measured by turbine meter, the gas is measured via orifice meters installed on the separator outlet. Water from the separators is run into skimmer tanks

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and disposed through water pits or further processed and injected back into the reservoir. Water treatment is done in stations (3), (5) and (6) for reservoir injection (wells N-4, 11 and 15). Rated Actuals Capacity for the day MMscf/D MMscf/D Station (1)(8.8- 6.4) Station (2)(29.5 -19.8) Station (3)(22.6 -15) Station (4)(37.3 -17) Station (5)(12.3- 6.5)Station (6)(30.5-0)Station (7)(7.5 –7.64) De-emulsifiers are injected into the separators to enhance the quality of separation. Corrosion inhibitor is also used. The oil outlet of production separator is directed to gas boot where the gas is stripped off. The oil is then run through wash tank and run tank (to remove traces of water) before being pumped by transfer pump. The pumped oil is heated and then goes through metering before leaving the station.

6. MATERIALS AND METHODS

- **Baker Hughes Demulsifier**:Baker Hughes is supplies chemicalschemicals such as demulsifier, wax controller, wax dispersant, biocides and corrosion inhibitors for compressors and downstream systems.
- **DMO86416** is being injected in all stations here in Amal field; all injection points are located at the manifolds. The chemical has been optimized recently for all stations to reduce the demulsifier consumption especially in summer season, where the higher temperature helps to reduce oil viscosity to be easy to break the emulsion layer. As known almost production wells are gas lift type where the gas lifts the oil to reach the surface and the othersElectrical Submersible Pumps (ESP)and natural flow. The emulsion problems are concentrated in gas lift wells than the other because of thermal conditions changes, which occur at mandril valves. Some wells have been recently changed from gas lift technology to ESP which has helped to make up the lack of heating especially in winter season.DMO86416 optimization been started in almost stations (1), (3), (5) and (6). Where the dosage has been reduced gradually to avoid any sudden upsets in the process following the salt in crude results at the same time. The tables below will show the quarts per thousand barrels of oil consumed per day compared with performance for two weeks before/after the

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optimization start up. the stations which have been selected and focused for this report are stations (3), (5) and (6) these are considered the most harder emulsion problems and kind of waxy.

7. RESULTS AND DISCUSSION

The optimization of the demulsifier DMO86416 involved several systematic steps. Initially, a comprehensive analysis of the chemical demulsification process was conducted to evaluate its baseline effectiveness. Following this, the impact of the demulsifier on various operational parameters, including temperature, mixing time, and chemical concentration, was examined to identify optimal conditions. Adjustments were then made reduce the quantity of DMO86416 required for the separation process, resulting in enhanced efficiency and reduced costs. Performance evaluations were carried out at multiple stations, with a particular focus on Station (3), where notable improvements in separation efficiency were recorded; specifically, chemical consumption was reduced from 1.12 barrels to 0.52 barrels per thousand barrels of oil. These modifications not only improved the quality of the produced oil but also contributed to minimizing environmental impacts by decreasing waste and operational expenses.

7.1. Results of using a DMO86416 demulsifier on station (3), (5)and (6) before and after optimization

7.1.1. Use of a demulsifierDMO86416)at station (3) before the optimization process.

TABLE. 1 : Station (3) DMO86416 optimization before 11 dayoptimization

Date	Barrels of Oil PerDay BOPD	Quarts/day	Quarts/1000bbl	Drum/day	(part per thousand barrels) salt (ptb)
15th May	2,104	30	14.3	0.14	8
16th May	2,503	29	11.6	0.12	9
17th May	2,626	26	9.9	0.12	13
18th May	2,622	26	9.9	0.11	13
19th May	2,395	24	10	0.12	12
20th May	2,456	25	10.2	0.11	12
21st May	2,690	24	8.9	0.10	11

22ndMay	2,627	21	8.0	0.10	8
23rd May	2,779	21	5.6	0.09	9
24th May	2,589	20	7.7	0.09	5
25th May	2,128	20	9.4	0.14	8
Total consumed drums period before 11 days				1.12	

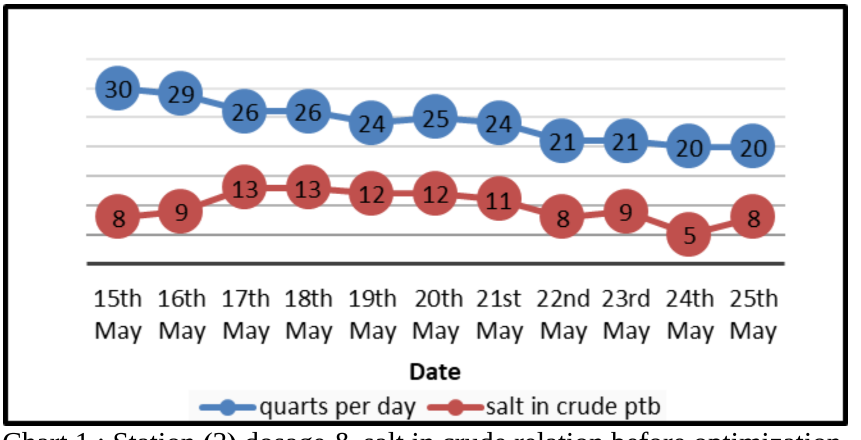

Chart.1.: Station (3) dosage & salt in crude relation before optimization.

7.1.2. Use of a demulsifier(DMO86416)at station (3) after the optimization process.

TALE2 . Station (3) DMO86416 optimization after 11 days optimization

Date	Barrels of Oil PerDay BOPD	Quarts/day	Quarts/1000bbl	Drum/day	(part per thousand barrels) Salt (ptb)
26th May	2,635	15	3.7	0.07	8
27th May	2,032	11	5.4	0.05	9
28th May	3,065	11	3.6	0.05	13
29th May	2,823	11	3.9	0.05	13
30th May	2,796	10	3.6	0.05	12

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31st May	2,546	10	3.9	0.05	12
1st June	2,306	10	4.3	0.05	11
2nd June	2,876	10	3.5	0.05	8
3rd June	2,979	11	3.7	0.05	9
4th June	2,455	10	4.1	0.05	5
5th June	2,994	11	3.7	0.07	8
Total consumed drums period after 11 days				0.052	

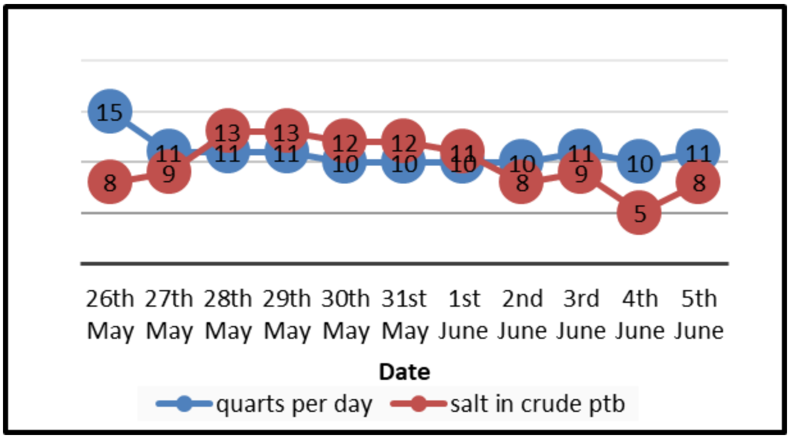

Chart 2: Station (3) dosage & salt in crude relation after optimization

7.1.3. Use of a demulsifier (DMO86416) at station (5) before the optimization process.

TABLE 3. Station (5) DMO86416 optimization before 11 days optimization

Date	Barrels of Oil per Day BOPD	quarts/day	Quarts/1000bbl	Drum/day	(part per thousand barrels) Salt (ptb)
15th May	523	4	7.6	0.02	5
16th May	2,036	10	4.9	0.05	5
17th May	1,980	10	5.1	0.05	7

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18th May	1,401	10	7.1	0.05	5
19th May	1,972	10	5.1	0.05	3
20th May	1,981	11	7.5	0.06	12
21st May	2,119	10	4.7	0.05	5
22ndMay	1,873	10	5.3	0.05	5
23rd May	1,231	10	8.1	0.05	5
24th May	1,291	10	7.7	0.05	7
25th May	1,356	10	7.4	0.02	8
Total consumed drums period before 11 days				0.48	

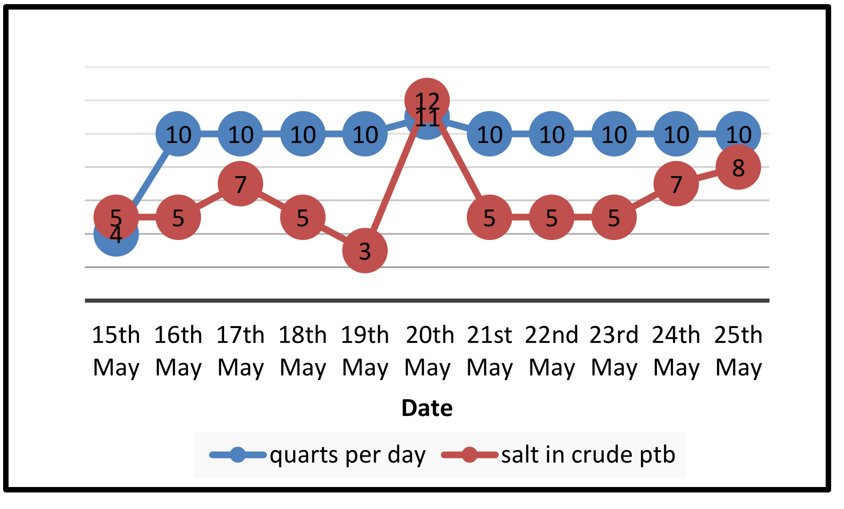

Chart 3: Station(5) dosage & salt in crude relation before optimization

7.1.4. Use of a demulsifier(DMO86416)at station(5) after the optimization process.

TABLE4 . Station (5) DMO86416 optimization after 11 days.

Date	Barrels of Oil PerDayBOPD	quarts/day	Quarts/1000bbl	Drum/day	(part per thousand barrels) Salt (ptb)
26th May	1,287	7	5.4	0.03	26
27th May	1,187	4	3.4	0.02	22
28th May	1,523	4	2.6	0.02	26
29th May	1,478	2	1.4	0.01	35
30th May	1,234	2	1.6	0.01	32
31st May	1,578	2	1.3	0.01	17
1st June	1,593	2	1.3	0.01	8
2nd June	1,848	5	2.7	0.02	16
3rd June	1,907	4	2.1	0.02	10
4th June	1,324	5	3.8	0.02	11
5th June	1,228	5	4.1	0.02	11
Total consumed drums period after 11 days				0.20	

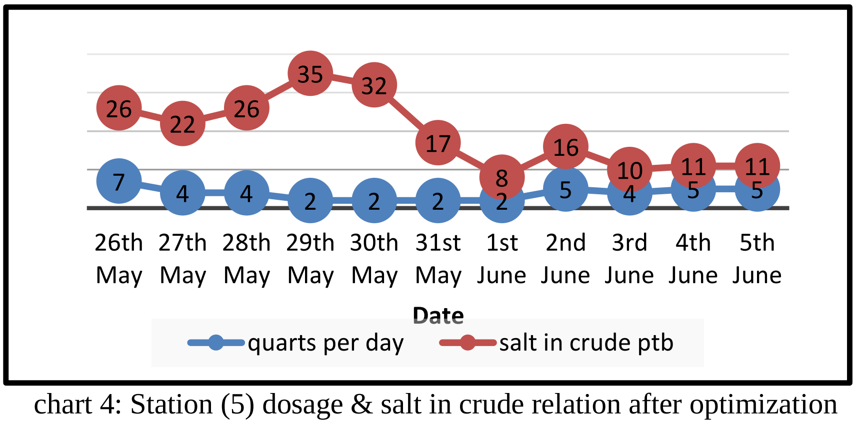

chart 4: Station (5) dosage & salt in crude relation after optimization

7.1.5. Use of a demulsifier (DMO86416) at station(6) before the optimization process.

Table5. Station (6) DMO86416 optimization before 11 days

Date	Barrels of Oil Per Day BOPD	Quarts/day	Quarts/1000bbl	Drum/day	(part per thousand barrels) Salt (ptb)
15th May	1,464	17	11.6	0.08	15
16th May	2,954	20	6.8	0.09	63
17th May	3,182	24	7.5	0.11	20
18th May	2,699	20	7.4	0.09	9
19th May	2,166	21	9.7	0.10	55
20th May	3,820	29	8.9	0.14	54
21st May	2,897	21	7.2	0.10	26
22nd May	3,380	21	6.2	0.10	36
23rd May	3,787	21	5.5	0.10	55
24th May	2,789	24	8.6	0.11	18
25th May	1,602	24	15	0.11	-
Total consumed drums period before 11 days				1.14	

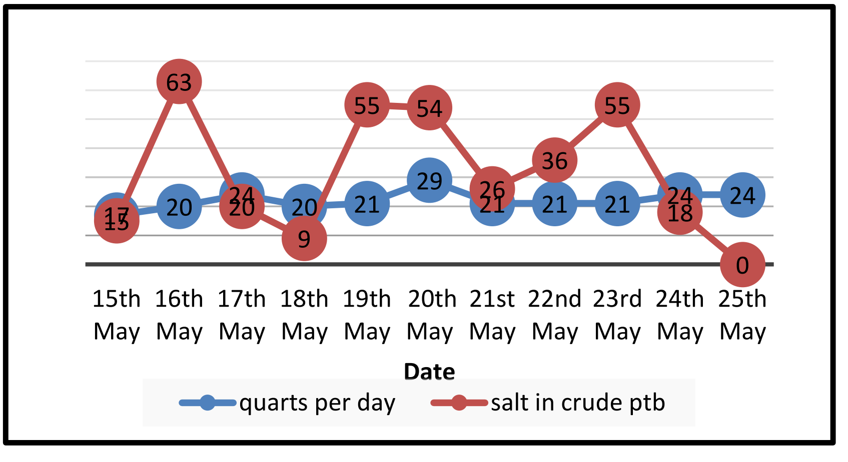

Chart 5: Station (6) dosage & salt in crude relation before optimization

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7.1.6. Use of a demulsifier(DMO86416)at station (6) after the optimization process.

Table 6. Station (6) DMO86416 optimization after 11 days.

Date	Barrels of Oil PerDay BOPD	Quarts/day	Quarts/1000bbl	Drum/day	(part per thousand barrels) Salt (ptb)
26th May	2,662	14	5.3	0.07	26
27th May	2,206	15	6.8	0.07	22
28th May	3,316	14	4.2	0.07	26
29th May	3,005	15	5	0.07	65
30th May	2,350	10	4.3	0.05	75
31st May	3,129	10	3.2	0.05	77
1st June	2,490	10	4	0.05	-
2nd June	3,236	18	5.6	0.09	30
3rd June	2,914	16	5.5	0.08	19
4th June	2,809	17	6.1	0.08	18
5th June	3,300	13	3.9	0.06	30
Total consumed drums period after 11 days				0.72	

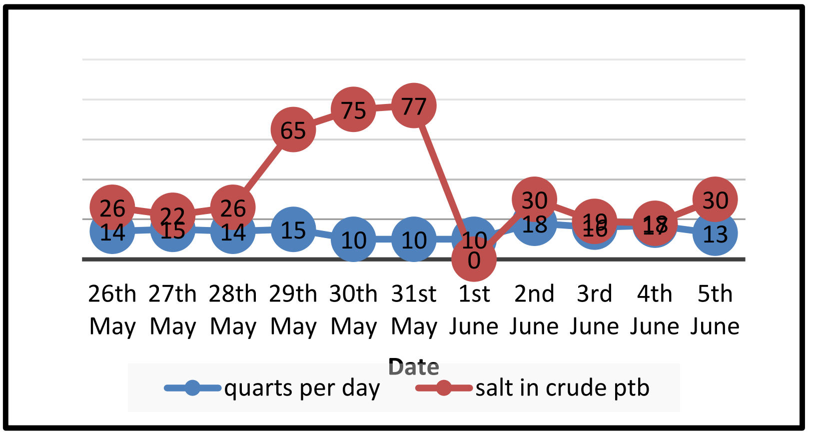

Chart **6**: Station (6) dosage & salt in crude relation before optimization.

8. Conclusion

This study develops a strategy to improve the bottle test and the reliability of the demulsifier evaluation and selection for dewatering wet crude oil emulsions. The following conclusions were obtained:

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- Good agreement between the bottle tests and the field trials was obtained by improving the commonly practiced methods with the exception of the inhomogeneous emulsifier.
- The separated water was observed to depend on the operating/emulsion parameters which include: temperature, demulsifier concentration, mixing time, salt content, pH values, and modifier concentration. The temperature, demulsifier concentration and mixing time were observed to predominate the separation process while the effect of pH values, salt content, and modifier concentration was relatively lower.
- Station (3) has been optimized up to 3.5 quarts per thousand barrels of oil, about 20ppm of chemical concentration also for the 11 days period the DMO86416 consumption was dropped from 1.12 drum to 0.52 drum, that means about 46% consumption reduction.
- Station (5) has also been dropped to 1.3 quarts per thousand barrels of oil where the chemical concentration is about 8ppm, the chemical consumption was dropped from 0.48 to 0.2 drum in 11 days period so about 42% consumption reduction.
- From the table above, station(6) was the harder emulsion than the others due to the tighter emulsion/ waxy wells are produced in this station, where the chemical optimization was not dropped less than 5 q/1000 bopd due to the upset of chemical injection pump of wax controller PAW80039 on N-50. The consumption was dropped from 1.14 to 0.72 drum in 11 days period. The chemical concentration for this station is about 25ppm.

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