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EFFECTS OF ADDING LOCAL MATERIALS ON DEMULSIFIER PERFORMANCE FOR OIL-WATER EMULSIONS

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ABSTRACT: Emulsions are a mixture of two kinds of immiscible fluids. Emulsions often occur during the production process. The emulsion should be broken down into oil and water phases so as not to disrupt oil processing. Emulsion stability is influenced by temperature, salinity, ph, and concentration of aspalten content. In general, this emulsion problem is often overcome by using demulsifier, while in this study using the addition of local materials on the demulsifier. The purpose of this study is to analyze the effect of the addition of local materials on the performance of demulsifier by looking at the factors that affect. This research was conducted in the laboratory using a bottle test method by using light oil available in the laboratory and some local materials such as Citrus Limon, and Citrus Hystrix which used as formulation. This study was conducted on several different temperatures, ph, and salinity conditions. Based on the results of the study, the addition of local ingredients to the demulsifier performance is effective in separating oil-water emulsions. In the research, the most effective formulation in the separation is DL (5 ml) formulation at 70˚C with 1000 ppm salinity.

Keywords: Demulsifier, Emulsions, Local material, Bottle test

1. INTRODUCTION

According to Nuri [1], emulsions in the crude oils are a major result in the oil production process. The emulsion will help and will increase the heat load and also the crude oil fractionation process, therefore emulsions must be broken down into air and oil phases. Air-oil emulsion (O / W) is an emulsion where oil is present as a dispersed phase and air as a dispersion medium (continuous phase). While the air emulsion in the oil (W / O) is an emulsion where air becomes dispersed, and oil acts as a dispersed medium [2].

In the study discussed the method of treatment of emulsion by using chemicals and its effect when added local material into the emulsion. These chemicals are also called emulsion breakers or demulsifiers. The effect of adding a chemical demulsifier is to damage the film formed around the droplet (internal phase), with the damaged film layer then separated droplet (external phase). Selection of these demulsifier chemicals is done through laboratory tests that depend on their emulsion properties [3].

The purpose of this research program is to analyze the effect of adding local ingredients to demulsifier performance by looking at the factors that influence it such as temperature, salinity and pH.

2. MATERIAL AND METHOD

The materials in this research consist of crude oil (viscosity 2 cP), aquadest, natrium chloride (NaCl), local material (*Citrus limon* and *Citrus hystrix*) and commercial demulsifier.

This research was conducted in Petroleum Engineering Laboratory Universitas Islam Riau by using the method:

2.1 Bottle Test

Bottles can be used to help determine the most effective demulsifier types of emulsions. Basically, you can compare the air deposition rate of different types of demulsifiers [4].

2.2 Water Bath

According to Husni [5], Water bath is a tool used for laboratory and industrial purposes such as chemical mixing that can maintain temperature with the system using a temperature sensor.

3. RESULT AND DISCUSSION

3.1 Effect of Temperature

In the research the temperature tested was 40˚, 50˚, 60˚, and 70˚C. The temperatures are tested based on the efficiency of water and oil separation. As with previous researchers Erfando [6], this test was performed using a bottle test method incorporated into a water bath for 3 hours (180 minutes). This test is done by using the bottle test method that is inserted into a water bath for 3 hours (180 minutes). Interval time is done a measurement of water separation every 30 minutes. So from there can be seen the effect of adding local material to the performance of demulsifier.

3.1.1 Temperature Condition 40ºC

Fig. 1 shows that in this condition there is no change in the volume of water separation in the base case. According [7], the difference in the efficiency rate of the demulsification of each of the formulas can be due to unequal homogenization of each sample and the durability and quality differences of each formula acting at a certain temperature. In conditions of 40ºC, there is generally no significant change in the volume of water separation due to this condition the emulsion is stable. Same as the results obtained by previous researchers, Novrizal [8] who did the testing at this temperature with the most stable emulsion results which was shown at temperatures of 40ºC.

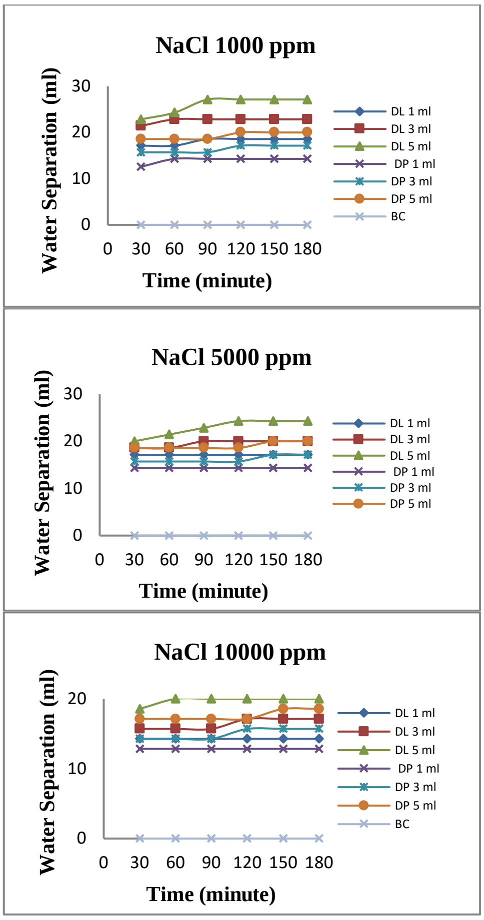

Fig. 1 Water separation at temperature 40˚C

The highest water separation was obtained at the demulsifier with the addition of lemon (DL 5 ml) with a separation of 27.14 ml.

3.1.2 Temperature Condition 50ºC

Fig. 2 shows that in temperature condition 50˚C the base case condition still has not experienced separation like the previous condition. In this condition, it can be seen that the highest water volume separation is obtained in DL 5 ml formulation with separation of 27.14 ml.

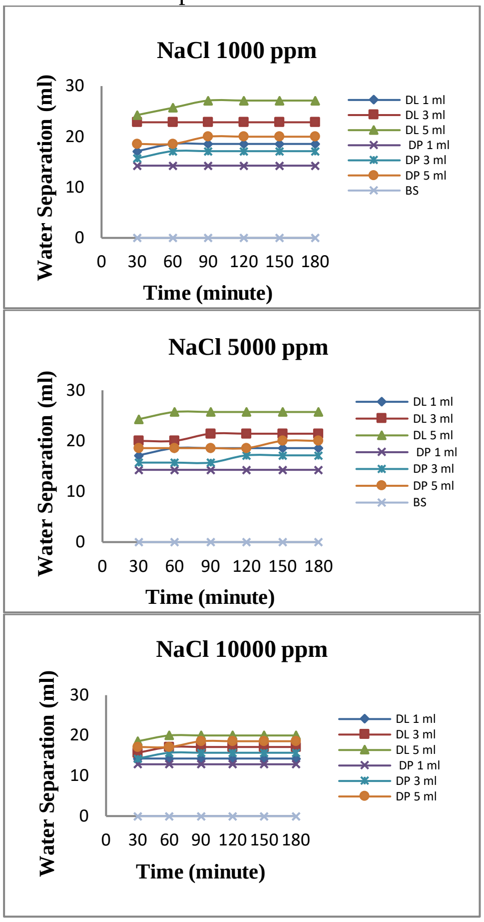

Fig. 2 Water separation at temperature 50˚C

3.1.3 Temperature Condition 60ºC

Fig. 3 shows that temperature condition 60˚C occurs the acquisition of water separation volume in the base case at minute 90 and the emulsion obtained under these conditions was unstable. This can be proven by looking at changes in the volume of water separation obtained by comparing the previous conditions. The highest separation also obtained at DL 5 ml formulation with separation of 32 ml.

3.1.4 Temperature Condition 70ºC

Fig. 4 shows that the temperature condition of 70˚C the acquisition of water separation volume in the base case increases faster than 60˚C. This increase occurs in the 30th minute. In addition to this condition, there is an unstable emulsion with the volume of water separation greater than the previous conditions. Seen from the fig. 4, DL formulation 5 ml is the highest water volume separation with a separation of 34 ml.

Seen in all of the above conditions the most unstable emulsions are generally obtained on DL formulations of 5 ml and 5 ml DP which are categorized as citric acid. Citric acid (Citric Acid) has a high demulsification efficiency because it has more carboxyl groups higher than other acids, so the demulsification efficiency using citric acid has a high value [9]. In addition, citric acid is a type of acid that is non-toxic, non-irritating, and environmentally friendly Liu D Suo.

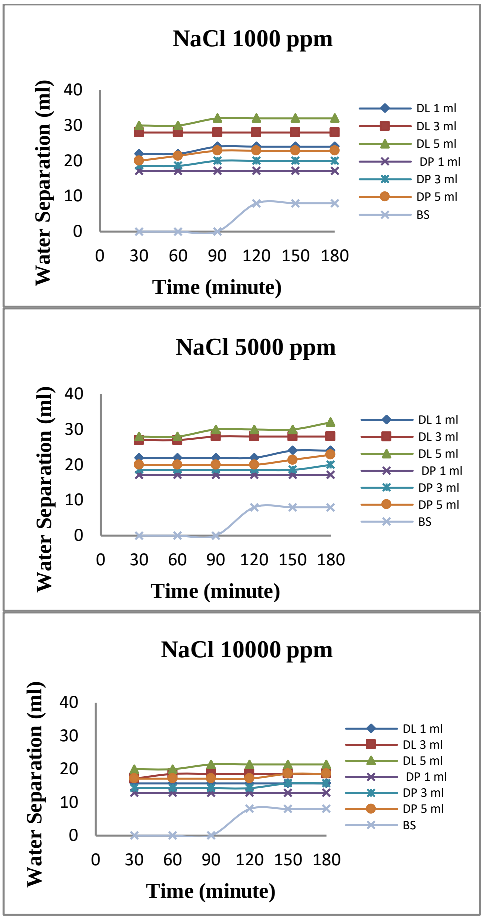

Fig. 3 Water separation at temperature 60˚C

The most unstable emulsion is shown by a temperature of 70ºC while the most stable emulsion is indicated by a temperature of 40ºC. It can be concluded that the higher the emulsion temperature will be increasingly unstable so that the amount of water is more and more separate [8]. Njoku [10] said that the increase in temperature generally reduces the concentration of vitamin C so as to decrease the acidity level.

In study Hajivand [11], also obtained a balanced result, namely by testing at temperatures of 10º to 80ºC with a constant ph for 72 hours. According to him, increasing the temperature also dramatically increases water separation. Increased the largest water separation obtained at 80ºC with a separation of 57%. However, the increase in temperature from 70º to 80ºC resulted in only 2% further separation. As a result, he concluded that a higher temperature promotes a destabilizing effect caused by an increase in brown motion and interface mass transfer caused by decreased viscosity due to an increase in temperature

3.2 Effect of Salinity

In this study used Natrium Chloride (NaCl). The salinity rate affects the amount of water that is separated, but the higher the salinity level of the oil separation process with water takes longer [12].

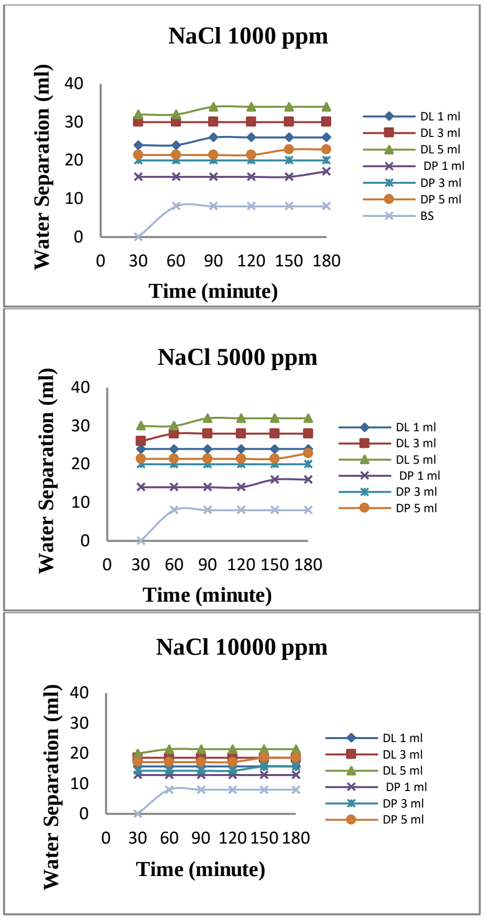

Fig. 4 Water separation at temperature 70˚C

Fig. 1 to 4 shows the effect of salinity addition of NaCl on emulsion stability. The results showed that the most unstable emulsion was obtained at the addition of salinity of 1000 ppm, while the most stable emulsion was obtained at the addition of salinity of 10000 ppm. The results show that the higher aqueous phase salinity, the smaller the percentage of water or oil separated from the emulsion. This shows that the higher the salinity, the more stable the emulsion. The greater the salinity results in the presence of a charged electrolyte solution in the emulsion system. So the demulsifier that works to break the emulsion cannot be maximized because the demulsifier will be bound by the anion in the aqueous phase solution [8].

It can be seen in Figures 1 to 4 showing the effect of adding NaCl salinity to emulsion stability. There were three salinity concentrations, namely 1000, 5000, and 10000 ppm which were conditioned in 4 formulations, namely the addition of local ingredients with demulsifier which was formulated with the same concentration in the bottle test. The results obtained at each salinity concentration vary.

The results showed that the most unstable emulsion was obtained at the addition of 1000 ppm salinity which is 0.0025 grams of NaCl in the solid phase, while the most stable emulsion was obtained at the addition of salinity of 10000 ppm or 0.25 grams of NaCl. The results show that the higher aqueous phase salinity, the smaller the percentage of water or oil separated from the emulsion. This shows that the higher the salinity, the more stable the emulsion. The greater the salinity causes the charged electrolyte solution in the emulsion system. So the demulsifier that works to break the emulsion cannot be maximized because the demulsifier will be bound by the anion in the aqueous phase solution. Aqueous phase with 1000 ppm salinity indicates the most unstable condition. In the research, it was found that the effect of the addition of local ingredients to the demulsifier performance with each salinity concentration and the influence of the most influential temperature was found in DL formulation (5 ml) with salinity concentration of 1000 ppm and 70ºC. At the temperature conditions, 40º-70ºC separation of changes in the volume of water is also obtained at the highest salinity with a concentration of 1000 ppm. Similar results were also obtained in previous researchers Novrizal [8] with salinity concentrations resulting from the most unstable emulsions obtained at the smallest addition of salinity.

In addition, Zaki [13] also conducted a study with different concentrations ranging between 0 and 1 M with the result of demulsification efficiency decreased with increasing degree of salinity. This is mainly due to the decrease in demulsifier solubility in the liquid phase as a result of the increase in salinity.

3.3 Effect of PH

This research was conducted to see the effect of pH on oil-water emulsions. Ph checking is done at the most optimum temperature in the change of volume of water separation that is at condition 70ºC with different salinity concentration. This is because salinity can affect the pH of the formulation. This result is comparable to that obtained by Hajivand [11], the greatest stability is shown in the largest Ph in the research that is around 9.3-13 and optimal Ph is obtained in Ph 5.5. therefore, we can conclude that high pH and low ph indicate a stable emulsion, while intermediate ph causes instability. The level of emulsion stability is highly dependent on crude oil emulsion. As a result, the optimum pH for crude oil emulsion appears to vary from 5 to 9 [11]. This is evident in the results of the study, wherein the DL formulation obtained the highest change in water separation volume that is at conditions of 1000 ppm with an intermediate pH of 6-7.

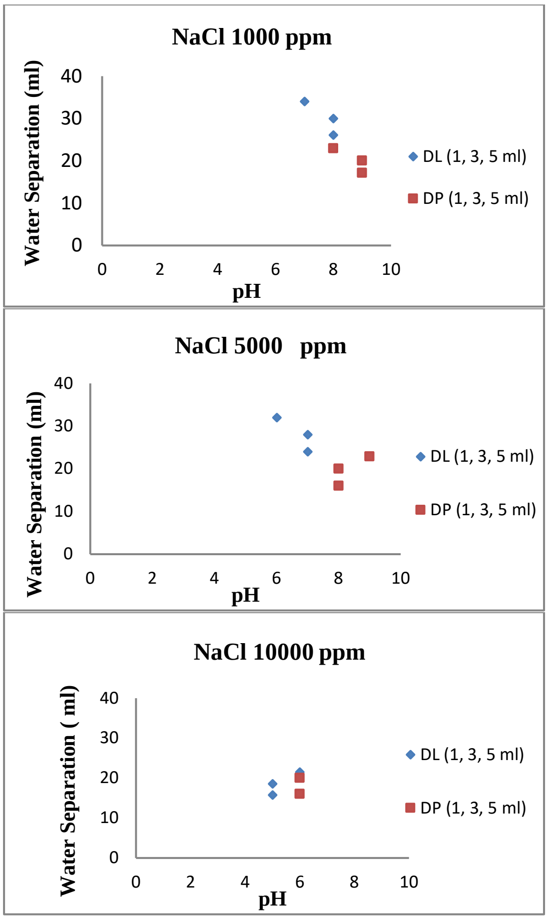

Fig. 5 Effect of pH on water separation at temperature 70ºC

In his research Halboose [14], also obtained similar results with ph measurements using a ph meter (HANNA PH 211) which states that water ph significantly affects emulsion stability. More recently Al-qamshouai [15] also obtained an unstable ph in its research at ph = 10. Tambe and Sharman (1993) studied that special water-in-water emulsions at low ph values ranged from 4 to 6, while emulsions water in a special oil at a high ph value of between 8 and 10 [15].

Other than Daaou [16] also obtained the largest water volume separation achieved at ph = 6 in the basic medium (pH = 8-13). The most stable emulsion occurs for weak acid environments. At Ph = 7, the emulsion is most stable because there is no water separating. Comparable results were obtained by Strassner (1968) who studied crude oil emulsion at different ph values that is in the emulsion of Venezuelan crude at ph <6 is very stable, whereas in ph> 10 indicates low or unstable stability even though at ph = 13 very emulsions stable. The effect of ph on emulsion stability is usually associated with the ionization of polar groups of surface active components inducing an electrostatic repulsive interaction sufficient to decrease the interfacial film cohesion [16].

At a very high pH level and a low pH value, the emulsion looks stable, while intermediate pH seems to cause instability. The optimum pH value in dealing with crude oil emulsions is between 5 and 12. Furthermore, the demulsifier used in treating the emulsion problem depends on the pH value [15].

4. CONCLUSIONS

From the results of research conducted, it can be seen that the addition of local materials to the demulsifier effect on oil-water emulsion separation. The separation can be seen from the parameters that affect it such as the addition of salinity, temperature and pH that affect the stability of the oil-water emulsion. The higher the temperature, the more unstable the oil emulsion. The greater the salinity concentration of added NaCl, the more stable the emulsion. As well as the more neutral the pH the more unstable the emulsion occurs so that the water splits are larger.

5. ACKNOWLEDGMENTS

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