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Laboratory Studies for The Development of a Demulsifier in Handling Production Fluid Emulsions in The "SRG" Field

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ABSTRACT - The "SRG" Oil Field is located in the South Sumatra basin, and the oil produced is classified as heavy oil and generally water-oil emulsion occurs. As a result of the formation of this emulsion which will cause corrosion of equipment in the field. The samples that have been taken in the field are then investigated in the laboratory of PT Farca Risa Sejahtera. First, perform BS&W testing on GS-belimbing and GS-11 oil samples to determine the water content and deposits present in the oil. The second is to determine the ratio of the amount of oil and formation water to be used in subsequent tests. The third selection of demulsifiers for formulation materials is based on the ability of water drop, clear water and interface. The four demulsifier formulations combine the demulsifiers that pass the selection into 5 formulas with the hope of uniting the advantages and covering each other's shortcomings of each demulsifier that passes the selection. The fifth test is overtreated to determine the appropriate dose for the use of a predetermined demulsifier formula. Emulsion sample testing was also carried out on CGS oil samples (GS-belimbing oil and GS-11) plus the oil present in the pits. The six BS&W tests after using the new formula. GS-belimbing has a production rate of ±22,000 BFPD with a water cut value obtained from the separator test in the field and validated by the BS&W test in the laboratory of ±92%, the value of oil production in GS Belimbing is ±1760 BOPD. While the GS-11 has a production rate of ±33,000 BFPD with a water cut value of ±91%, the value of oil production in GS 11 is ±2970 BOPD. While the CGS has a fluid production rate of ± 58,000 BFPD with a water cut of ± 90%, the value of oil production at the CGS is ± 5800 BOPD. Formula code H5 with a composition of 10% (F-13; water drop) plus 10% (1030; interface) and 80% (F-16; clear water) which was selected for GS-belimbing. The formula with code A1 which has a composition of 80% F-8 plus 10% 1030 and 10% F-16 was chosen for the GS-11. For the CGS, the S5 formula is 10% (F-16 clear water) plus 10% (1030; interface) and 80% (F-8; water drop). The results of the BS&W test after the new formula showed that there was no water in the oil in the centrifuge tube and it was stated that the BS&W value was close to 0%. There are 3 demulsifier products from the formulation, namely HAS-1 for GS-belimbing, HAS-2 for GS-11, and HAS-3 for CGS plus pit. The amount of HAS-3 demulsifier that needs to be injected into the CGS is 7.31 gallons per day (GPD). The number of HAS-1 demulsifier injected into GS Belimbing was 2.22 GPD, while the number of HAS-2 demulsifier injected into GS-11 was 3.74 GPD.

Keywords: Crude oil, Demulsifiers, Bottle test, Formulation, Dose, Overtreat

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INTRODUCTION

Water is typically produced in the oil field at the same time as the oil. There are two forms of water in oil: free water and water emulsion. Free water does not pose a significant threat to the production process, but the existence of emulsified water poses a threat and necessitates careful treatment moving forward. Emulsions in pipes or reservoirs in the petroleum industry can lower output (Subiatmono et al., 2007). Mechanical, thermal, electrical, and chemical methods can be used to separate water from a crude oil emulsion (Grace, 1992). The use of a demulsifier in a chemical separation process is the most effective of the four approaches. By integrating several methods, such as chemical separation methods combined with thermal methods, can increase the efficiency of water separation in crude oil. Demulsifier and reverse demulsifier chemicals are classified as surface active agents (surfactants) which function to break and separate water and oil emulsions.

The function of the demulsifier is to overcome emulsion problems that occur in an oil field, the results of which are indispensable as a reference in overcoming further emulsion problems (Yodi, 2018). The method used to determine the performance of the demulsifier is the bottle test. With the bottle test, observations will be made about the demulsifier being tested from the fastest water drop value, namely the speed at which water and oil separate, water clarity or separate water clarity, and a good interface, which is a straight line that separates oil and water, then adjusted to the conditions at field and the optimal price will be obtained.

This demulsifier was created over the course of seven stages. Taking samples of crude oil and formation water in the field for later testing in a lab constitutes the first stage. Next, evaluate the crude oil samples using the BS&W (basic sediment and water) method at PT. Farca Risa Sejahtera. The ratio of crude oil to formation water utilized in the bottle test is then determined in the third stage. Choose a demulsifier that received high marks from the SP-starfruit, SP-11, and SPU samples together with pit oil as your fourth option. Fifth, based on the decision that was taken in the previous stage, formulate the demulsifier that has been chosen. To identify the ideal dose to employ in the new formula, the sixth performed an overtreat test. On the sample that has been injected with the new formula, the seventh step is to perform the BS&W test once more.

METHODOLOGY

An emulsion is defined as a system consisting of two immiscible liquid phases stabilized by an emulsifier (surfactant), where one liquid phase is dispersed in the other liquid (Dian Nadia, 2018). In the presence of an emulsifying agent, water and oil can form an emulsion. Water in the reservoir can be bound as an emulsion or in the form of free water. Free water can be separated only by using a physical process, namely by the influence of gravity. Water that forms an emulsion with petroleum will be difficult to separate.

Definition of an emulsion is a colloidal dispersion of one liquid (disperse phase) in another (continuous phase) (Tjuwati Makmur, 2010). He divided Type of emulsion can be divided into three parts:

- Oil in water.
- Water in oil.
- Complex/multiple emulsions.

There are several types of emulsions classified based on how the oil and water phases are present in the dispersion system (Henriquez, 2009). The words "oil" and "water" are used in a more polar sense, coming from two immiscible phases. Figure 1 gives various types of emulsions, such as Water in oil (W-O) emulsion gives water droplets dispersed in the oil phase, or oil in water (O-W) emulsion if what happens is that oil droplets are dispersed in the water phase, while two or more emulsions are denoted using W1-O-W2 or O1-W-O2. W1 (each O1) and W2 (each O2) provide the outermost and innermost phases. A biemulsion is an emulsion containing two droplets of different internal phases, with different sizes or properties.

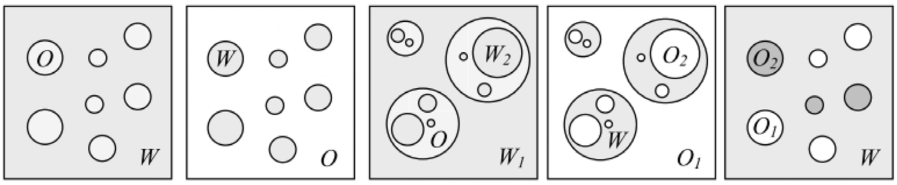
A demulsifier is a surface active substance that has the function of reducing the surface tension between liquids by wetting, dispersing, and replacing the emulsifier layer, which causes water and oil droplets to separate. The most commonly used demulsifier is a nonionic surfactant. Nonionic surfactants also reduce electrostatic interactions with salts or the influence of pH. The requirements to be said to be a demulsifier are as follows:

- Has a high concentration which is diffused between phases.
- The adsorption rate is high between phases and creates interfacial tension
- Molecular partitions exist in the water and oil phases
- Dissolved in the organic phase.

The crude oil contains a number of components, which in nature have interfacial properties. These components especially are asphaltenes, resins and naphthenic acids. These components may accumulate at the water-oil interface and inhibit the oil droplets to a separate phase. Among these components, asphaltenes are the major material involved in emulsion stabilization (R. Desrina, 2012). In the separation process, the demulsifier, which will break the emulsion, will go through 3 stages, namely flocculation, coalescence, and solid wetting. Flocculation is the process when colloids come out of suspension in the form of flocs or flakes, either spontaneously or due to the addition of a clarifying agent to an oil emulsion.

This clarifying agent is a demulsifier. At this stage, the flocs from the internal phase will be combined, and if the formation of the oil-water emulsion layer is weak, then these flocs which are incorporated will merge with the continuous phase. When the droplets of the dispersed phase combine after being churned to create larger droplets and merge with the continuous phase, the process is known as coalescence, and the emulsion melts or cracks. The final step is solid wetting, which collects solid phases in the oil after the previous stage. Typically, crude oil contains particles including clay, paraffin, drilling mud, and iron sulfide. One of the most used techniques for the demulsification test is the vial test method.

This approach was chosen based on a number of field variables, including the demulsifier’s chemical characteristics, its dosage, the testing period’s duration, the temperature, and the amount of stirring. The theoretical surface area (grind out) of petroleum, formation water, water reduction, oil dryness, and interface quality are all measured using the bottle test method.



(a) (b) (c) (d) (e)

Figure 1
Various emulsions (Henríquez, 2009, p.12)

Data from bottle tests that measure the emulsion’s strength on the basis of laboratory analysis can be attributed to the characteristics of crude oil. Another factor affecting the stability of an emulsion is how much water is still present in the oil. Several different parameters can be used to compute this remaining water. The emulsion state is still present for a portion of the leftover water in the oil phase.

Research Data

The value of oil output in GS Belimbing is around 1760 BOPD, with a production rate of 22,000 BFPD and a water cut value of 92% acquired from the separator test in the field and corroborated by the BS&W test in the laboratory. The value of oil output in the GS-11 is 2970 BOPD, despite having a production rate of 33,000 BFPD and a water cut value of 91%. The CGS produces fluids at a rate of 58,000 BFPD with a 90% water cut, however its oil production is worth 5800 BOPD. In order to prevent the oil in the tank from freezing and to ensure that the demulsifier functions well because it is more effective at high temperatures, the manufacturing facility’s temperature is kept at 60 C. The number of doses needed to choose the demulsifier and formulation before figuring out the right formula dose is 50 ppm, or 0.005 ml per 100 ml sample. This value is decided based on the data already available or the demulsifier’s prior use at CGS. If any chemical is injected into the wellhead, such as a scale inhibitor, it must be closed first to ensure that the fluid received is clean before sampling is done on a flowline close

Table 1
Types of demulsifier (Halwin Ariandi Siregar, 2022)

No	Types of Demulsifier	
	Name	Function
1	F-7	Water Drop
2	F-8	Water Drop
3	F-13	Water Drop
4	F-14	Water Drop
5	F-15	Water Drop
6	18406	Water Drop
7	F-9	Interface
8	F-10	Interface
9	F-12	Interface
10	F-25	Interface
11	1030	Interface
12	F-16	Clear Water
13	4114	Clear Water
14	9001	Clear Water

to the wellhead.

The fluid is then placed in a unique container after that. According to laboratory study, oil has an emulsion concentration of 7%, and 406 BEPD worth of emulsion is estimated to be present in CGS oil. While the rate of oil production in GS 11 is 2970 BOPD, the total fluid production rate is 33,000 BFPD with a water cut of 91%. The amount of emulsion in the research findings' oil was calculated to be 8%, or 238 BEPD, based on the amount of emulsion found in GS-11 oil. At GS Belimbing, the rate of total fluid production is 22,000 BFPD with a 92% water cut, and the rate of oil production is 1760 BOPD. According to laboratory study, oil has an emulsion percentage of 9%, and 158 BEPD of emulsion is estimated to be present in CGS oil. These are the many types of demulsifiers. Three demulsifier assessment criteria in breaking emulsions, namely the speed of separation (water drop), the clarity of the separated water (clear water), and the resulting interfacial tension, have been developed as a score system to aid in the selection process (interface). Demulsifiers are the most effective at resolving emulsion issues in the SRG field because they can at least achieve a total rating of 80.01 on the rating scale.

Table 2
Scale of rating for demulsifier based on interface criteria, water drop, and clear water, emulsion breaking capability (Source PT. Farca Risa Sejahtera)

Score	**Rating Scale based on Ability**			**Total**
	Interface	***Water Drop***	***Clear Water***	
Very good	33,3	33,3	33,3	99,9
Good	26,67	26,67	26,67	80,01
Moderate	20	20	20	60
Bad	13,3	13,3	13,3	39,9
Very bad	6,67	6,67	6,67	20,01
Does not work	0	0	0	0

RESULTS AND DISCUSSION

Basic Sediment and Water (BS&W) Test

In this experiment, GS-belimbing oil and GS-11 oil samples from two different 10 ml centrifuge tubes were combined to create two separate samples. The centrifuge tube was then heated for 10 minutes in a water bath at a temperature of 60°C.

The sample was then circulated in a centrifuge for 5 minutes, and observations were made on it. The results showed that the GS-belimbing oil sample had 9% emulsion, the GS-11 oil sample had 8%, and there was emulsion in the centrifuge tube. The test was then repeated using the same approach, but this time a demulsifier was injected before the centrifuge was used to rotate the sample. The demulsifier of choice is PT Farca Risa Sejahtera's F-46, which is the type being employed. 50 ppm F-46 was injected, spun for 5 minutes, and watched. Better separation and the absence of emulsion in the sample are the results.

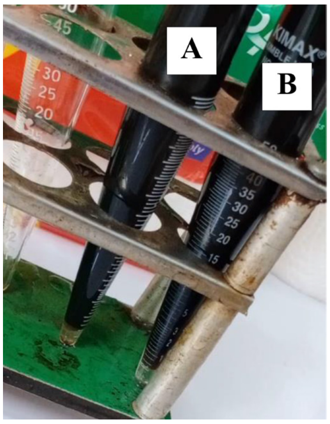


Figure 2
GS-belimbing (A) and GS-11 (B) Oil Sample Results from BS&W (Halwin Ariandi Siregar, 2022)

Determination of the Volume Ratio between Crude Oil and Water

Determining the ratio employed for this investigation is crucial before testing the demulsifier. The sample of oil used for this test comes from GS 11, which contributes the most oil to the main collection station (CGS). Four bottles of sani glass, each holding the following ratios of oil to water: 60 (oil): 40 (formation water), 65 (oil): 35 (formation water), 70 (oil): 30 (formation water), and 75 (oil): 25 were used in the test (formation water). The emulsion sample from these four samples that met the fewest requirements but wasn't saturated was chosen.

Figure 3
Comparison of the oil and water ratio of the formation. (Halwin Ariandi Siregar, 2022)

60:40 is the ratio According to experiments and observations, a ratio of 60:40 was selected with 60% crude oil and 40% formation water to be used for bottle testing demulsifier on GS and CGS. The separation process is not too fast and not too long for 15 minutes, and at a ratio of 60:40 the emulsion that occurs between oil and formation water can be seen.

Table 3
Capability value of formation oil and water comparison ratio (Halwin Ariandi Siregar, 2022)

Minyak:air	ml of water for 15 minutes	Ability Value Based on			Total
		Inter face	Water Drop	Clear Water	
60: 40	36	6.67	6.67	13.3	26.64
65: 35	34	6.67	6.67	6.67	20.01
70: 30	30	6.67	6.67	0	13.34
75: 25	0	0	0	0	0

GS-Belimbing Bottle test

This choice seeks to obtain a demulsifier that can function by fulfilling the GS assessment requirements. The parameters for belimbing crude oil are water clarity, interfacial tension, and speed of separation (water drop). The following 14 types of demulsifiers were used in the experiments: F-7, F-8, F-9, F-10, F-12, F-13, F-15, F-16, F-25, 1030, 4114, and 18406. The finest six demulsifiers will be chosen from among all demulsifiers based on the observations made. The demulsifier’s capacity for the quickest water drop, clear water, and nice interface determines this best criterion. Six demulsifiers with the codes F-8, F-13, F-15, F-25, 1030, and F-16 were chosen in accordance with the observations and the findings.

Figure 4
Testing on 14 types of demulsifier for gs-belimbing (Halwin Ariandi Siregar, 2022).

The F-8 can quickly separate water from oil due to its clear clear water capabilities, straight interface, and water drop capacity. Excellent separation speed, acceptable interface lines, and well-separated formation water were all attained by F-13. The F-15 features a great interface, great clarity in the water, and great separation speed. Fast water drop from the F-25, decent water results during formation, and great interface lines. Demulsifier 1030 has good water clarity, nice interface, and outstanding separation ability. F-16 has exceptional water separation properties, and the resulting interface is superb.

Demulsifier Formulation for GS-belimbing

Following the demulsifier type selection experiment, a formulation employing the GS-belimbing crude oil technique was carried out. The crude oil was heated in a water bath and poured into 10 bottles with a ratio of the formation water and crude oil amounts that had been established in the earlier test. Then, depending on the dose of prior use, it is injected with a different demulsifier formula in each bottle up to 50 ppm or 0.005 ml per 100 ml sample. The formula for GS-belimbing is as follows:

- H1: 30% (F-15; water drop) + 60% (1030; interface) +10% (F-16; clear water)
- H2: 30% (F-13; water drop) + 50 % (1030; interface) +20% (F-16; clear water)
- H3: 10% (F-8; water drop) + 25% (F-15; water drop) +40% (1030; interface) +25% (F-16; clear water)
- H4: 25% (F-15; water drop) +20% (F-25; interface) +20% (1030; interface) +35% (F-16; clear water)
- H5: 10% (F-13; water drop) +10% (1030; interface) +80% (F-16; clear water)

Figure 5
Test the demulsifier formulas for GS-belimbing (Halwin Ariandi Siregar, 2022)

The formula with code H5 has the best water drop, interface, and clear water, and it is in compliance with GS-belimbing oil, according to testing, observation, and evaluation of all available samples. Additionally, this recipe serves as a suggestion that will be employed in GS-belimbing to create the demulsifier product HAS-1.

Table 4
Demulsifier formula ability assessment
At the GS-belimbing (Halwin Ariandi Siregar, 2022)

Formula	Ability Value Based:			Total
	Water Drop	*Interface*	*Clear Water*	
H1	33.3	26.67	26.67	86.64
H2	26.67	33.3	33.3	93.27
H3	33.3	33.3	26.67	93.27
H4	26.67	33.3	26.67	86.64
H5	33.3	33.3	33.3	99.9

GS-11 Bottle test

There were 14 different types of demulsifiers employed in the GS-11 experiments, and the top 6 will be chosen. It was decided to use a demulsifier with the code F-8, F-14, F-10, F-25, 1030, F-16 based on the observations and the findings. The F-8 demulsifier code produced separation results quite quickly, had outstanding water clarity, and had a nice interface as well. F-10 has very good separation, nice clear water, and good interface line, while F-14 has a quick water drop, clear formation water, and outstanding interface. The F-25 features a superb interface, good clear water, and the ability to dump water quickly. The formation water produced at code 1030 is fairly good, the separation occurs quickly, and the interface is satisfactory. F-16 having the best capacity to clear water, good water drop, and good interface.

Figure 6
Testing of 14 types of demulsifier for GS-11
(Halwin Ariandi Siregar, 2022)

Demulsifier Formulation for GS-11

Following the demulsifier selection experiment, a formulation based on the six chosen demulsifiers was carried out. This is how the GS-11 demulsifier formula is put together:

- A1: 80% (F-8; water drop) +10% (1030; interface) +10% (F-16; clear water)
- A2: 80% (F-14; water drop) +10% (1030; interface) + 10% (F-16; clear water)
- A3: 10% (F-8; water drop) +30% (F-10; interface) +60% (F-16; clear water)
- A4: 60% (F-8; water drop) + 30% (1030; interface) +10% (F-16; clear water)
- A5: 50% (F-14; water drop) + 20 % (F-25; interface) +30% (F-16; clear water)

Using the bottle test method, the five formulae were injected into the samples. The five samples were then observed, and this was followed by formula development for GS-11. Based on the outcomes of examinations, observations, and evaluations performed on the GS-11 samples. Formula with code A1, which is consistent with the characteristics of GS-11 oil and has the best water drop, interface, and clear water. Additionally, this formula serves as a suggestion that will be incorporated into GS-11 to create the demulsifier product HAS-2.

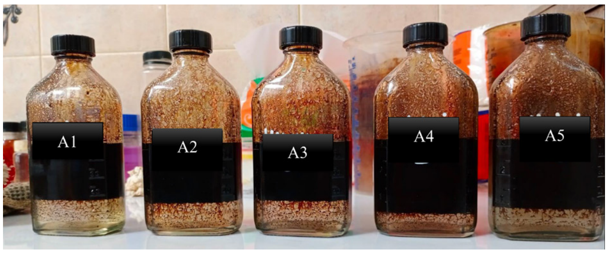


Figure 7
Test the demulsifier formulas for GS-11 (Halwin Ariandi Siregar, 2022)

Table 5
Demulsifier formula ability assessment
at the GS-11 (Halwin Ariandi Siregar, 2022)

Formula	Ability Value Based on			Total
	Water Drop	*Inter face*	*Clear Water*	
A1	33.3	33.3	33.3	99.9
A2	33.3	33.3	26.67	93.27
A3	33.3	33.3	26.67	93.27
A4	33.3	26.67	26.67	86.64
A5	33.3	26.67	26.67	86.64

CGS *Overtreat* Test

The overtreat test was conducted to establish the ideal dosage and prevent demulsifier overuse. Based on the use of the demulsifier dose before the formulation was carried out, the 50ppm dose in the prior experiment was chosen. Oil from GS-11 and the oil that has been separated from the GS-belimbing will eventually be directed to the CGS due to field conditions. Following a meeting in a flowline, the oil and demulsifier from the two GSs will flow collectively to the washtank at the CGS.

Table 6
Demulsifier Dosage Data for CGS. Overtreat Test
(Halwin Ariandi Siregar, 2022)

Sample	Injected Formula	
	GS-belimbing (H5)	GS-11 (A1)
A	20 ppm	30 ppm
B	30 ppm	20 ppm
C	30 ppm	30 ppm
D	40 ppm	40 ppm
E	50 ppm	50 ppm

When different demulsifiers are used with oil, an overdose may occur where the demulsifier is no longer effective. Both samples of GS-11 oil and GS-belimbing oil were combined for the test. The ratio of the oil mixture from GS-belimbing and GS-11 is changed based on the specific BOPD in order to approximate the field circumstances. According to the statistics provided, the proportion of GS-11 to GS-belimbing oil at CGS is 40:60. Before testing, combine GS-belimbing oil and GS-11 in a 1000 ml measuring cup according to the ratio and stir to combine. The oil mixture will then be applied to the sample in the sunlit glass later. Five samples will then be mixed after being injected with the GS-belimbing and GS-11 demulsifier formulations. The oil mixture will then be applied to the samples in a bright glass. The GS-belimbing and GS-11 formulas were injected into 5 samples in accordance with the doses listed in table 6.

The heated sample was added to four sani glass bottles, just like in the earlier testing, along with formation water in a 60:40 ratio. Next, the demulsifier formula discovered via the tests was injected into each bottle. prior testing using various doses in every container. If one of the examined samples is overtreated, the results of this test will establish the dosage limit. After the demulsifier was injected, the sample was shaken for 2 minutes while the water and oil were separated, and after 1 minute, the water level of the separation was noted. The sample was then placed in a water bath for 2 minutes, after which it was removed to observe and record the water and oil separation. The separation process was observed every 2 minutes for 15 minutes.

Figure 8
CGS Overtreat test results (Halwin Ariandi Siregar, 2022)

Additionally, as stated in the table, a review of the water drop, interface, and clear water capabilities is conducted.

Table 7
Evaluating the CGS Overtreat Test Sample's Demulsifier Formula Ability (GS-belimbing + GS-11)
(Halwin Ariandi Siregar, 2022)

Formula	Ability Value Based on			Total
	Water Drop	*Interface*	*Clear Water*	
A	33.3	26.67	26.67	86.64
B	33.3	26.67	26.67	86.64
C	33.3	33.3	33.3	99.9
D	33.3	26.67	26.67	86.64
E	33.3	26.67	26.67	86.64

Following a number of tests and evaluations, it was determined from the results that no sample had been overtreated. However, sample C, which has advantages over the other 4 samples in its ability to function in clear water and has a better interface, shown the best change. Therefore, 60 ppm with details of 30 ppm formula H5 (GS-belimbing) + 30 ppm formula A1 is the recommended dose for CGS without extra oil from the pit (GS-11).

CGS Plus Pit Oil Formulation

Additionally, the washtank will get the oil from the CGS pit. The oil will then mix with oil from GS-11 and GS-belimbing, thus a new demulsifier must be created and injected before the oil reaches the wash tank. Because the oil in the CGS comes from GS in the SRG field and the BOPD GS 11 and GS Belimbing values are able to represent 50% of production in the SRG field and are assumed to be the majority, this formulation uses the best type of demulsifier that has been tested in the GS-belimbing and GS-11 bottle tests. Comes from the GS Belimbing and GS Belimbing regions. The demulsifier selection tests in GS Belimbing and GS 11 produce very identical results, and the demulsifier that passes is coded F-8, F-10, F-15, F-16, F-25, 1030. Five formulations using the following formula were created using the six different types of demulsifier:

- S1: 90% (F-16; *clear water*) + 10% (F-8; *water drop*)
- S2: 70% (F-16 *clear water*) +20% (F-10; *interface*) +10% (F-15; *water drop*)
- S3: 80% (F-16 *clear water*) + 15% (1030; *interface*) +5% (F-15; *water drop*)
- S4: 70% (F-16 *clear water*) +30% (1030; *interface*)
- S5: 10% (F-16 *clear water*) +10% (1030; *interface*) +80% (F-8; *water drop*)

Figure 9
Demulsifier formula test on CGS
(Halwin Ariandi Siregar, 2022)

Based on the ratio of the production percentages at CGS, the oil sample used in this test is a combination of GS Belimbing and GS 11 oils in a ratio of 40 (GS-Belimbing): 60 (GS-11). After being filled with liquid in the proportion of 60 (oil): 40 (formation water), the sample bottles were shaken for 2 minutes, then immediately submerged in a water bath. After 5 minutes, the sample was removed, added with oil from the pit in the amount of 20 ml, and then immediately injected with the new demulsifier formula. Additionally, a determination of the capability of the water drop, interface, and clear water is made.

Table 8
Demulsifier formula ability assessment in CGS formulation samples plus pit oil (Halwin Arindi Siregar, 2022)

Formula	Ability Value Based on			Total
	Water Drop	Interface	Clear Water	
S1	26.67	20	33.3	79.97
S2	33.3	20	26.67	79.97
S3	33.3	20	26.67	79.97
S4	33.3	20	33.3	86.6
S5	33.3	20	33.3	86.6

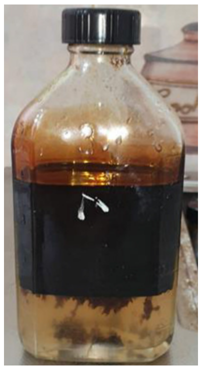


Figure 10
The results of the addition of F-46 for 2 hours
(Halwin Ariandi Siregar, 2022)

The temporary demulsifier formulations for CGS plus oil from the pit are S4 and S5, according to the experiments that have been conducted in accordance with the protocols and observations. changes in the formations' water volume S4 formula balances S5 formula in terms of water drop capabilities. The results for all samples' interface lines are not particularly good because the oil in the pits is made up of leftover oil from various cellar tanks, wells in the "SRG" field that enable rainwater or trash to enter, and any oil spills that may have occurred. In the event that the flowline pipe is repaired, it may also carry trash or other materials that may alter the properties of the oil in the pit.

According to observations, there are still lumps that resemble emulsions in each sample bottle. In an effort to solve this issue, the researchers applied the best demulsifier available in the PT Farca Risa Sejahtera laboratory F-46 to the chosen sample.

The results of this test show that the oil from the pit at the CGS is extremely damaging because it contains rainwater or garbage, and from an oil spill in the event of repair of the flowline pipe it can also

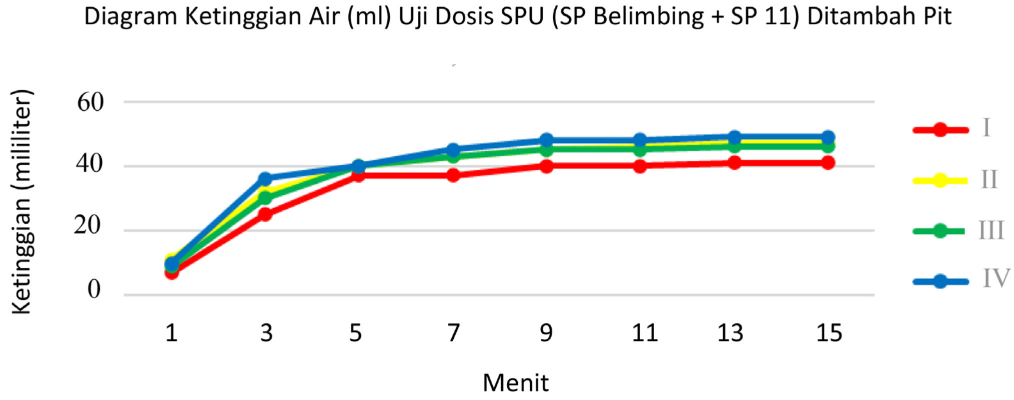


Figure 11
Graph of change in water level against time in the CGS overtreat test + pit oil

Table 9
Demulsifier dosage data for CGS overtreat test (Halwin Ariandi Siregar, 2022)

Sample	Injected Formula		Formula CGS+Pit	
	GS-belimbing (H5)	GS-11 (A1)	S4	S5
I	50 ppm	50 ppm	100 ppm	-
II	50 ppm	50 ppm	-	100 ppm
III	30 ppm	30 ppm	30 ppm	-
IV	30 ppm	30 ppm	-	30 ppm

carry garbage or dirt. The lumps that resemble emulsion on each sample bottle cannot disappear. It may change how the oil in the pit behaves.

Overtreat Test of CGS Plus Pit Oil

Due to the new oil formula in CGS (GS-belimbing and GS-11 + pit oil), an overtreat test for the chosen formula, specifically S4 and S5, is required. GS-Blimbing oil samples and GS-11 were combined in a ratio of 40 (GS-belimbing): 60 (GS-11), and the method was then heated in a water bath that had been preheated to 60 C. Similar to the procedure used in the previous test, the sample was heated and placed in 4 bottles. It was then mixed with formation water in a 60:40 ratio, shaken for 2 minutes, and then placed immediately in a water bath. After 5 minutes, the sample was removed and mixed with up to 20 ml of pit oil. It was then immediately injected with the CGS demulsifier formula plus pit with codes S4 and S5.

After being injected with demulsifiers S4 and S5, the sample was shaken for 2 minutes while being watched to see how the water and oil separated. After 1 minute, the water level of the separation was recorded, and after 2 minutes, the sample was removed to watch and record the water and oil separation. For 15 minutes, the separation process was recorded every 2 minutes. The GS-C formula sample overtreatment test results (CGS plus oil from the pit).

Table 10
Demulsifier formula ability assessment in the CGS overtreat test plus pit oil (Halwin Ariandi Siregar, 2022)

Sample	Ability Value Based on			Total
	Water Drop	*Interface*	*Clear Water*	
I	26.67	20	26.67	73.34
II	33.3	20	26.67	79.97
III	26.67	20	33.3	79.97
IV	33.3	20	33.3	86.6

The capacities of the water drop, interface, and clear water are then evaluated. Because the previous test was the highest dose but there was no overtreating, formula H5 and A1 were injected 50 ppm in samples I and II. A subsequent test was then conducted with a new formula added to test the overtreat. Testing and observation revealed that there was no overtreatment, although sample IV with the formulas H5 up to 30 ppm and A1 30 ppm with formula S5 30 ppm shown good changes and received high ratings for the fastest water drop, clear water, and good interface. As a result, the HAS-3 demulsifier product is recommended using the S5 formula and is aimed at CGS in the SRG field.

BS&W Test on Final Formula Sample

Three new demulsifier products HAS-1 from formula H5 for the Belimbing collection station, HAS-2 from formula A1 for the GS 11 collecting station, and HAS-3 from formula S5 for Pit oil from the main collection station were produced as a consequence of the study that was conducted. This experiment was conducted on sample IV, the results of testing the dosage of the CGS formula plus Pit oil on the CGS by taking only the top part, namely oil, because this sample is the assumption of the final product where all demulsifier formula products that have been made, namely HAS-1, HAS- 2 and HAS-3, which have been injected into the emulsion sample with a predetermined dose of 30 ppm for each formula, are present. Figure 11 explains the outcomes of the centrifuge-based emulsion test on Sample IV. According to the BS&W test findings for sample IV, there was no water in the oil in the centrifuge tube, and the test's BS&W value was close to 0%. This test demonstrates the new formula's excellent performance and how well it addresses emulsion issues in the SRG field.

Figure 12
Final BS&W test results on sample IV (Halwin Ariandi Siregar, 2022)

Application on SRG Field

Three demulsifier products are advised following a series of experiments and observations, as well as an evaluation of all samples that have been tested: the HAS-1 product with the H5 formula, which is composed of 10% (F-13; water drop) plus 10% (1030); interface) and 80% (F-16); clear water; and the HAS-2 product with the A1 formula, which is composed of 80% (F-8; water drop) mixed with 10% (1030); interface) and 10% (F-8; water drop) (F-16 ; clear water). 10% (F-16 clear water) plus 10% (1030; interface) and 80% of the HAS-3 product with S5 formula for CGS (F-8; water drop). For each 100 ml of fluid, the three formulas' dose on the laboratory scale is 30 ppm.

The amount of oil produced may reach 5800 BOPD based on data from the main collecting station's predicted oil output. The amount of demulsifier that needs to be injected is 7.31 gallons per day in order to break the oil emulsion using the PPM calculation as in formula 3.2. (GPD). And for GS-belimbing and GS-11, based on BOPD data, the ratio of GS Belimbing and GS 11 crude oil sent to CGS is 60 (GS 11): 40 (GS Belimbing). Accordingly, the estimated BOPD at GS Belimbing is 1760 BOPD while the BOPD in GS 11 is 2970 BOPD, and the number of HAS-1 demulsifiers injected into GS Belimbing is 2.22 At GS Belimbing, GS 11, and CGS, the demulsifier formula was injected shortly before the fluid entered the wash tank, following the separator.

CONCLUSION

If a chemical, such as a scale inhibitor, is injected into the wellhead while sampling is being done on a flowline close to the wellhead, the wellhead must first be closed to ensure that the fluid collected is clean (not mixed with chemicals).

GS-belimbing has a production rate of 22,000 BFPD and an oil production value of 1760 BOPD. The water cut value was determined by the separator test in the field and validated by the BS&W test in the laboratory. The value of oil output in the GS-11 is 2970 BOPD, despite having a production rate of 33,000 BFPD and a water cut value of 91%. The CGS's fluid production rate is 58,000 BFPD with a 90% water cut, but its oil production is worth 5,800 BOPD.

Formula code H5, which is used for GS-belimbing, has 10% (F-13; water drop), 10% (1030; interface), and 80% (F-16; clear water). For the GS-11, the formula with code A1, which consists of 80% F-8 + 10% 1030 and 10% F-16, was chosen. The S5 formula for the CGS is composed of 80%,

GLOSSARY OF TERMS

Symbol	Definition	Unit
	Gathering Station	GS
	Central Gathering Station	CGS
	Barrel fluids per day	BFPD
	Barrel oil per day	BOPD
	Barrel emulsion per day	BEPD
	Gallons per day	GPD
%	Basic Sediment and Water	BS&W
Parts per million (ppm)	Injected rate	Dose

10% (1030; interface), and 10% (F-16 pure water) (F-8; water drop).

The BS&W test results revealed that the oil in the centrifuge tube was completely devoid of water and that the BS&W value was very near to zero.

The formulation contains three demulsifier products: HAS-1 for GS-belimbing, HAS-2 for GS-11, and HAS-3 for CGS plus pit.7.31 gallons of HAS-3 demulsifier need to be injected into the CGS every day (GPD). HAS-1 demulsifier was injected into GS Belimbing at a rate of 2.22 GPD, whereas HAS-2 demulsifier was injected into GS-11 at a rate of 3.74 GPD.

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