Emulsion Treatment using Local Demulsifier from Palm Oil

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Keywords: Emulsion, Local Demulsifier, Palm Oil, Bottle Test

Abstract: Conventional demulsifier (chemical) are still used until now in many of oil industries which the formulas are both expensive and harmful for the environment.In this research, the new formula of local demulsifier will be tested with palm oil, lemon, glycerin, and KOH as the materials. Those materials are more friendly for the environment and contain hexane group and octadecenoic acid that are composition in plant that can break the emulsion. Crude oil (20.8°API) is taken from wellhead of the X Field in Riau, Indonesia. Emulsion sample will be treated with formula local demulsifier and tasted in water bath for 3 hours vulnerable with 30 minutes of observation. Bottle test method will be used with the following of 40°C, 60°C, and 80°C as temperature test.The test revealed that the formula demulsifier + lemon (DKL) given the best result than conventional demulsifier within 120 – 180 minutes at 80°C that separated 39 ml of water with 5 ml of concentration.P-value of temperature is the only less than the significance value (α=0.05) means that the linear regression model meet the criteria of linearity and the changes that occur are significant.

1 INTRODUCTION

The participation of water in the production process of oil is common in upstream oil and gas activities. The water is formation water that has a chemical content that will cause problems in the series of equipment both under and above the surface. The occurrence of one of them is the forming of an emulsion. These problems result in high pumping costs, pipe corrosion, and special handling of certain equipment (Abdel-Raouf,). An emulsion is a mixture of two immiscible fluids, one of which is shaped droplets on the other and chemically bound or stabilized by emulsifying agents (Soffian and Niven, 1993). Demulsifier injection is often used to overcome emulsion problems. The process of breaking down oil-water emulsions into an oil phase and the water phase is called the demulsification (Kokal, 2005).

However, its use is still using commercial (chemical) materials which are relatively expensive (Emuchay, Onyekonwu, Ogolo, & Ubani, 2013) and cause damage to the environment. In several studies, demulsifier tests with local materials have been carried out, for example testing with coconut oil (Emuchay et al., 2013),lime(Erfando et al., 2018), and curcas oil (Sulaiman et al., 2015). Where in all the three studies shows the potential of local demulsifiers.The potential in the oil and gas sector should be developed to increase local and national revenues(Erfando and Herawati, 2017).

In this study, new of local demulsifier are formulated to minimize the negative impact of commercial demulsifier both in reduce the high cost and minimize the negative impact of using chemical on the environment. The new local demulsifier formula will be formulated using palm oil, gliserin, lemons and KOH compounds. Palm oil contain hexane group and octadecenoic acid. Those compositions are two main plant components that can break the emulsion (Yaakob and Sulaimon, 2017).

For the result, those local and commercial demulsifiers will be comparing within take abest result of temperature, concentration of separation, and the time of separation.This study was conducted to know which formula will give the best result in separated the water and to know the contribution of the parameter toward the test through analysis of regression.

The emulsion is defined as a colloidal system in which small grains from one of the phase presses in other phases where they are usually not mutually mixed. An emulsion can be found in the production process and equipment. The type that we often encounter in the field is water emulsion in oil (w/o). The stability of the emulsion itself cannot be separated from crude oil asphaltenes

Erfando, T. and Fathan, E.
Emulsion Treatment using Local Demulsifier from Palm Oil.
DOI: 10.5220/0009360102990303
In *Proceedings of the Second International Conference on Science, Engineering and Technology (ICoSET 2019)*, pages 299-303
ISBN: 978-989-758-463-3
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and resins (Abdel-Raouf, 2012). Emulsion in the production field can be classified into three types, Water-Emulsion in Oil (W/O);Oil Emulsion in Water (O/W); and Complex Emulsion (Multiple/Complex). Emulsion is an unstable system, according to (Wylde et al., 2009), classifying the length of time an emulsion system is separated based on its stability:

- Loose emulsion: is separated in minutes;
- Medium emulsion: separate in 10 minutes or more;
- The emulsion sight will be stable for hours or even days and in some cases, will not be able to be overcome.

Some of the causes of the stability of the emulsion are explained in the study (Kokal, 2005). Such as agitation, the grain size, surfactant, effect of pH, the composition of brine water, viscosity, and temperature. For demulsification of emulsion, injecting the demulsifire is one of the option for separate the emulsion to dissolve dispersed phase from the dispersing phase. The molecule of a demulsifier will mobilize to the interface of oil-water and separated both natural surfactant (asphaltenes and resins) (Zhou et al., 2014). Over the years there has been an over dependence on the use of foreign/commercial demulsifiers this has been found not to be quite effective in most cases due to incompatibility with the nature of some kinds of crude (Emuchay et al., 2013). For some cases it will led to the challenge for the advanced studies to locallyformulated demulsifier in result for improved cost efficiency and effectiveness.

2 MATERIAL & METHOD

2.1 Material

The material we used for laboratory study of emulsion and demulsification are a water bath (Memmert WNB 14), heater and stirrer (Wisd.), digital scale (Amastech), bottle for test (duran), several breakers (Pyrex Iwaki TE-32), several graduated cylinder (Pyrex), density bottle, and stopwatch. For producing local demulsifier we used a commercial palm oil, potassium hydroxide (KOH), aquades, glycerin ($C_3H_8O_3$), and citrus limon.

2.2 Method

Generally we used saponification, bottle test method, and statistical test. In order to produce the liquid soap as a base of local demulsifier, we used saponification with following step based on (Naomi et al., 2013; Sukeksi et al., 2017; Zulkifli and Estiasih, 2014). Bottle test used to observing the result and converting the data into graphic. As for statistical method will be using statistic application that allows providing which parameter (time of separation, temperature, or injecting volume) most contribute for the test.

2.2.1 Production of Local Demulsifier

Local demulsifier (DKS) will be formulated with saponification method, with the following step;**a)** 50 ml of palm oil commercial was added to a breaker and heated with 80°C for 30 minutes. **b)** 12.5 g of KOH add into breaker along with 25 ml aquades and then heated until homogenous; **c)** Add KOH + Aq into palm oil and stir it with heater and stirrer in 80°C, 800 rpm, for 3 hours and 20 minutes; **d)** For the last add 50 ml of aquades and stir for 5 minutes, then wait the formula for 24 hours until the formula become liquid. Both formulas are the local demulsifier for this research.

2.2.2 Demulsification with Bottle Test Method

The following formulas that will be tasted are: a) Local demulsifier (DKS); b) Local demulsifier + lemon (DKL); c) Commercial demulsifier (DK);and d) Base case (without adding demulsifier). Those formulas will be injected to a bottle of sample emulsion (1 ml, 3 ml, and 5 ml). Each volume are tested in several temperature (40°C, 60°C, and 80°C) for 3 hours.

Emulsion separation was recorded at various time intervals (Hirasaki et al., 2010).The process was monitored for every 30 minutes in 3 hours. The step based on (Erfando et al., 2019; Hirasaki et al., 2010)

3 RESULT

Table 1 is the properties data for sample oil. The data was calculate to determine the type of oil. The type of oil sample is heavy oil with SG = 0.929 and 20.8°API. Figure 1-3 are the result of the test with bottle test method in water bath.From those figures we found out the best, highest, and also the bad separation within the formulas.

Based on data, base case formula has the highest separation in figures 1 (40°C). Meanwhile not the case in temperature of 60°C and 80°C. Formula DKShas the highest separation value on figure 2 when adding 5 ml concentration. Figures 2 shown that

commercial formula (DK) has stable separation at temperature of 60°C. Meanwhile bad at temperature of 40°C (figure 1).

Table 1: Properties of Crude Oil

No	Properties	Value	Unit
1	Oil Mass	23.2	gr
2	Oil Density	0.93	gr/ml
3	Specific Gravity	0.93	-
4	°API	20.8	-

In figure3, formula DKL (5 ml,80°C) given the stable and highest separation from 120 to 180 minutes with temperature of 80°C.The result from the bottle test method shown in figure 3, that the value of local + lemon demulsifier (DKL) separation is 39 ml.

Based on the data above, the best result shown in figure 3 as DKS and it takes 120 – 180 minute for water separated from emulsion sample.(Hayuningwang et al., 2015) said, moreover the salinity and temperature here also affects the amount of separation of water, but the higher the value of salinity the process of separating oil from water takes longer.

Based on data, the additional of 5 ml is the best concentration for injecting the formulas into sample, while temperature of 80°C is the ideal temperature in this research.(Augustina and Sylvester, 2015)said, the temperature or heat broke up some of the weak emulsion thereby causing coalescence and dropping of water out of the emulsion which settle in the bottom of bottle. When the temperature is rise there is also an increase of demulsification efficiency. The research of (Erfando et al., 2019) also make an explanation that the temperature is one of the parameters that can affect the condition of emulsion significantly.

3.1 Analysis of Regression and Correlation

Table 2: Regression Analysis Data

No	Parameter	P-Value	R-Sq	R-Sq (adj)
1	Temperature	0	62.2	62.1
2	Injected Volume	0.362	0.4	0.1
3	Time	0.1	0.9	0.6

Comparison of the linear regression models determines the effect of variables X on Y (Subekti, 2015). If the contribution is positive then the value of variable X agrees to the value of variable Y.Theanalysis of regression and correlation from this research are from statistical software, to get the information of regression and correlation from the parameters (time, injected volume, and temperature) versus separation.

From table 2, at the output obtained p-valueof temperature is the onlyless than the significance value (α=0.05) means that the linear regression model meet the criteria of linearity and the changes that occur are significant(Draper and Smith, 1998).

R-Sq (adj) of temperature is 62.1%, the value is interpreted as a percentage of contribution in the test. Both parameter injected volume and time have each 0.1% and 0.6%. From those data temperature has the highest contribute.

4 CONCLUSION

Based on laboratory test, formula DKL given the high result than conventional demulsifier within 120 – 180 minutes at 80°C that separated 39 ml of water with 5 ml of injected volume. The effectiveness of emulsion breakdown using local material is better based on base case reference and it's comparison with a conventional demulsifier result.The temperature has the biggest contributes among all the parameters seen from the regression analysis data.

ACKNOWLEDGMENTS

The author gratefully acknowledge financial support from Universitas Islam Riau and Petroleum Engineering's laboratory for the facilities.

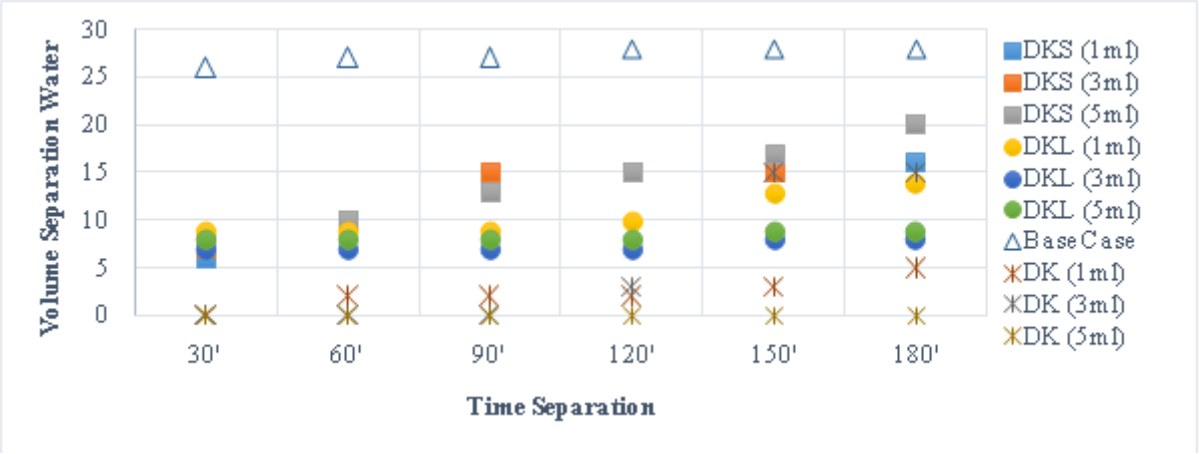

Figure 1: Bottle test in temperature of 40°C.

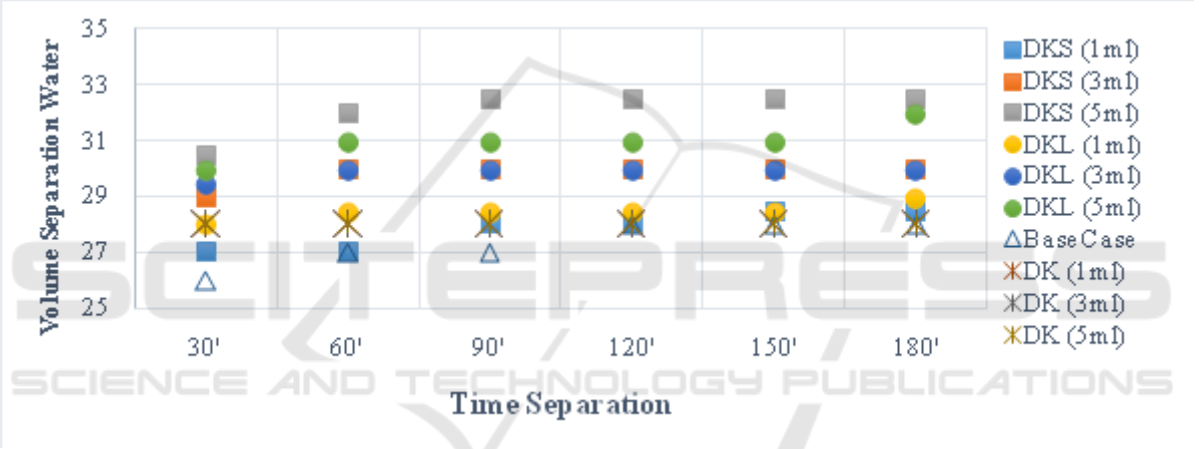

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Figure 2: Bottle test in temperature of 60°C.

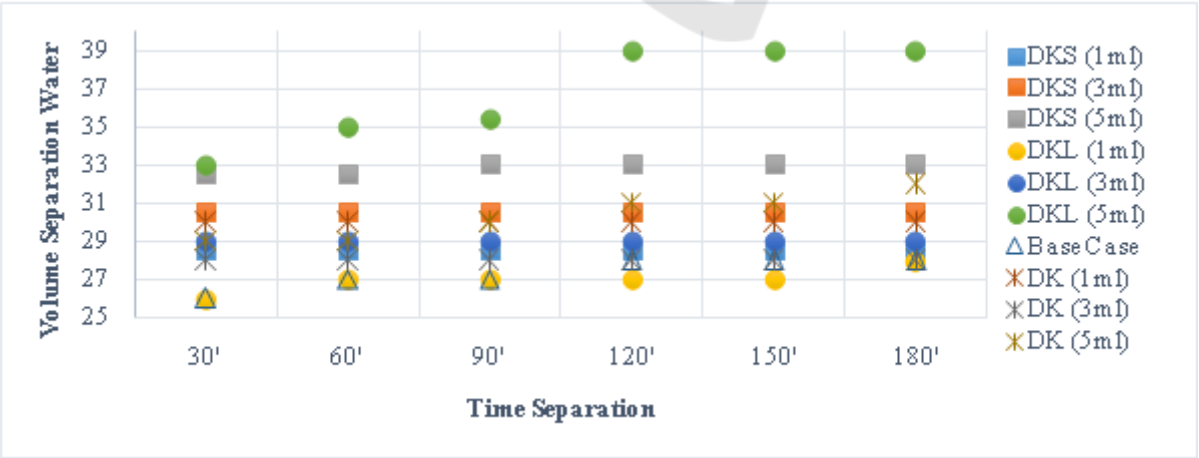

Figure 3: Bottle test in temperature of 80°C.

REFERENCES

Abdel-Raouf, M. E. S. *(2012)*. Factors affecting the stability of crude oil emulsions.

Augustina, O. and Sylvester, O. (2015). *Emulsion Treatment in the Oil Industry: A Case Study of Oredo Field Crude Oil Emulsion*. SPE Nigeria Annual International Conference and Exhibition.

Draper, N. R. and Smith, H. (1998). *Applied regression analysis (Vol*. 326).

Emuchay, D., Onyekonwu, M. O., Ogolo, N. A., and Ubani, C. (2013). *Breaking of emulsions using locally formulated demusifiers*. SPE Nigeria Annual International Conference and Exhibition.

Erfando, T., Cahyani, S. R., and Rita, N. (2019). The utilization of citrus hystrix and citrus limon as an organic demulsifier formulation. *IOP Conference Series: Materials Science and Engineering*, 509(1):12145.

Erfando, T. and Herawati, I. (2017). Analysis of petroleum downstream industry potential in riau province. *Journal of Geoscience, Engineering, Environment, and Technology*, 2(2).

Erfando, T., Rita, N., and Cahyani, S. R. (2018). Identifikasi Potensi Jeruk Purut Sebagai Demulsifier Untuk Memisahkan Air Dari Emulsi Minyak di Lapangan Minyak Riau. *Jurnal Kimia Mulawarman*, 15(2).

Hayuningwang, D., Fadli, A., and Akbar, F. (2015). Pengaruh Salinitas KCl & NaCl terhadap Kestabilan Emulsi Minyak Mentah–air di Lapangan Bekasap. *PT. Chevron Pacific Indonesia. Jurnal Online Mahasiswa Fakultas Teknik Universitas Riau*, 2(1).

Hirasaki, G. J., Miller, C. A., Raney, O. G., Poindexter, M. K., Nguyen, D. T., and Hera, J. (2010). Separation of produced emulsions from surfactant enhanced oil recovery processes. *Energy & Fuels*, 25(2).

Kokal, S. L. (2005). Crude oil emulsions: A state-of-the-art review. *SPE Production & Facilities*.

Naomi, P., Gaol, A. M. L., and Toha, M. Y. (2013). Pembuatan sabun lunak dari minyak goreng bekas ditinjau dari kinetika reaksi kimia. *Jurnal Teknik Kimia*, 19(2).

Soffian, R. M. and Niven, T. L. (1993). *Emulsion Treatment Program*. SPE Asia Pacific Oil and Gas Conference.

Subekti, P. (2015). *Perbandingan Perhitungan Matematis Dan SPSS Analisis Regresi Linear Studi Kasus (Pengaruh IQ Mahasiswa Terhadap IPK)*. 1–21.

Sukeksi, L., Sidabutar, A. J., and Sitorus, C. (2017). Pembuatan Sabun dengan Menggunakan Kulit Buah Kapuk (Ceiba Petandra) sebagai Sumber Alkali. *Jurnal Teknik Kimia USU*, 6(3).

Sulaiman, A. D. I., Abdulsalam, S., and Francis, A. O. (2015). *Formulation of Demulsifiers from Locally Sourced Raw Materials for Treatment of a Typical Nigerian Crude Oil Emulsion*. (January 2015).

Wylde, J. J., Coscio, S. E., and Barbu, V. (2009). A case history of heavy-oil separation in northern alberta: A singular challenge of demulsifier optimization and application. *SPE Production & Operations*.

Yaakob, A. B. and Sulaimon, A. A. (2017). Performance assessment of plant extracts as green demulsifiers. *Journal of the Japan Petroleum Institute*, 60(4).

Zhou, H., Dismuke, K. I., Lett, N. L., and Penny, G. S. (2014). *Development of More Environmentally Friendly Demulsifiers*. (February), 15–17.

Zulkifli, M. and Estiasih, T. (2014). Sabun Dari Distilat Asam Lemak Minyak Sawit: Kajian Pustaka [In Press Oktober 2014]. *Jurnal Pangan Dan Agroindustri*, 2(4).

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