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RESEARCH OF THE IMPACT OF NEW COMPOSITIONS ON THE DECOMPOSITION OF STABLE WATER-OIL EMULSIONS OF HEAVY OILS

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The article characterizes the degree of the impact of individual reagents and compositions on stable water-oil emulsions obtained from the wells of «SOCAR» (Republic of Azerbaijan) such as Muradkhanli, Bulla-deniz, Balakhani, Neft dashlari and Surakhani fields. The article reports the results of the corrosion protection effect of A2 composition in hydrogen sulfide formation water. Physicochemical properties of the oil samples taken for the research were studied by the known methods. The method of «bottle test» was used to carry out the deemulsification process in laboratory conditions. Experiments were conducted at temperatures of 20, 30, 40, and 50^{0}C in order to study the impact of reagents on the deemulsification of the mentioned emulsion oils. Compositions of ND-12, Gossypol, Disulfan-4411, Alkan reagents, compositions with 1:1:1:1 ratio of Dissolvan-4411, Alkan, ND-12 and Gossypol resin reagents (A1) and 3:1 ratio of ND-12 and Gossypol resin reagents (A2) were used as demulsifiers. The results of the obtained laboratory experiments showed that the composition of A2 has the highest demulsifying effect. Along with demulsifying effect of gossypol resin based A2 composition, the corrosion protection effect was also studied under laboratory conditions. For this purpose, hydrogen sulfide formation water was used as an aggressive corrosion environment. Corrosion rate was determined by gravimetric method both in reagent-free and reagent based environments, and corrosion protection effect of the composition was calculated. It was found that Gossypol resin-based A2 composition also shows high corrosion protection effectiveness. Thus, this effectiveness is 98% at the concentration of 800 g/t of the composition. The use of the composition prepared on the basis of ND-12 and Gossypol resin produced in Azerbaijan at the same time in the decomposition of stable water-oil emulsions of heavy oils and also in the protection of the internal surface of transport preparation facilities from electrochemical corrosion can be considered appropriate both from the economic and ecological point of view.

Keywords: composition, water-oil emulsion, oil, demulsifier, deemulsification, dehydration, deposition, corrosion, hydrogen sulfide, formation water, bottle test.

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Introduction

Currently, most of the world's large oil fields and mines have entered their final stage of production, as a result of which oil production becomes difficult, its hydration increases to 80–90%, and the properties of produced oils, especially their viscosity, change [1,2]. The quality of oils mainly depends on the composition and properties of hydrocarbons, as well as their mixtures, which significantly affects the refining technology, the quality and yield of the obtained oil products, leads to equipment corrosion and poisons expensive catalysts. All this ultimately results in an increase in the cost of oil refining and oil products. Therefore, it is necessary to prepare oil before entering refining, or rather, it is necessary to maximally remove contaminants such as water, salts, mechanical mixtures, etc. from it. In the presence of water, chlorides, chlorine-organic and sulfur compounds cause intensive corrosion of facilities.

Currently, due to the extraction of active resources of light oils, tendencies in the increase of the amount of high-viscosity heavy oils production have been discovered in the world. Unlike conventional oils, which consist of low and medium-concentrated dispersed systems, high-viscosity heavy oils are considered high-concentrated associated dispersed systems, which is reflected in the efficiency of their production, transportation and refining processes.

In the processes of production of heavy oils and their joint movement with formation waters, stable water-oil emulsions are formed with a high amount of water in them. The presence of surface-active agents (SAAs) such as asphaltenes, paraffins, resins and naphthenic acids in heavy oils leads to the processes of water droplet dispersion. Such SAAs are suspended in oils [3–6]. The concentration of existing natural SAAs, which affect the stability of water-oil emulsions, is higher in heavy oils than in light oils [7,8].

In the final stages of production of oil fields, the amount of water in oils can be 90% or more. At this time, the raw materials entering oil refining facilities are characterized not only by the variety of physical and chemical properties, but also by the change of its composition over time.

The problem of reducing expenditure of energy in heavy oil accumulation systems in mines remains relevant and is partly related to the formation of stable high-viscosity emulsions. Therefore, its solution depends significantly on the efficiency of water-oil emulsion decomposition.

Increasing the amount of production of heavy and high-viscosity oils capable of forming stable water-oil emulsion systems requires improvement of traditional technologies and preparation of hydrocarbon raw materials for further processing. During dehydration and desalination of such oils, complications, as a rule, appear in the presence of various types of mixtures, which should be removed by the most effective methods. Currently, the development of composition demulsifiers is considered an important aspect in the preparation of the above-mentioned type of oils. The main requirements for such reagents are efficiency at low temperatures and good dehydration dynamics of stable water-oil emulsions [9–12].

The use of composition compounds, in most cases, is more effective than the use of any compound in its pure state. In this regard, the development of relatively effective composition demulsifiers and their application in the decomposition of stable water-oil emulsions is considered one of the most topical problems of the modern oil industry.

The research objective is the development and research of new compositions for the decomposition of stable water-oil emulsions and protection of the internal surface of the facilities being prepared for transportation from corrosion.

Research methodology

During laboratory tests, the method of «bottle test» (static deposition) was used [13]. The bottle method is based on the percentage of water separated from the oil at a given temperature of the oil sample filled in a glass container. The mechanism of the process is based on the separation of water due to the decomposition of the emulsion in oil after mixing the demulsifier added to the previously taken oil sample with oil at an intensive rate. 3–4 drops of demulsifier added to the oil in the bottle should meet its specific properties in accordance with regulatory requirements. The oil taken from the mine is initially analyzed in terms of appearance, and the next appearance analysis is carried out according to the specified time under normal conditions. At the end, after adding the given temperature and chemical reagent, the amount of water separated from oil is determined by means of mathematical express analysis, and special graduated bottles are used during the process.

Laboratory tests were performed taking into account specific technological modes, such as separation temperature, dehydration period, hydrodynamic properties, dosing, and hydration of products. Demulsifiers were dosed in the forms of commodity, and decomposition of stable water-oil emulsions was carried out at temperatures of 20, 30, 40, 50^{0}C. The main assessment criteria of the dynamics of oil dehydration are considered to be residual amount of water in oils, the quality of water and the wall of precipitator-cylinders in accordance with SS 39-133-81.

During experiments in laboratory conditions, ND-12 (Azerbaijan production), Gossypol resin (Azerbaijan production), Disulfan-4411 (Russia production), Alkan (Azerbaijan production) reagents and compositions with 1:1:1:1 (A1) ratio of Dissolvan-4411, Alkan, ND-12 and Gossypol resin reagents, and compositions with 3:1 (A2) ratio of ND-12 and Gossypol resin reagents were used. The physicochemical characteristics of the reagents used are shown in Tables 1–4.

In the current study, experiments on dehydration of the oil emulsions of the fields such as Muradkhanli, Bulla-deniz, Balakhani, Neft dashlari, and Surakhani with different degrees of hydration for the reagents produced abroad were conducted under laboratory conditions. Physical and chemical properties of the mentioned oils are shown in Table 5.

Table 1

Physico-chemical characterization of gossypol resin

Composition and properties	Indicators
color	dark brown
smell	specific oily smell
density g/cm^3	0.8600
acidity (KOH, mg)	50
freezing temperature, K	301
ignition temperature, K	435

The selection of these oils is related to the fact that chemical reagents are used to increase the oil yield in the existing field, and their use leads to an increase in the stability of water-oil emulsions. In addition, the oil samples taken for the research have both paraffin and resin-asphaltene types of stabilizers, and generate stable water-oil emulsion systems over time.

The tested water-oil emulsion samples are placed in a specially graduated 100 ml precipitator with a conical bottom, and a pre-calculated amount of commercial demulsifiers is added to each of them by means of syringe-micro-dosers. The precipitators

Table 2

Physical and chemical characteristics of Dissolvan 4411 demulsifier

External appearance	Yellowish liquid
Composition	Ethylene oxide/propylene, dissolved in methanol
Density g/ml, 200C (ASTM D 1475/ DIN 51757)	0.95±0.02 g/cm^3 at 20^{0}C
Freezing temperature (ASTM D 97/ DIN ISO 3016)	up to –36^{0}C
Viscosity mm2/s (ASTM D 445/DIN 53015)	25 mPa·s (+20^{0}C) 80 mPa·s (0^{0}C) 400 mPa·s (–20^{0}C)
Ignition temperature (ASTM D 93)	11^{0}C
Efficacy (using ECG)	Meets the requirement of the standard

Table 3

Physicochemical characterization of ND-12 demulsifier

Component	Isopropyl alcohol Methanol Nonionic surfactant Organic basis
Physical and chemical properties	External appearance – liquid Color – light yellow Solutions – soluble in oil and water Freezing temperature –50^{0}C Density g/ml (20^{0}C) – 0.910–0,980 Viscosity mm^2/s (20^{0}C) – 25–30

Table 4

Physicochemical characterization of Alkane demulsifier

Component	Used as a demulsifier in the petroleum industry, block copolymers of simple and complex esters
Physical and chemical properties	External appearance – liquid Color – transparent yellow-brown Solutions – soluble in oil and water Freezing temperature –38^{0}C Smell – specific solvents

Table 5

Physical and chemical properties of oils [14]

Parameters	Muradkhanli	Bulladeniz	Balakhani	Neft dashlari	Surakhani
Density (20^{0}C), kq/m^3	947.3	973.8	923.0	904.7	912.8
Viscosity (20^{0}C), mPa·s	2157.3	2445.8	2126.3	1968.4	2021.3
Amount of water, %	41	31	29	24	27
The amount of chlorine salts, mg/l	534.3	493.8	378.7	329.3	394.9
The amount of mechanical mixtures, %	5.86	4.53	3.98	3.26	3.85
Amount of resins, %	16.9–18.1	8.1–9.3	6.7–8.4	12.4–13.7	13.1–14.9
Amount of asphaltenes, %	3.7–4.5	0.12–0.18	0.09–0.14	2.2–3.9	1.79–2.75
Amount of paraffins,%	3.9–5.8	11,7–12.9	0.27–0.43	1.8–2.6	1.43–2.1
Freezing temperature, ^{0}C	+9	+12	–3	–9	–3

are closed tightly and shaken by hand for 10 minutes to ensure even distribution of the demulsifiers in the volume of oil phase, as well as good mixing.

The calculation of demulsifier doses is carried out based on the initial hydration of water-oil emulsions without taking into account the concentration of the demulsifier and the concentration of oils.

The volume of the demulsifier solution dosed in the emulsion weight is calculated according to the following formula:

$$V_d = \frac{m(100 - W_{or})O_p}{1000},\ \mu l$$

where m is emulsion weight, ml; O_p is the given dose of demulsifier, g/t; and W_{or} is the initial average hydration degree of the emulsion, %.

After mixing, the precipitators with water-oil emulsions processed with demulsifiers are placed in the thermostat for the period of time corresponding to their stay in the pipelines and technological oil production facilities. Thermostating temperature corresponds to the technological dehydration temperature mode of oils. The amount of the water separated at pre-selected time intervals is recorded. In addition, the quality of the water separated after dehydration of oils is visually analyzed. Then, using a special sampler, an oil sample is taken to determine the amount of residual water at a level of 10 mm above «oil-water» phase separation boundary (SS 2477-2014). On the base of volume of the water separated over time, dehydration degree of emulsions is calculated by knowing the initial hydration degree of water-oil emulsions:

$$\text{Dehydration degree (\%)} = \frac{\text{volume of the separated water}}{\text{initial hydration degree}} \cdot 100\%.$$

The methodology for determining the effectiveness of demulsifiers under laboratory conditions is based on the comparative tests. The purpose of the current tests is considered to select a relatively more effective product from a number of tested products. The amount of residual water in the oil is determined through Din-Stark apparatus according to SS 2477-2014:

$$F = D + E.$$

The amount of total (F) water is determined by adding the amount of water (E, %) defined through Din-Stark apparatus according to SS 2477-2014 to the amount of water (A, %) separated by bottle method.

Results and discussion

In the research process, first of all, deemulsification of crude oil samples taken from Muradkhanli, Bulla-deniz, Balakhani, Surakhani and Neft dashlari fields without adding reagent for 0.5, 1.0, 1.5, 2.0 hours was studied and the obtained results are given in Table 6.

As is seen from Table 6, the volume of formation water separated from oil increases over time. The maximum amount of water separated from the emulsion during two hours is observed for Muradkhanli field oil sample (31.6%).

Table 6

Time dependence of deemulsification of crude oil emulsions (reagent-free)

Oils	The amount of separated water from the emulsions (vol.%)			
	0.5 hours	1.0 hours	1.5 hours	2.0 hours
Muradkhanli	4.9	11.7	20.3	31.6
Bulla-deniz	6.3	11.8	17.1	23.5
Balakhani	6.7	10.8	18.9	22.1
Neft dashlari	8.9	11.4	16.4	18.8
Surakhani	8.1	12.6	19.4	22.0

In order to study the impact of reagents on the deemulsification of the mentioned emulsion oils, experiments were conducted under laboratory conditions using the method of «bottle test» at the temperatures of 20, 30, 40, and 50^{0}C. As a deemulsifying reagent, ND-12, Gossypol resin, Disulfan-4411, Alkan reagents and compositions with 1:1:1:1 (A1) ratio of Dissolvan-4411, Alkan, ND-12 and Gossypol resin reagents and compositions with 3:1 (A2) ratio of ND-12 and Gossypol resin reagents were used. Demulsifying effect of various concentrations of the mentioned individual reagents and compositions was investigated and the highest result was observed mainly at their amount of 800 g/t. Therefore, the experimental results of the impact of 800 g/t concentration of demulsifying agents on stable water-oil emulsions of various oil samples are presented in Tables 7–11. It should be noted that compositions with 1:1:1:1 ratio of Gossypol resin, Dissolvan-4411+Alkan+ND-12 +Gossypol resin and compositions with 3:1 ratio of ND-12 + Gossypol resin were used as a demulsifying agent for the first time.

As is seen from Tables 7–11, since the temperature increases, the impact of demulsifying

Table 7

Impact of demulsifying agents on Muradkhanli oil (t=2 hours)

Reagents	Temperature, ^0C	The amount of separated water, vol.%
Reagent-free	20	31.60
	30	32.80
	50	34.50
Reagent ND-12	20	40.10
	30	40.92
	50	40.93
Dissolvan-4411	20	40.90
	30	40.92
	50	40.94
Alkan	20	40.40
	30	40.52
	50	40.64
Gossypol resin	20	34.60
	30	35.32
	50	35.71
Dissolvan-4411+Alkan+ND-12+Gossypol resin=1:1:1:1 (A1)	20	40.70
	30	40.86
	50	40.94
ND-12+Gossypol resin=3:1 (A2)	20	40.92
	30	40.94
	50	40.96

Table 8

Impact of demulsifying agents on Bulla-deniz oil (t=2 hours)

Reagents	Temperature, ^0C	The amount of separated water, vol.%
Reagent-free	20	23.50
	30	24.70
	50	26.00
Reagent ND-12	20	30.30
	30	31.12
	50	31.13
Dissolvan-4411	20	32.20
	30	32.22
	50	32.24
Alkan	20	28.90
	30	29.02
	50	29.76
Gossypol resin	20	25.80
	30	26.52
	50	26.91
Dissolvan-4411+Alkan+ND-12+Gossypol resin=1:1:1:1 (A1)	20	30.80
	30	30.86
	50	30.89
ND-12+Gossypol resin=3:1 (A2)	20	30.80
	30	30.82
	50	30.84

Table 9

Impact of demulsifying agents on Balakhani oil (t=2 hours)

Reagents	Temperature, ^{0}C	The amount of separated water, vol.%
Reagent-free	20	22.10
	30	23.30
	50	24.60
Reagent ND-12	20	28.20
	30	28.44
	50	28.56
Dissolvan-4411	20	28.40
	30	28.42
	50	28.44
Alkan	20	27.60
	30	27.72
	50	28.46
Gossypol resin	20	24.20
	30	24.92
	50	25.31
Dissolvan-4411+Alkan+ND-12+Gossypol resin=1:1:1:1 (A1)	20	28.80
	30	28.86
	50	28.89
ND-12+Gossypol resin=3:1 (A2)	20	28.80
	30	28.82
	50	28.84

Table 10

Impact of demulsifying agents on Neft dashlari oil (t=2 hours)

Reagents	Temperature, ^{0}C	The amount of separated water, vol.%
Reagent-free	20	18.80
	30	20.00
	50	21.30
Reagent ND-12	20	22.40
	30	23.22
	50	23.23
Dissolvan-4411	20	23.20
	30	23.22
	50	23.24
Alkan	20	22.40
	30	22.52
	50	23.26
Gossypol resin	20	20.80
	30	21.52
	50	21.91
Dissolvan-4411+Alkan+ND-12+Gossypol resin=1:1:1:1 (A1)	20	23.90
	30	23.92
	50	23.93
ND-12+Gossypol resin=3:1 (A2)	20	23.90
	30	23.92
	50	23.94

Table 11

Impact of demulsifying agents on Surakhani oil (t=2 hours)

Reagents	Temperature, ^{0}C	The amount of separated water, vol.%
Reagent-free	20	22.00
	30	23.20
	50	24.50
Reagent ND-12	20	26.20
	30	26.34
	50	26.50
Dissolvan-4411	20	26.20
	30	26.32
	50	26.39
Alkan	20	25.40
	30	25.52
	50	26.26
Gossypol resin	20	23.10
	30	23.82
	50	24.21
Dissolvan-4411+Alkan+ND-12+Gossypol resin=1:1:1:1 (A1)	20	26.80
	30	26.86
	50	26.89
ND-12+Gossypol resin=3:1 (A2)	20	26.90
	30	26.92
	50	26.94

agents also increases. In both reagent-free and reagent-added oil samples, the most amount of water separated in percentage is observed mainly at the temperature of 50^{0}C.

In reagent-free case and after adding 800g/t of ND-12, Dissolvan-4411, Alkan, Gossypol resin, A1 and A2 reagents, the amount of residual water is 6.5%, 0.07%, 0.06%, 0.36%, 5.29%, 0.06% and 0.04% (in Muradkhanli oil); 5%, 0.87%, 0.76%, 1.24%, 4.09%, 0.11% and 0.03% (in Bulla-deniz oil); 4.4%, 0.44%, 0.56%, 0.54%, 3.69%, 0.11% and 0.04% (in Balakhani oil); 2.7%, 0.77%, 0.76%, 0.74%, 2.09%, 0.07% and 0.06% (in Neft dashlari oil); and 2.5%, 0.50%, 0.61%, 0.74%, 2.79%, 0.11% and 0.06% (in Surakhani oil), respectively.

The comparison of the results of numerous scientific studies shows that the compositions have a higher effect on the decomposition of stable water-oil emulsions. In our laboratory experiments, the composition of ND-12+Gossypol resin=3:1 (A2) shows the highest effect. This can be explained by the occurrence of a positive synergistic effect during the mixing of components.

The presence of mineral salts, carbon dioxide, hydrogen sulfide gas, and sulfate-reducing bacteria in formation water generating water-oil emulsion causes the internal surface of transport preparation facilities to be exposed to electrochemical corrosion. In this regard, along with demulsifying effect of Gossypol resin based composition, the corrosion protection effect was investigated in laboratory conditions (Table 12). Hydrogen sulfide formation water was used as an aggressive corrosion environment. The corrosion rate was determined by gravimetric method both in reagent-free and reagent-based environments, and the corrosion protection effect of the composition was calculated (Table 13).

Gravimetric tests were performed on steel samples in accordance with the requirements of state standards GOST 9.502-82 and GOST 9.506-87. The average static relative error of measuring the corrosion speed of metallic samples is no more than 0.5%.

As can be seen from Table 13, the composition of ND-12+Gossypol=3:1 prepared under laboratory conditions not only effectively decomposes stable water-oil emulsions, but also has a high corrosion protection effect. The highest protection effect is observed at a concentration of 800 g/t of the composition (98%).

Thus, the results obtained above give reason to mention that the application of A2 composition, which shows a high demulsifying and corrosion protection effect during the preparation of heavy oils with a stable water-oil emulsion for transportation, is considered

Table 12

Ionic composition of layer water taken from well No. 1082

Components	Concentration, mg/l	Equivalent concentration, mg eq/l	Equivalent quantity, %
$Na^{+}+K^{+}$	31298.987	1304.12	46.57
Ca^{2+}	1122.24	56	1.9998
Mg^{2+}	486.4	40	1.4284
Fe^{3+}	2561.58	853.86	–
Cl^{-}	49010.49	1382.52	49.37
SO_4^{2-}	28.81	0.60	0.0214
CO_3^{2-}	0.00	0.00	0.0000
HCO_3^{-}	1037.00	17.00	0.6071
H_2S	34	–	–

Table 13

Corrosion protection efficiency of the composition of ND-12+Gossypol resin=3:1 (A2) in hydrogen sulfide formation water (St3 brand steel were used in the samples for gravimetric tests)

Reagent consumption, C, g/t	The rate of corrosion, k, g/m^2h		Protection effectiveness, %
	reagent-free	when the reagent was added	
0	4.2	–	–
400	4.2	0.63	85
600	4.2	0.37	92
800	4.2	0.084	98

to be economically and ecologically efficient in mining conditions. Multifunctional A2 composition not only decomposes the emulsion, but also increases inter-repair time and life cycle of transport preparation facilities. The water-oil emulsion, which is a highly aggressive environment in terms of creating corrosion, causes rapid corrosion of the internal surface of devices during transport preparation, which in most cases leads to puncture of transport preparation devices. As a result, crude oil spills into the environment and damage to flora and fauna is inevitable. However, the composition prepared by us neutralizes corrosion along with to preparation for transportation. From this point of view, the A2 composition is considered ecologically efficient.

Conclusions

1. The effect of individual reagents and newly developed compositions on decomposition of stable water-oil emulsion in heavy oils produced from wells of various fields was investigated under laboratory conditions for the first time in terms of selecting more effective reagents by conducting a comparative analysis. Protection effect of Gossypol resin based A2 composition against internal surface corrosion was also investigated. Deemulsification process was carried out by the method of «bottle test», and the corrosion rate was carried out according to the gravimetric method.

2. The results of the experiments revealed that it is the composition (A2) of ND-12+Gossypol resin=3:1 that decomposes stable water-oil emulsions at the temperature of 50^0C and reduces the amount of residual water to a minimum, and its consumption rate is 800 g/t.

3. The impact of the composition (A2) of ND-12+Gossypol resin=3:1 taken in different concentrations on electrochemical corrosion rate in hydrogen sulfide formation water was investigated and its optimal consumption rate was determined to be 800 g/t. The protection effect of A2 composition against internal surface corrosion at optimal consumption rate is 98%.

4. Wide use of composition (A2), prepared on the basis of ND-12 and Gossypol resin, which can be industrially produced in Azerbaijan, is expedient both economically and ecologically in mining conditions, at the same time in decomposing stable water-oil emulsions of heavy oils and also in protecting the internal surface of transport preparation facilities from electrochemical corrosion.

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ДОСЛІДЖЕННЯ ВПЛИВУ НОВИХ КОМПОЗИЦІЙ НА РОЗКЛАДАННЯ СТІЙКИХ ВОДОНАФТОВИХ ЕМУЛЬСІЙ ВАЖКИХ НАФТ

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У статті охарактеризовано ступінь впливу окремих реагентів і композицій на стійкі водонафтові емульсії, отримані зі свердловин компанії «SOCAR» (Азербайджанська Республіка) родовищ Мурадханли, Булла-деніз, Балахани, Нефт дашларі та Сурахані. У статті наведено результати антикорозійного ефекту композиції A2 у сірководневих пластових водах. Фізико-хімічні властивості відібраних для дослідження зразків нафти вивчали відомими методами. Для перебігу процесу деемульгації в лабораторних умовах використовувався метод «пляшкового тесту». З метою вивчення впливу реагентів на деемульсифікацію зазначених емульсійних масел проводили досліди при температурах 20, 30, 40 і 50^{0}C. Композиції реагентів ND-12, Gossypol, Disulfan-4411, Alkan, композиції із співвідношенням реагентів Dissolvan-4411, Alkan, ND-12 і Gossypol resin=1:1:1:1 (A1) і реагентів ND-12, смола Gossypol=3:1 (A2) використовували як деемульгатори. Результати отриманих лабораторних дослідів показали, що найбільшу деемульгуючу дію має композиція A2. Поряд з деемульгуючою дією композиції на основі госиполової смоли A2 в лабораторних умовах досліджували також антикорозійний ефект. Для цього використовували сірководневу пластову воду як агресивне корозійне середовище. Швидкість корозії визначали гравіметричним методом як у безреагентному, так і в реагентному середовищах і розраховували антикорозійний ефект композиції. Встановлено, що композиція A2 на основі смоли Gossypol також демонструє високу антикорозійну ефективність. Таким чином, ця ефективність становить 98% при концентрації 800 г/т композиції. З метою використання композиції, виготовленої на основі азербайджанської смоли ND-12 і Gossypol, одночасно при розкладанні стійких водонафтових емульсій важких нафт, а також для захисту внутрішньої поверхні транспортних засобів від електрохімічної корозії можна вважати доцільними як з економічної, так і з екологічної точки зору.

Ключові слова: композиція; водомасляна емульсія, масло, деемульгатор, деемульсація, зневоднення, осадження, корозія, сірководень, пластова вода, пляшковий тест.

RESEARCH OF THE IMPACT OF NEW COMPOSITIONS ON THE DECOMPOSITION OF STABLE WATER-OIL EMULSIONS OF HEAVY OILS

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The article characterizes the degree of the impact of individual reagents and compositions on stable water-oil emulsions obtained from the wells of «SOCAR» (Republic of Azerbaijan) such as Muradkhanli, Bulla-deniz, Balakhani, Neft dashlari and Surakhani fields. The article reports the results of the corrosion protection effect of A2 composition in hydrogen sulfide formation water. Physicochemical properties of the oil samples taken for the research were studied by the known methods. The method of «bottle test» was used to carry out the deemulsification process in laboratory conditions. Experiments were conducted at temperatures of 20, 30, 40, and 50^{0}C in order to study the impact of reagents on the deemulsification of the mentioned emulsion oils. Compositions of ND-12, Gossypol, Disulfan-4411, Alkan reagents, compositions with 1:1:1:1 ratio of Dissolvan-4411, Alkan, ND-12 and Gossypol resin reagents (A1) and 3:1 ratio of ND-12 and Gossypol resin reagents (A2) were used as demulsifiers. The results of the obtained laboratory experiments showed that the composition of A2 has the highest demulsifying effect. Along with demulsifying effect of gossypol resin based A2 composition, the corrosion protection effect was also studied under laboratory conditions. For this purpose, hydrogen sulfide formation water was used as an aggressive corrosion environment. Corrosion rate was determined by gravimetric method both in reagent-free and reagent based environments, and corrosion protection effect of the composition was calculated. It was found that Gossypol resin-based A2 composition also shows high corrosion protection effectiveness. Thus, this effectiveness is 98% at the concentration of 800 g/t of the composition. The use of the composition prepared on the basis of ND-12 and Gossypol resin produced in Azerbaijan at the same time in the decomposition of stable water-oil emulsions of heavy oils and also in the protection of the internal surface of transport preparation facilities from electrochemical corrosion can be considered appropriate both from the economic and ecological point of view.

Keywords: composition; water-oil emulsion; oil; demulsifier; deemulsification; dehydration; deposition; corrosion; hydrogen sulfide; formation water; bottle test.

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