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DEMULSIFICATION STUDIES OF CRUDE OIL

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Abstract: Oil production and transportation via pipelines results in the formation of water-oil emulsions due to the presence of shear forces and pressure and may also contain hydrocarbons like asphaltenes, waxes, resins, solids from crude, and carboxylic acids which serve as natural emulsifiers. Several problems may arise from the co-production of water and crude oil. This may include the cost associated with the pumping or transportation of the water by tanker or via the pipeline, corrosion of production facilities (like pipes, pumps, and downstream distillation columns), poisoning of the downstream by industrial catalysts. Demulsification refers to the breaking down of emulsion into its component incompatible phases (ie. water and oil). It is an important process in the petroleum sector where emulsions are always encountered as deliberate or natural occurrences. In this work heavy oil from Western onshore, Gujarat, India was collected in order to examine the temperature-dosage optimization of chemical demulsification.

This work will focus on the analysis of the effectiveness of various oil soluble demulsifiers on heavy crude oil and the importance of temperature-dosage optimization in demulsification process.

Keywords: - *Emulsion, demulsifier, demulsification*

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I INTRODUCTION

Cambay basin is situated in Gujarat and producing oil and gas for last 50 years. Important field of Cambay basin include; Cambay, Akholjuni, Gandhar, Ankleshwar, Padra, Limbodra & Mehsana.

Oil from Padra field, South Cambay India was taken for demulsification studies. The separation of water from crude oil is an important process in the petroleum refineries as it must be performed prior to oil refining. The two step process governing demulsification are:

- Flocculation (or aggregation, or agglomeration or coagulation)
- coalescence

Various demulsification processes have been suggested by the previous researchers; however, there are two major demulsification approaches in current use are physical and chemical approaches. Chemical method, involves addition of a suitable demulsifier into the emulsion while the physical technique involves heating, mechanical or electrical methods. The Emulsions can be characterized in three wide groups:

Oil-in-water (o/w), water-in-oil (w/o), and multiple emulsions [like water-in-oil-in-water (w/o/w) and oil-in-water-in-oil (o/w/o)]

.II EXPERIMENTAL METHODOLOGY

Bottle test was carried on 3 different demulsifier. 4 demulsification bottles are filled with 50ml homogeneous crude oil each, the crude is kept at a temperature of 90°C at which the viscosity of the oil (non-Newtonian fluid) is greatly reduced and flow property enhanced. Demulsifier solution at various concentrations are added into demulsification bottles and 100 shakes are made to homogenize the mixture. The various samples are allowed at temperature of 90°c for 1hr and then allowed for 24hr shift for optimal demulsification. The various experiments were carried out at same temperature with equal amount of oil of similar properties.

Figure 1 A - Demulsification process at various doses (dosing temperature 60(±)2°C), B - Temperature optimization by heating samples up to 90(±)2°C, C - Separation of water and oil phase

III RESULTS

TABLE 1 CRUDE OIL PARAMETERS

Pour Point (ºC)	42
Density at 15º C (g/cm^3)	0.8882
Specific Gravity	0.8885
API gravity at 15ºC	27.67
IBP – Initial Boiling Point (ºC)	120
Water Cut (%)	48

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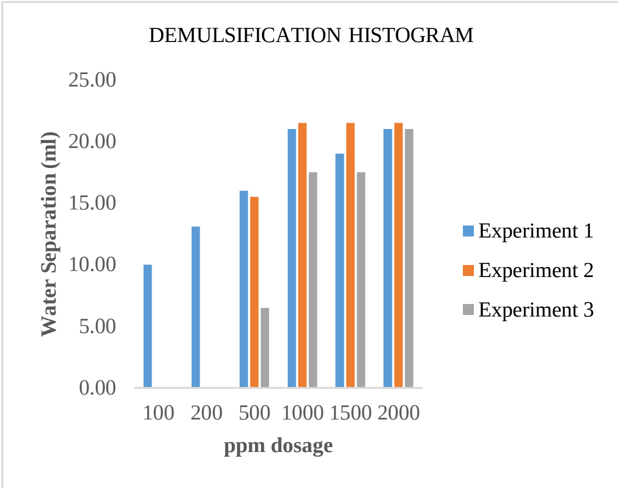
TABLE 2 DATA OF DEMULSIFICATION STUDIES

Demulsifier	Dose (ppm)	Water content (ml)	Oil content (ml)	Remarks
-Oil soluble demulsifier 1020 (Experiment 1)	100	10	40	-Clear water
	200	13.5	36.5	-Clear water
	500	16	34	-Clear water
	1000	21	29	-Tiny oil particles scattered in water
	1500	19	31	-Clear separation -hazy -pale yellow colour
	2000	21	29	-Clear separation -hazy -Pale yellow
Oil soluble demulsifier 1818 (Experiment 2)	500	15.5	34.5	- Clear separation - Pale yellow - No oil droplet
	1000	21.5	31	-Hazy -Pale yellow -No oil droplet
	1500	21.5	33	-Pale yellow -Hazy -No oil droplet
	2000	21.5	39	-Hazy -No oil droplet -Pale yellow
Oil soluble demulsifier 189 (Experiment 3)	500	6.5	38	-Clear separation -Pale yellow -No oil droplet
	1000	17.5	24	-Pale yellow -No oil droplet -Clear separation
	1500	17.5	35.5	-Hazy -Very fine oil droplets -Pale yellow
	2000	21	38	-Hazy -Very fine oil droplets -Pale yellow

IV DISCUSSIONS

A Chemical demulsification is implemented by adding a desired amount of demulsifier to emulsions and mixing them vigorously. After mixing, sufficient time is required to allow Ostwald ripening, flocculation, coalescence and phase separation (sedimentation) to occur.



V CONCLUSIONS

- Oil soluble demulsifiers are generally used for the demulsification of highly stable w/o (water in oil) emulsions.
- Oil soluble demulsifier 1818 showed a constant trend of water separation from 1000-2000ppm with a relatively higher volume of water separated (21.5ml) compared to oil soluble demulsifier 1020 and 189 under similar conditions of temperature and dosing with the absence of oil droplets within the water phase. From the result discussion above optimum demulsification was experienced at dosage of 1000ppm at 90°C.
- A slight variation in effectiveness of separation depending on the demulsifier used, this can be accounted based on the affinity of the demulsifier with the oil components since other conditions (temperature, oil volume and type) has been kept identical throughout the bottle testing processes.
- Higher doses of demulsifier at high temperatures indicates that the emulsion is tough in nature.
- Tough emulsions require higher doses of demulsifier along with high temperature in order to break emulsion for effective demulsification.

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