

PROCEEDINGS

JOINT CONVENTION YOGYAKARTA 2019, HAGI – IAGI – IAFMI- IATMI (JCY 2019)

Tentrem Hotel, Yogyakarta, November 25th – 28th, 2019

More Cost Effective Highly Paraffinic Oils Treatment Using The Better New Formulated Paraffin Solvent

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Abstract

Precipitation and deposition of solids in highly paraffinic oil wells have been recognized to be a significant problem in oil production and facilities in Langgak field. These paraffin deposits can occur in tubing, flowline, or in the pore of the reservoir rock, especially near wellbore area, and effectively choke the flow of hydrocarbons. The result is a decrease or even cessation of production unless some remedial action is taken on periodic basis.

The primary cause of paraffin deposition is simply a loss in solubility in the crude oil. This loss of solubility is usually a result of changes in temperature, pressure, or composition of the crude oil as a result of dissolved gasses. Therefore, among the various common methods to solve paraffin accumulations, solvents are considered the best for dealing with it. Paraffin solvent (parasol) have been largely used in Langgak field and successfully overcome our problems.

A new formulated solvent with density higher than water, “Heavy Parasol”, was introduced and tested. This solvent offers better ability, in term of solubilization capability, and increase operational efficiency, in term of cost and time. Through the new treatment, the flow of hydrocarbons to the wellbore can be restored and improved, and the cost to run the treatment can be minimized. Better result at lower cost.

This paper will explain the process in treatment, and also compare the benefits and easiness associated with the application of Heavy Parasol. Case study and lab test data will be presented to compare the performance and economics of both paraffin solvents used in Langgak field.

Introduction

Organic deposition during highly paraffinic oil production and transport is one of the most serious problem faced in downhole and surface operations in Langgak field. Paraffins can build up as deposits in the wellbore, flowline, production line, and other facilities. These deposits are mainly constituted by n-paraffins (linear alkanes) and small amounts of branched paraffins and aromatic compounds. These deposits can act as chokes within the wellbore, resulting in a gradual decrease in production with time as the deposits increase in thickness. Almost all wells have experienced this problem where a partial or total loss in productivity was reported due to wax problem.

This deposition occurs mostly due to changes in production environment that lead to loss in paraffin solubility in crude oil. Paraffin often settles as a result of falling temperature or pressure that usually occurs during well service, workover, well stimulation or well down for a long period of time. The treatment has been done on a periodic basis in order to fix the problem.

Several methods of removing paraffin deposits involve thermal, mechanical removal, and chemical. Among these various methods, paraffin solvent (parasol) has been chosen and largely used in Langgak field. A chemical treatment using solvent was preferred chiefly because its lower cost.

The parasol injection was done during the well service/workover job to clean the wellbore and near wellbore area from paraffin deposition, known as downhole cleaning (DHC). A relatively large volume of solvent and diesel mixed are injected through tubing during the wellservice job. With the help of rig, parasol is spotted into the treating perforation. Later, the well is closed for several hours to let the parasol to work (soaking). The well will be back into production while the wellservice job has finished.

In some cases, the DHC may be needed while the rig is not ready for the well. The need to run the DHC job without rig (rig-less) brought up an idea for us to make a new formulated paraffin solvent that can be used for our purposes. A higher density parasol (heavy parasol) which is denser than water was made and tested. Using this new formulated paraffin solvent, not only the process become easier and faster, but also its cheaper and better in term of solubilizing ability.

Data and Method

Langgak crude oil is classified as “Paraffinic-Intermediate” according to Lane and Garton Classification, with 27.5% wax content. Langgak oil properties can be seen in Fig.1.

Langgak Crude Oil Properties		
API Gravity @ 60°C	30.3	
Specific Gravity @60°C	0.8743	
Pour point	105-110	°F
Asphaltene Content	0.051	% wt.
Wax Content	27.46	% wt.
Kinetic Viscosity @122°F	12.77	cSt.

Figure 1: Oil Properties

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Laboratory Test Methods

The heavy parasol tested in the laboratory to see its solubilizing ability towards highly paraffinic Langgak oil and we compare it with our previous paraffin solvent. The solubility test was performed on the congealed Langgak crude oil. The test was conducted at static condition without agitation. The objective of carrying out the test at static condition is to simulate the actual treatment process in the well which no agitation take place when the well is shut-off.

Injection Methods

The conventional parasol treatment that has been done in many of Langgak wells before was injected through tubing using perforation wash tool to target specific perforated layer. The parasol was pumped in 2 stages, pre-flush and main treatment, and followed by water displacement. Then, the well was soaked for several hours for the parasol to work. Due to its light density, a large amount of treating fluid (parasol + diesel oil) is needed for efficient slug placement. Rig is required to run the treatment job.

The new formulated paraffin solvent treatment is carried out without rig (rig-less), only the pump needed to inject parasol through annulus straight to open interval. Most of the time, the heavy parasol was spotted only by poured from casing head. Due to its higher density, it will automatically settle in the bottom of well and in front of the perforated layer. A small amount of water is pumped to push the parasol a little bit pass through the perforation hole and into the reservoir. The well was soaked for several hours and afterwards the well can be put back on production.

All this injection process was done using our existing facility which is very simple. Fig.2 shows the injection facility used for our rig-less parasol treatment.

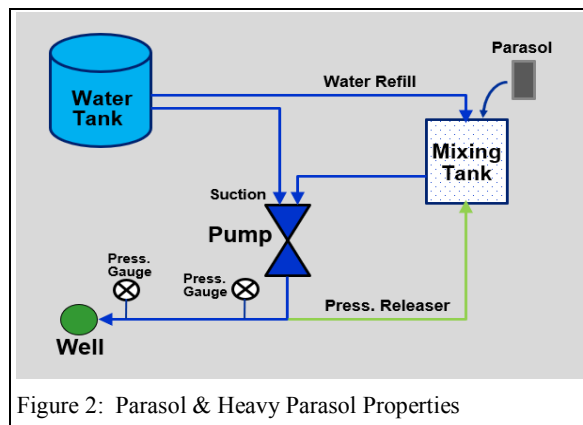


Figure 2: Parasol & Heavy Parasol Properties

Result and Discussion

The new formulated paraffin solvent (heavy parasol) has been created as the result of our idea to simplify the treatment methods and process. With the aim that parasol can be dispelled pass through the annulus and directly to the open perforated interval, we design solvents with higher specific gravity than water. With a higher density, heavy parasols can be poured or pumped directly on the wellhead and directly settle at the bottom of the well. The injection pump is used to pump water through the annulus to push the parasol into the reservoir. With this method, no rig is needed. The injection process become simpler.

However, not all rig-less treatment wells can be done. Rig-less heavy parasol use is limited to certain well configurations. This method can be applied to wells where the treating zone / interval is located on the bottom of the well or where there is a packer below the treating target interval. Fortunately, in many wells in Langgak this method is quite applicable so that it reduces the number of conventional treatments that consume more cost. About 70% of wells in Langgak field can be treated with this injection method. As for other wells, conventional use of parasol injection cannot be replaced. For zones or intervals with a position above or in the middle of the well, it still needs a packer and trough tubing injection to spot the paraffin solvent in the desired zone.

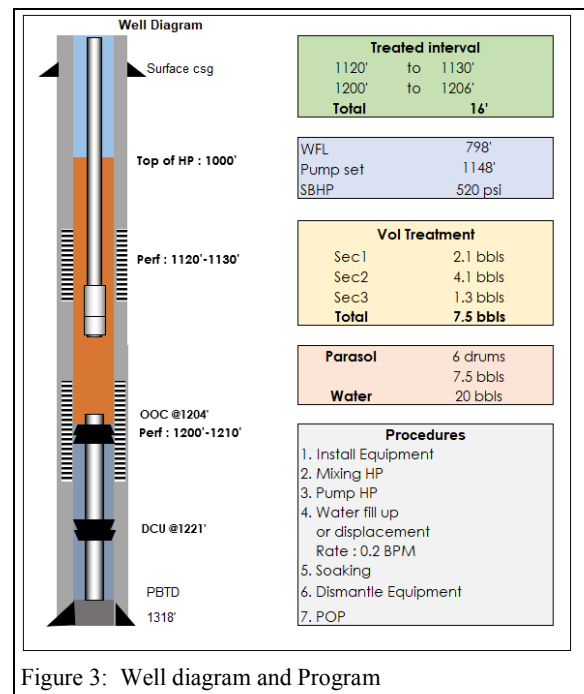


Figure 3: Well diagram and Program

For each heavy parasol treatment, the volume of parasol injected sufficiently includes the length of the interval to be treated with the addition of a small amount of excess to

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enter the reservoir, see Fig.3. The heavy parasol will be placed in front of the perforation of treating interval with specific volume. Some of the heavy parasol inside the borehole will be replaced by water so some of it will enter the reservoir. The well will be pressurized by injected specific amount of water before soaking to let the heavy parasol go inside trough perforation hole slowly. Hydrostatic pressure will help the water to push heavy parasol deeper during the soaking period. During this time, the heavy parasol will dissolve paraffin deposition which having contact with parasol and clean the downhole. Some of deposits which has melted away and mixed with solvent will move up due to its lower density. The longer the soaking period will be better for the treatment to allow more solvent to have contact with more deposits.

Unlike in conventional parasol treatment, where the parasol that injected ahead cannot be displaced by water inside the tubing due to its lighter density, the larger amount of parasol needs to mix with diesel oil to add volume of treatment to be pumped in order to cover the volume of line and tubing to deliver the parasol to the front of perforation and reservoir. Despite the price of heavy parasol alone is more expensive, the total material cost for conventional parasol treatment will be more expensive due to additional solvent included. By using heavy parasol, we can eliminate the need of additional solvent, which not only increase the total cost but also reduce the solvent solubilizing ability.

The heavy parasol is proven to have better solubilizing ability and speed than the previous paraffin solvent. The properties of both parasol and the result of our laboratory test can be seen in Fig.4. The minimum soaking time of treatment also determine from the results of the test.

Unit	Parasol	Heavy parasol	
Density	g/cm ³	0.865	1.13
Viscosity	cSt	0.64	1
Solubility in water	%	5.00%	Insoluble
Solubilizing ability	% oil in 30 min	32	45
Time to solubilize all crude oil	hours	5.75	3.5
Material	Aromatic hydrocarbon	Blended Solvent	

Figure 4: Parasol & Heavy Parasol Properties

To compare our previous parasol treatment and the heavy parasol treatment, we select 1 well which has used both parasol treatment and compare the cost spend for each treatment. The comparison of material, time consumed, and the total cost can be seen at Fig.5.

In terms of the results of both treatments, we cannot see a significant difference due to lack of data and the accuracy of the well test data, see Fig.6. But in general, the two treatments were successful in bringing back the production of wells to their optimum condition. Most of our well can

stay for 1 year and more before the treatment need to be done again.

	Parasol	Heavy Parasol
Price IDR/drum	5,500,000	10,000,000
Volume Injected, drum	6	6
Additional Solvent (solar), drum	7	-
Total Time injected, hours	7	2
Soaking Time, hours	4 - 12	12
Rig cost, \$	5,400	-
Total Cost	8,663.89	4,166.67

Figure 5: Cost Comparison for Parasol vs Heavy Parasol treatment

In some of our wells, the treatment does not contribute a significant improvement in production, this may occur because the decrease in production is not caused by the presence of paraffin deposition but because of natural production decline of the well. However, almost all wells with paraffin deposition problems were successfully treated by using a newly formulated paraffin solvent which can be seen from an increase in production after the treatment.

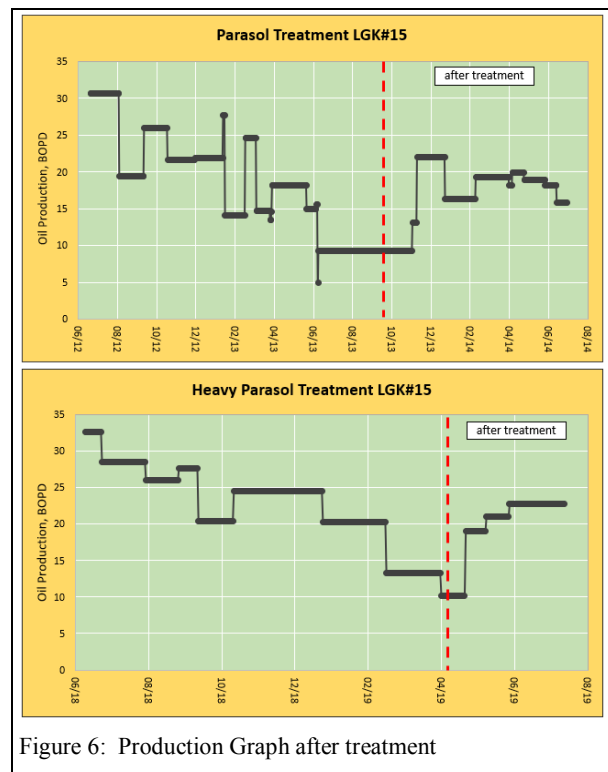


Figure 6: Production Graph after treatment

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Conclusions

1. The new formulated paraffin solvent has been created and proved to be able to handle the paraffin deposits so that oil production can be restored.
2. The treatment process for the new formulated paraffin solvent is simpler and more time-saving compared to the conventional treatment.
3. The total cost for the treatment using the new formulated paraffin solvent is cheaper compared to conventional paraffin solvent treatment due to the unnecessary of Rig and smaller injection volume or the absence of diesel oil.
4. Besides being cheaper, the new formulated paraffin solvent has better solubilizing ability than the previous paraffin solvent.

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