ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Issue 5 , May 2019

Destruction of Sustainable Water-Oil Emulsion of Local Oils Using the Developed Deemulgers and Electromagnetic Processing

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ABSTRACT. The paper describes the experience of using the magnetic field in the process of destruction of stable oil-water emulsions of local oils. The effect on emulsion with constant and variable magnetic field is considered. The effectiveness of the dehydration process was evaluated by the dynamics of the separation of water from oil and the depth of dehydration.

KEYWORDS:demulsifier, water-oil emulsion, oil, electromagnetic processing, electrophysical methods, intensity, magnetization, polarization, combined effect, adsorption, coalescence, water globule.

I. INTRODUCTION

Regardless of the type of demulsifiers used for the destruction of stable oil-water emulsions (OWE) of local oils, this process takes a long time (7-10 hours) with a significant consumption of valuable reagents [1-3]. Therefore, to intensify this process, nontraditional methods of external influence, in particular electro physical methods, are used [4-6].

II. SIGNIFICANCE OF THE SYSTEM

The paper describes the experience of using the magnetic field in the process of destruction of stable oil-water emulsions of local oils.The study of literature survey is presented in section III, methodology is explained in section IV, section V covers the experimental results of the study, and section VI discusses the future study and conclusion.

III. LITERATURE SURVEY

Of these, for the difficult field conditions of oil production and treatment, the use of electromagnetic processing (EMP) of stable OWE, which changes its physicochemical and colloidal properties, is considered promising [7, 8].

IV. METHODOLOGY

Taking this into account, we studied in laboratory conditions the influence of EMP on the process of destruction of resistant OWES from the high-resinous oil from the Djarkak and Shurchi fields. In this case, experiments were carried out at a temperature (50°C) and an electromagnetic field strength (H) of 1240 oersted. The consumption of imported K-1 (People's Republic of China - PRC) and the developed demulsifier (КМД) was studied under comparative conditions in the range of 20-60 g / ton of oil.

In table 1, the results of the study of the effect of EMP on the stability of OWE in the presence of a different amount of imported demulsifier K-1 (PRC) are presented.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
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Table 1.

The amount of residual water (%) after de-emulsification of OWE, depending on the temperature and intensity of the electromagnetic field (N)

The amount of demulsifier, g / t					
20	40	60	20	40	60
Djarkak Deposit Emulsion			Shurchi field emulsion		
Without electromagnetic processing (control)					
32	20	12	31	21	11
After magnetic processing with a magnetic field strength of 760 oersted					
28	16	7	26	12	5
After magnetic processing with a magnetic field strength of 1240 oersted					
23	9	0,8	21	8	0,6

As can be seen from the table 1, the OWE of the Djarkak and Shurchi fields after EMP are separated more intensively than without it. For example, with the introduction of the K-1 demulsifier (PRC) in an amount of 60 g / t of oil without magnetization, the emulsion of the Djarkak deposit after demulsification contains 12% water, and the emulsion "magnetized" in a field with a strength of 760 oersted – 0.8%.

This is explained by the fact that, under the action of EMP in OWE, the density of electron clouds of ions with water molecules, which make up the immediate environment of ions, and polarization, which affects the change in the structure of the emulsion, changes [9, 10].

V. EXPERIMENTAL RESULTS

Of course, this effect is reflected in the surface tension, viscosity and electrical resistance of these emulsions.

We studied the effect of temperature in the EMP of stable emulsions of the Djarkak and Shurchi fields. The number of input demulsifier K-1 (PRC) is constantly maintained at a constant 60 g / t of oil.

The results are presented in Table 2.

Table 2.

The amount of residual water (%) after de-emulsification of VNE, depending on the temperature and intensity of the electromagnetic field (H)

Temperature, °C					
30	45	60	30	45	60
Djarkak Deposit Emulsion			Shurchi field emulsion		
Without electromagnetic processing (control)					
13	10	8	11	9	7
After magnetic processing with a magnetic field strength of 760 oersted					
7	5	2	5	3	1
After magnetic processing with a magnetic field strength of 1240 oersted					
0,8	0,6	0,4	0,6	0,5	0,3

From Table 2, it can be seen that with the increase in the temperature of the OWE of the Djarkak and Shurchi deposits from 30 to 60°C, the amount of residual water after their separation greatly decreases. With an increase in the magnetization intensity from 760 to 1240 oersted, the amount of residual water after separation in the emulsion also decreases. Consequently, the combined effect on the sustainable OWE of the Djarkak and Shurchi deposits makes it possible to intensify the process of their destruction.

Considering the prospect of using the developed local demulsifierКМД in the process of separation of stable OWE, we studied together with them. In this case, as a demulsifier, we used КМДin the amount of from 20 to 60 g / ton of oil. The experiments were carried out at a temperature of 60°C and an EMP strength of 760 and 1240 oersted.The results are presented in Table 3.

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International Journal of Advanced Research in Science, Engineering and Technology
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Table 3.
The amount of residual water after emulsion demulsification using a combined method at a temperature of 60°C

Type of emulsion	The amount of residual water after demulsification,%	
	Demulsifier K-1 (China), 60 g / t of oil, (control)	The proposed demulsifier KMD, 60 g / t of oil
Sustainable OWE of the Djarkak field		
Without electromagnetic processing (control)	12	13
Magnetic in a magnetic field 760 oersted	7	7,4
Magnetic OWE in a magnetic field of 1240 oersted	0,8	0,9
Sustainable OWE of the Shurchi deposit		
Without electromagnetic processing (control)	11	11,5
Magnetic OWE in a magnetic field of 760 oersted	5	6
Magnetic OWE in a magnetic field of 1240 oersted	0,6	0,6

From table 3, it is clear that when using the proposed local demulsifier and EMO resistant emulsions almost reaches the level of residual water content, which is achieved when using imported demulsifier K-1 (PRC).

As can be seen using the proposed demulsifier KMD and EMP sustainable VNE is achieved by intensifying the process of their separation. Analyzing the above results, we can assume that initially the emulsion is a substance of the class “oil in water” and further “water in oil”, and the so-called “armor shells” are formed at the interfaces between the phases, preventing the self-destruction of the emulsion. Molecules of the demulsifier adsorbing at the interface, displace less surface-active natural emulsifiers and thereby accelerate the coagulation of water. However, although the film formed by the demulsifier, has low strength, the action of the forces of gravity is not enough to ensure rapid deposition and coalescence of small globules of water. The use of a magnetic field causes the polarization of water globules and their mutual attraction, which leads to a significant acceleration of the coagulation processes and coalescence of water globules and their rapid precipitation. Moreover, the most effective EMP emulsion after adding a demulsifier into it [11]. At the same time, the process of hydration of metal ions and the supply of a depolarizer to the metal surface are slowed down by the action of a magnetic field. The acceleration of polarization during the "magnetic treatment" prevails over the process of increasing the thermodynamic instability of the metal (potential shift to more negative values), as a result, the rate of separation of stable OWE increases [12].

VI. CONCLUSION AND FUTURE WORK

Thus, we can say that combining thermochemical and EMP of sustainable OWE can intensify the processes of their dehydration and desalination, which is very important for improving the technical and economic indicators of preparing oil for industrial processing.

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