International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-3, January 2020

Intensification of Destruction Process of Sustained Emulsions Formed In Local Oil Sludge

Ochilov Abdurahim, Abduraximov Saidakbar, Eshmetov Rasulbek, Adizov Bobirjon

Abstract: ***Stable emulsions contained in oil sludge make it difficult to conduct. The physical properties of oil sludge usually vary widely and depend on the oil's own viscosity, temperature, oil-water ratio. Therefore, emulsions being dispersed systems under certain conditions have specific properties i.e. they are non-Newtonian liquids. Heavy oil and oil sludge are diluted with hydrocarbons, more often, gas condensate, which reduces the viscosity, density and other rheological parameters of high-sulfur oil.***

Keywords: Sludge, solids, disperse system, deposits, gas condensate, sour crude oils, oil emulsions, highly stable water-oil emulsion demulsifier, desalting, dehydration.

I. INTRODUCTION

Oil production is accompanied by an increase in the formation of oil sludge in the oil treatment plant, oil refineries, etc.

The composition of oil sludge is very different from each other and contains a significant amount of water, mechanical impurities and other components that complicate the subsequent processes of their processing.

The presence of asphaltenes, resins, paraffins and other surfactants in oil sludge contributes to the formation of stable emulsions with a high content of dispersed mechanical impurities.

Turbulent movement of oil sludge in the means of transportation increases the stability of emulsions due to the formation of complex compounds (associates, clusters, etc.). In addition, a large number of oil sludge is formed at oil refining enterprises during storage, processing of oil and oil products, washing of technological equipment, steaming of railway and tankers.

The composition of oil sludge is divided into the following groups: - ground, bottom and reservoir type.

Revised Manuscript Received on January 30, 2020.
***** Correspondence Author
Ochilov Abdurahim*, Senior Lecturer of the department "Technology of the oil and gas industry" of the Bukhara engineering-technological institute, Republic of Uzbekistan, Bukhara.
Abduraximov Saidakbar, Doctor of technical sciences, professor, chief researcher of the laboratory “Colloid chemistry” of the Institute of the general and inorganic chemistry AS of Rep Uz, Tashkent, Uzbekistan.
Eshmetov Rasulbek, Candidate of technical sciences, doctoral candidate of the laboratory “Colloid Chemistry” of the Institute of the general and inorganic chemistry AS of Rep Uz, Tashkent, Uzbekistan.
Adizov Bobirjon , Candidate of technical sciences, doctoral candidate of the laboratory “Colloid Chemistry” of the Institute of the general and inorganic chemistry AS of Rep Uz, Tashkent, Uzbekistan.

The first are formed when oil products with tank metal, water, oxygen and mechanical impurities are watered on the ground. In addition, during storage, oil is stratified and oil sediments settle at the bottom of the tanks.

II. MATERIALS AND METHODS

Oil sludge are refined at oil refineries, devices of oil preparation and other industries as a secondary raw material for obtaining fuels, building materials and others.

Sustained emulsions existing in oil sludges impede to conduct the abovementioned processes and thus they require to work out new methods of their destruction.

Relatively high existence of mechanical admixtures, water and mineral salts promotes increase of viscosity of oil sludges, that also decreases entensity of oil emulsion’s destruction [1-3].

Viscosity of oil sludge usually changes in wide ranges and depends on own viscosity of oil, temperature, correlation of oil and water. Therefore, as emulsions are dispersive systems they have specific properties at definite conditions, that is they are non-newton liquids and are characterized by effective viscosity [4-6].

In Uzbekistan oils of different structure and physical and chemical properties, which have highly different meaning depending on the location of the deposits, their depth and other factors, are extracted. For example, the oil of Djarkurgan region is mainly useful for the production of bitumen of different marks. But, in spite of this fact, nowadays oil, kerosene and other oil products with high inundation, steady emulsion and difficulties of their dehydration and desalination are obtained from the oil of Djarkurgan region at low efficiency of the used technology.

Therefore, such oils and oil sludges are diluted by hydrocarbons, more often, gas-condensate which decreases viscosity, thickness and other rheologic indices of high sulfurous oil [7-9].

III. DISCUSSION OF RESEARCH RESULTS

The structures of water-oil emulsions formed in the local oil sludges were studied by us. Gotten results are presented in table 1. Table 1 shows that significant amount of water (20-45%), mechanical admixtures(165-350 mg/l), tars7-50%), asphaltenes (2-10%), paraffins (7-14%) and other natural emulgents which stabilizes the sustainability of the formed water-oil from emulsions are contained in local oil sludges. Besides, more sustained water-oil emulsions from the oil of Djarkurgan region which has high thickness and viscosity.

Table 1. The bases of the structure of the emulsions formed in the local oil sludges

Oil field	Water content %	Mechanical admixtures mg/l	Tars, %	Asphaltenes, %	Paraffins, %
Djarkurganneft	30-45	200-350	10-50	3-10	10-14
Shurchi	20-25	180-200	8-15	2-7	8-10
Djarkak	27-30	165-185	7-13	2-5	7-9

We studied the change of viscosity of the local oil sludges at placement of gas-condensate of different amounts in them. The results of measuring of the local oil sludges'viscosity at the temperature of 20 0C are presented in table 2.

Table 2 shows that with the placement of the stable gas-condensate from 10 to 30 % in the local oil sludges the viscosity of the oil of Djarkurgan decreases 2.1 times, the oil of Shurchi – 2.4 times and the oil of Djarkak – 2.45 times. It is determined that gas-condensate dilutes the hardened tars, paraffins, asphaltenes and other compositions which increase the viscosity of oil sludge.

Table 2 Change of the viscosity of the local oil sludge depending on the introduced gas-condensate

The amount of the introduced gas-condensate, %	Viscosity of the oil sludges (μ), mPa·c at 20 ^{0}C		
	The oil of Djarkurgan	The oil of Shurchi	The oil of Djarkak
-	133	121	114
10,0	104	95	87
20,0	87	71	64
30,0	61	50	46

The literatures [10-12] show that high content of asphaltenes (more than 2%) and tars (more than 5%) in oils and oil sludges forms sustained water-oil emulsion with hard interphase-adsorptive layer. In few cases emulsion has instable character and versatile interphase-adsorptive layer.

Consequently, if in oils and oil sludges balancers of emulsions are only finely ground indissoluble hard particles, for example, hard micro crystals of paraffin, the allegible emulsion Pikering, in which finely ground hard particles are moistened more with oil than with water. In this case coalescence is stimulated by adding demulsifier possessing high moistening ability, as a result of which oil adsorbed on a solid body is pushed out by water. Here, polar asphaltenes and tars demonstrate anion properties in an alkaline medium and, vice versa, in an acidic medium they show cation properties.

In addition, sustainability of water-oil emulsions is a result of the formation on the drops of the emulsified water of dark films of Perrinshen which are formed by oil-dissolving surface active substances at condition of durable attachment of surface-active molecules to the surface of the division with a formation of adsorptive layer owing to hydratation of polar groups.

Surface active substances accumulate on the borderline of the division of phases and at that the more rate it has, the more surface pull-up in their presence decreases.

Stability of emulsions depends not only on the ability of surface active substances to decrease surface pull-up on the surface of the division of these liquids, but also on the other factors. For example, soaps of oil-naphthenic acids (A.A. (acid amount)145 mg PHO(potassium hydroxide)) at concentration of 0.01 mol/l decrease surface pull-up about twice on the borderline of benzole-water and form highly sustainable emulsion. On the contrary, though soaps of kerosene-naphthenic acids (A.A. 315 mg PHO/g) at the concentration of 0.5 mol/l decrease surface pull-up more than five times on the same borderline, but they do not form any durable emulsion. As seen, durability of emulsion depends on the durability of forming protective film as well.

Destruction of emulsions takes place at the expense of approaching water drops and their coalescence , as well as destruction of armoring inter-phase film of water globule. Unfortunately, more complicated approaches of thermo-chemical and other methods of outer influence are required for the separation of fine water drops from the sustained stabilized emulsions.

Specific property of oil sludge containing fine clays and iron sulphide show, that they worsen the action of demulsifiers on the surface of armoring films of water.

It is shown in the work [13], that mechanical admixtures accumulating on the surface cause not only stabilization of big drops of water, but also the rise of share of the fine part of water globule, which are far the most hardly extracted out of the trap water-oil emulsions. It was elicited, that removal mechanism of mechanical admixtures and water from trap emulsion are interconnected: more complete removal of mechanical admixtures from the surface of the division into the water phase causes, in its turn, the release of coalescence of water drops, decrease of aggregative durability of emulsion and more complete segregation of water drops.

At destruction of emulsions formed in oil sludge it is necessary to take into consideration the temperature of hardening of oil which impacts on the sustainability of the system.

The effect of the introduced gas-condensate on the temperature of hardening of local oils at the roam temperature (+25 0C) was studied by us. The results of measuring are presented in table 3

Table 3 The change of the thickness and temperature of hardening of oil sludge

The amount of introduced gas condensate , %	Jarkurgan oil		Shurchi oil		Jarkak oil	
	ρ, kg/m^3	T_{hard}, ^{0}C	ρ, kg/m^3	T_{hard}, ^{0}C	ρ, kg/m^3	T_{hard}, ^{0}C
-	998	25	905	16	901	18
10,0	985	23	880	12	875	13
20,0	977	20	861	8	860	10
30,0	970	18	842	5	840	6

Table 3 shows that with the increase of condensate amount from 10 to 30 % of the total weight of the mixture hardening temperature of Jarkurgan oil in the sludge decreases about 1.3 times, Shurchi oil – 3.2 times and Jarkak oil – 3.0 times. This ratio is related to the content of components that affect the pour point of local oils. If we consider that resins and asphaltenes contain a number of heterocyclic compounds, it is possible to predict their emulsifying properties.

Therefore, the introduction of gas condensate in the composition of high-resinous oils obtained from oil sludge can significantly reduce the dynamic viscosity and shear tension, which is very necessary for the intensification of the process of destruction of sustainable water-oil emulsions. In this case, the "aging" of emulsions on water globules increases the emulsifier layer and increases its mechanical strength accordingly. This is accelerated by the high mineralization of layer water, which contributes to the "aging" of emulsions formed in oil sludge. Moreover, the hydrophobic films must be replaced by surface active substances.

The time of destruction of sustainable water-oil emulsions is one of the most important indicators of this process and more objectively assesses the effectiveness of a particular solution of this issue.

We studied the effect of introduced gas condensate on the time of destruction of emulsions formed from local oil sludge. The results are presented in table 4.

Table 4 Change of destruction time of emulsions depending on the amount of introduced gas condensate

The amount of introduced gas condensate , %	Destruction time of emulsions, hour		
	Jarkurgan oil	Shurchi oil	Jarkak oil
-	8,0	7,0	6,5
10	6,5	6,0	5,0
20	4,0	4,5	4,0
30	3,5	3,0	3,5

IV. CONCLUSION

Increasing the input of gas condensate (from 10 to 30 %) in the mixture the time of destruction of emulsions formed from local oil sludge is significantly reduced. This is due to the fact that the gas condensate reduces the mechanical strength of the armor film (shell) of water and thereby intensifies the process of coagulation and separation of dispersed water.

Thus, the studies allow to intensify the destruction process of sustainable water-oil emulsions formed in oil sludge 2-2. 5 times. The use of gas condensate in the dilution of oil sludge allows to reduce the density and viscosity of oils due to the expansion of the intermolecular distance of molecules and dissolution of resins and asphaltenes, i.e. natural surfactants. Thus, the studies allow to intensify the process of destruction of stable water-oil emulsions formed in oil sludge 2-2. 5 times. The use of gas condensate in the dilution of oil sludge allows to reduce the density and viscosity of oils due to the expansion of the intermolecular distance of molecules and dissolution of tars and asphaltenes, i.e. surface active substances.

REFERENCES

1. Khamidullin R. F. Research of destruction processe of oil-sludge emulsion / / R. F. Khamidullin, R. H. Fassakhov, N. S. Garayeva, O. N. Shibayeva / / Oil and gas. 2001. - No. 1. - Pp. 26-33.
2. Tronov V. P. Field preparation of oil. Kazan: Fen, 2000.- p. 414.
3. Johan Sj Blom, Li Mingyan, Hiland Harald. Demilsifacation of oil – water emulsions. - Shiyu syueboa. Azta Petrol.: Sin., 1991. - No. 2.- Pp. 124-126.
4. Kapustin V. M., Rudin M. G. Chemistry and technology of oil refining.- M: Chemistry, 2013.- p. 495.
5. Gromov V. P. Field preparation of oil abroad. Moscow: Chemistry, 2005.-p. 515.
6. Hevard D. Oil and gas production handbook an introduction to oil and gas production, transport, refining and petrochemical industry. - Oslo: 2013.
7. Pokonova Yu. Oil and petroleum products. Handbook.- M: Chemistry, 2005.-p. 515.
8. "Reference guide for the design of development and exploitation of oil fields". Under the editorship of S. K. Gimatudinov, Moscow, Alyans - 2007, p. 455.
9. Ibragimov, I. T., Mishenko I. T., Cheloyans D. K. Intensification of oil production. Moscow, "Science" - 2000. P. 230.
10. Mazlova Ye.A. Reagent separation of plant oil-containing sludge and sediments // Ye. A. Mazlova, S. V. Mesherekov, L. Z. Klimova // Chemistry and technology of fuels and oils. 2000. - No. 6. - Pp. 46-47.
11. Bunchuk V. A. Transportation and storage of oil, oil products and gas. M.:
12. Nedra, 1977, - p. 366.

13. Bagirov I. T. Modern installations of primary oil refining. - Baku: Ilim, 1998. –p. 125.
14. Kuzova I.Ye. Preparation of trap oil product for refining // Oil refining and petrochemistry. 1999. - No. 12. - Pp. 14-18.

AUTHORS PROFILE

Ochilov Abdurahim Abdurasulovich - Candidate of the department "Technology of the oil and gas industry" of the Bukhara engineering-technological institute, Republic of Uzbekistan, Bukhara
E-mail:ochilov82@mail. ru.

Abduraximov Saidakbar Abdurakhmanovich - Doctor of technical sciences, professor, chief researcher of the laboratory “Colloid chemistry” of the Institute of general and inorganic chemistry, Academy of sciences of Uzbekistan, Republic of Uzbekistan, Tashkent
E-mail: sherzodbuxoro @mail.ru

Eshmetov Rasul Jimyazovich - Candidate of technical sciences, doctoral candidate of the laboratory “Colloid Chemistry” of the Institute of general and inorganic chemistry, Academy of sciences of Uzbekistan, Republic of Uzbekistan, Tashkent
E-mail:rasulbek2015@mail.ru

Adizov Bobirjon Zamirovich - Candidate of technical sciences, doctoral candidate of the laboratory “Colloid Chemistry” of the Institute of general and inorganic chemistry, Academy of sciences of Uzbekistan, Republic of Uzbekistan, Tashkent
E-mail: bobirjon_adizov@mail