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DEVELOPMENT AND IMPLEMENTATION OF NANOEMULSIFIERS FOR THE PURIFICATION OF OIL FROM FORMATION WATER AND FORMATION WATER FROM OIL IN THE CONDITIONS OF THE PRIMARY PREPARATION OF OIL

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Abstract:

The article presents the results of the experimental-industrial tests (EIT) of the innovative nanodeemulsifiers "IKHLAS"-1 and "IKHLAS"-2 at the shop primary preparation of oil (ShPPO) and at the fields of oil and gas production department (OGPD) "Zhaikmunaigas" JSC "Emba Munai Gas". Preliminary positive results of the EIT allowed realize a two-fold reduction in the daily consumption rate of "IKHLAS"-1 at the ShPPO. Nanodemulsifier "IHLAS"-1 since 2017-2019 is implemanted on in the oil fields JSC "Phystech II", LLP "Tenge Oil & Gas", "Akkulka" of "Tetis Aral Gaz" LLP, OGPD "Zhaikmunaigas" JSC "Emba Munai Gas", on the Karsak ShPPO and the Botaxan field OGPD Dossormunayqaz" of JSC "Emba Munai Gas" of the Republic of Kazakhstan.

Key Words: Innovative nanodemulsifiers "IKHLAS"-1 and "IKHLAS"-2, desuspenders, colloidial barns, oilfield nanotechnology, hybrid aggregative state, "Zhaikmunaigas" JSC "Emba Munai Gas"

Introduction:

In the period 06.01.2018-25.01.18 at oilfields of the OGPD "Zhaikmunaigas" JSC "Emba Munai Gas" by us have been carried out a joint EIT of the nanodemulsifiers "IKHLAS"-1 and "IKHLAS"-2, which were developed by specialists and scientists LLP "International Oil Services Kazakhstan" and Azerbaijan State University of Oil and Industry [1]. The average specific flow rate (Sfr) is respectively 246 g/t and 41.2 g/t. The delivery of commercial oil to "Kaz Trans Oil" JSC is an average of 23-24 times a month. "IKHLAS"-1 has superhigh surface activity and adsorption capacity on different phase sections, including at the water-oil interface (in reverse emulsions) and at the oil-water interface (in direct emulsions) [2]. Therefore, are achieved standard levels of commercial oil (water not more than 0.5%, salts not more than 100 mg/dm3, mechanical impurities not more than 0.05%) for delivery to JSC "Kaz Trans Oil" and commercial water (oil not more than 50 mg/dm^3) for utilization in a system for maintaining reservoir pressures (MRP). At the beginning of the EIT (06.01.18), at freed tanks are from the basic demulsifiers of the type "Dissolvan"-4397 and "Dissolvan"-4795, we found in the mass quantity amorf sediments from these reagents. These deposits are potential sources of continuous disruptions in the system of dosing pumps in the ShPPO.

Literature Survey:

The authors studied interfacial energy during the emulsification of water and a Brazilian heavy crude oil [3]. For such purpose an experimental set-up was developed to measure the different energy terms involved in the emulsification process. W/O emulsions containing different water volume fractions (0.1, 0.25 and 0.4) were prepared in a batch calorimeter by using a high-shear rotating homogenizer at two distinct rotation speeds (14000 and 22000 rpm). The results showed that the energy dissipated as heat represented around 80% of the energy transferred to the emulsion, while around 20% contributed to the internal energy. Only a very small fraction of the energy (0.02 – 0.06%) was stored in the water-oil interface. The results demonstrated that the high energy dissipation contributes to the kinetic stability of the W/O emulsions. Such emulsions as visco-elastic systems (VES) has a high viscosity (2250 mPa·s), which are potential colloidal barns and can create quite serious problems under PPN conditions. Some authors [4, 5] give advantage to special inhibitors of emulsions. But these inhibitors are only intended for water-oil emulsions. The best inhibitors for all types of emulsions, including for the VES, in our opinion, are nanoemulsifiers. They should be pumped at a certain dosage into the bottomhole formation zone. Generally there are many unresolved issues in the field of polyfunctional nanodeemulsifiers, imparting properties of highly efficient demulsifiers, desuspenders, depressants, dispersants, dehydrators, inhibitors in relation to all types of oil emulsions (reverse W/O; direct O/W; medium W/O/W), suspensions, oil colloids [intermediate layers or hard destroyed water-oil emulsions (HDWOE); hard destructible water-oil suspensions (HDWOS); barn oil; trap oil slimes; bottom sediments of technological and commodity reservoirs based on a mixture of HDWOE and HDWOS; viscoelastic systems (VES); gas hydrates,

etc.].. Therefore, the development and implementation of polyfunctional nanoemulsifiers, imparting properties of highly effective demulsifiers, desuspenders, depressants, dispersants, dehydrators, inhibitors in relation to all types of oil emulsions (reverse W/O; direct O/W; medium W/O/W), suspensions, oil colloids [intermediate layers or hard destroyed water-oil emulsions (HDWOE); hard destructible water-oil suspensions (HDWOS); barn oil; trap oil slimes; bottom sediments of technological and commodity reservoirs based on a mixture of HDWOE and HDWOS; viscoelastic systems (VES); gas hydrates, etc.] is one of the priorities direction of oil-field nanotechnology.

Results of EIT and Their Discussion:

Table 1 presents the comparative results of analytical monitoring for S. Balgimbayev oil and for a mixture of oil from other fields.

Table 1: Comparative results of analytical monitoring in the ShPPO for oil "S. Balgimbayev" and for on a mixture of oil from other fields

Date	Demulsifier	Daily consumption of demulsifier, kg		C_{Cl} on TPS, mg/dm^3		Efficiency by average values,% (or in times)
		for oil "S.Balgimbayev"	on a mixture of oils	basic technology	In EIT	
06.12.17	"Dissolvan"-4397, 4795	89.940	89.940	199	-	68 (1.68)
07.12.17	"Dissolvan"-4397, 4795	89.940	89.940	179	-	51 (1.51)
08.12.17	"Dissolvan"-4397, 4795	89.940	89.940	187	-	58 (1.58)
09.12.17	"Dissolvan"-4397, 4795	89.940	89.940	190	-	61 (1.61)
10.12.17	"Dissolvan"-4397, 4795	89.940	89.940	223	-	88 (1.88)
11.12.17	"Dissolvan"-4397, 4795	89.940	89.940	155	-	25 (1.25)
12.12.17	"Dissolvan"-4397, 4795	89.940	89.940	187	-	51 (1.51)
13.12.17	"Dissolvan"-4397, 4795	89.940	89.940	157	-	27 (1.27)
15.12.17	"Dissolvan"-4397, 4795	89.940	89.940	195	-	57 (1.57)
Av. val.				186		
07.01.18	«IKHLAS»-1	89.940	89.940	-	73	155 (2.55)
09.01.18	«IKHLAS»-1	89.940	89.940	-	164	13 (1.13)
11.01.18	«IKHLAS»-1	89.940	87.692	-	91	104 (2.04
13.01.18	«IKHLAS»-1	89.940	89.940	-	109	71 (1.71)
15.01.18	«IKHLAS»-1	44.970	89.940	-	143	30 (1.30)
17.01.18	«IKHLAS»-1	44.970	44.970	-	130	43 (1.43)
19.01.18	«IKHLAS»-1	44.970	44.970	-	106	75 (1.75)
21.01.18	«IKHLAS»-1	44.970	44.970	-	115	62 (1.62)
Av. val.					118	58 (1.58)

As follows from the data of Table 1, the effectiveness of the "IKHLAS"-1 nanodemulsifier over mean values of chloride salts exceeds the efficiency of the base demulsifiers ("Dissolvan-4397" and "Dissolvan"-4795) by 58%. In the tables 2 and 3 presents values the intervals of the dominant concentrations of chloride salts (C_{IDCChS}) for the basic technology and “IKHLAS"-1 at delivered the commercial oil to JSC Kaz Trans Oil before the reduction of consumption demulsifier, and Table 4 presents the C_{IDCChS} for "IKHLAS"-1 after a two-fold reduction in the daily flow rate of the nanodemulsifier. As can be seen from the data of Tables 2-4 of C_{IDCChS} for "Dissolvan"-4795 is compose 21.1-30 mg/dm^3, and for "IKHLAS"-1 15-21 mg/dm^3.

Table 2: Calculated values of C_{IDCChS} when delivering commercial oil to JSC "KazTransOil" for "Dissolvan-4397" and "Dissolvan"-4795

Differentiated intervals by the values of the concentrations of chloride salts (mg / dm^3) at the delivery of commercial oil to JSC "KazTransOil" for "Dissolvan" -4397 and "Dissolvan" -4795		
15-21	21.1-30	30.1-40
the number of analyzes (n_i) for differentiated intervals of chloride concentrations		
5	7	1
the percentage contribution (V) of each differentiated interval from the total value of the number of analyzes (no): $V = (n_i/n_o) \times 100$, %		
38.5	53.8	7.7

Table 3: Calculated values of C_{IDCChS} at delivery of commercial oil to JSC "Kaz Trans Oil" of the expense for “IKHLAS" -1 (before reduction of demulsifier consumption)

Differentiated intervals by the values of the concentrations of chloride salts (mg/dm^3) at the delivery of commercial oil to JSC "Kaz Trans Oil" for «IKHLAS»-1		
15-21	21.1-30	30.1-40
the number of analyzes (n_i) for differentiated intervals of chloride concentrations		
4	3	0
the percentage contribution (V) of each differentiated interval from the total value of the number of analyzes (no): $V = (n_i/n_o) \times 100$, %		
57.1	42.9	0

Table 4: Calculated values of C_{IDCChS} at delivery of commercial oil to JSC "Kaz Trans Oil" of the expense for “IKHLAS" -1 after a two-fold reduction of daily flow rate of the demulsifier

Differentiated intervals by the values of the concentrations of chloride salts (mg/dm^3) at the delivery of commercial oil to JSC "Kaz Trans Oil" for «IKHLAS»-1		
15-21	21.1-30	30.1-40

the number of analyzes (n_i) for differentiated intervals of chloride concentrations		
8	5	0
the percentage contribution (V) of each differentiated interval from the total value of the number of analyzes (no): $V = (n_i/n_o) \times 100$, %		
61.5	38.5	0

Figure 1 shows the comparative diagrams for C_{IDCChS} when delivering commercial oil to JSC "Kaz Trans Oil" for the basic technology and for EIT "IKHLAS"-1, which also demonstrate the advantages of the nanodemulsifier "IKHLAS" -1. Table 5 and Figure 2 shows the values of C_{IDCChS} in oil after TPS: for the base technology (Dissolvan-4397, Dissolvan-4795), C_{IDCChS} = 151-170 mg/dm^3, and for "IKHLAS"-1 (table 6, 7) before and after a two-fold reduction in the daily consumption of the demulsifier C_{IDCChS} = 50-100 mg/dm^3. Consequently, the efficiency of "IKHLAS"-1on average is 2.1 times higher than that of basic demulsifiers.

Table 5: Calculated values of C_{IDCChS} in oil after TFS at the ShPPO of OGPD "Zhaikmunaigas" for "Dissolvan" -4397 and "Dissolvan" -4795

Differentiated intervals by the values of the concentrations of chloride salts (mg/dm^3) in oil after TFS for "Dissolvan" -4397 and "Dissolvan" -4795								
50-100	101-130	131-150	151-170	171-200	201-250	251-300	301-350	351-400
the number of analyzes (n_i) for differentiated intervals of chloride concentrations								
0	14	64	77	49	31	7	6	1
the percentage contribution (V) of each differentiated interval from the total value of the number of analyzes (no): $V = (n_i/n_o) \times 100$, %								
0	5,2	25,8	31,1	19,8	12,5	2,8	2,4	0,4

Table 8 shows the values for C_{IDCChS} in oil VST No. 6 at the ShPPO for basic demulsifiers ("Dissolvan"-4397 and "Dissolvan"-4795), and in Tables 9 and 10 during EIT "IKHLAS"-1 before and after a two-fold reduction in the daily consumption of demulsifier. For the basic technology: C_{IDCChS} = 81-100 mg/dm^3; for "IKHLAS"-1: C_{IDCChS} = 41-80 mg/dm^3. In Fig. 3 shows the comparative diagrams of C_{IDCChS} in oil of VST No. 6, which also confirm the significant advantage of the nanodemulsifier "IKHLAS"-1. Consequently, the "IKHLAS"-1 nanodemulsifier at one of the important facility (VST No. 6) of the ShPPO shows significant advantages in comparison with the base demulsifiers "Dissolvan"-4397 and "Dissolvan"-4795. This can be explained by the fact that "IKHLAS"-1, unlike "Dissolvan", due to the nano structure, has ultrahigh surface activity and adsorption capacity at various surface sections of the phases, including at the water-oil and oil-water interface [6], as a result, oil even before delivery to "Kaz Trans Oil" meets the requirements of the standard.

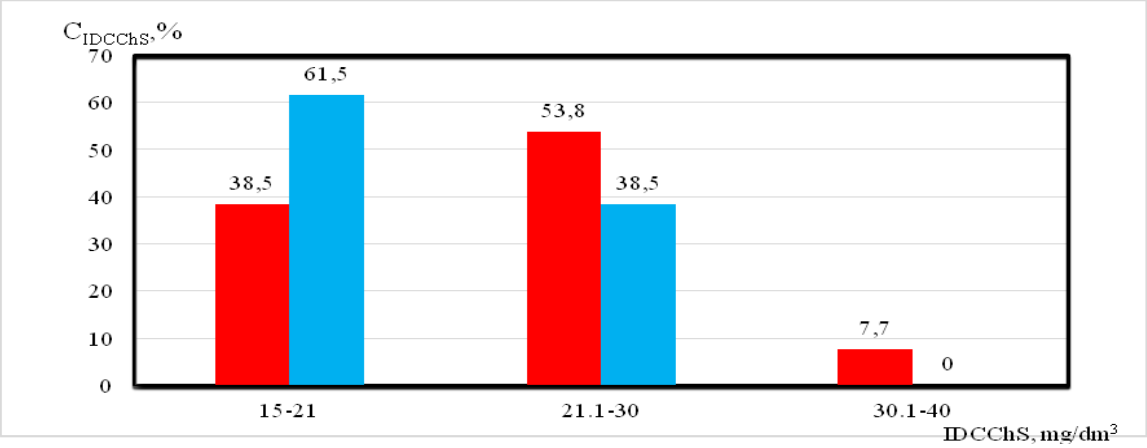

Figure 1: Comparative diagrams for C_{IDCChS} (red: "Dissolvan"-4397, "Dissolvan"-4795; blue: "IKHLAS"-1) at delivering commercial oil to JSC Kaz Trans Oil.

Table 6: Calculated values of C_{IDCChS} in oil after TPS at the ShPPO of the OGPD "Zhaikmunaigas" for «IKHLAS»-1 up to a two-fold reduction in the daily flow rate of the demulsifier

Differentiated intervals by the values of the concentrations of chloride salts (mg/dm^3) in oil after TFS for «IKHLAS»-1								
50-100	101-130	131-150	151-170	171-200	201-250	251-300	301-350	351-400
the number of analyzes (n_i) for differentiated intervals of chloride concentrations								
43	20	19	7	6	3	2	-	-
the percentage contribution (V) of each differentiated interval from the total value of the number of analyzes (no): $V = (n_i/n_o) \times 100$, %								
43	20	19	7	6	3	2	0	0

Table 7: Calculated values of C_{IDCChS} in oil after TPS at the ShPPO of the OGPD "Zhaikmunaigas" for "IKHLAS"-1after a two-fold reduction of daily flow rate of the demulsifier

Differentiated intervals by the values of the concentrations of chloride salts (mg/dm^3) in oil after TFS for «IKHLAS»-1								
50-100	101-130	131-150	151-170	171-200	201-250	251-300	301-350	351-400
the number of analyzes (n_i) for differentiated intervals of chloride concentrations								
50	45	28	12	7	4	2	0	0
the percentage contribution (V) of each differentiated interval from the total value of the number of analyzes (no): $V = (n_i/n_o) \times 100$, %								

33.8	30.4	18.9	8.1	4.7	2.7	1.3	0	0

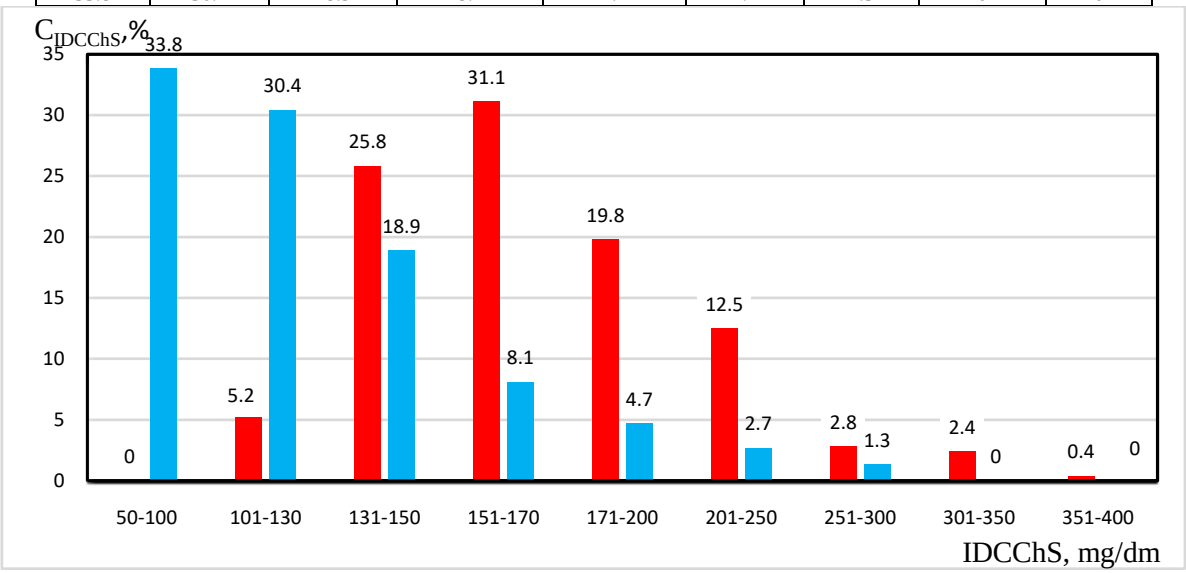

Figure 2: Comparative diagrams on the values of C_{IDCChS} (red: "Dissolvan" -4397, 4795; blue: "IKHLAS" -1) in oil after TPS at the ShPPO.

Table 8: Calculated values of C_{IDCChS} in oil of VST No. 6 at the ShPPO OGPD "Zhaikmunaigas" for "Dissolvan" -4397 and "Dissolvan" -4795

Differentiated intervals by the values of the concentrations of chloride salts (mg/dm^3) in oil of VST No. 6			
20-40	41-80	81-100	101-150
the number of analyzes (n_i) for differentiated intervals of chloride concentrations			
-	-	16	3
the percentage contribution (V) of each differentiated interval from the total value of the number of analyzes (no): $V = (n_i/n_o) \times 100$, %			
-	-	84.2	15.8

Table 9: Calculated values of C_{IDCChS} in oil VST No. 6 at the ShPPO of the OGPD "Zhaikmunaigas" for "IKHLAS"-1 up a two-fold reduction in the daily flow rate of the demulsifier

Differentiated intervals by the values of the concentrations of chloride salts (mg/dm^3) in oil of VST No. 6 for "IKHLAS"-1			
20-40	41-80	81-100	101-150
the number of analyzes (n_i) for differentiated intervals of chloride concentrations			
1	40	7	1
the percentage contribution (V) of each differentiated interval from the total value of the number of analyzes (no): $V = (n_i/n_o) \times 100$, %			
2.0	81.7	14.3	2.0

Table 10: Calculated values of C_{IDCChS} in oil VST No. 6 at the ShPPO of the OGPD "Zhaikmunaigas" for "IKHLAS"-1 after a two-fold reduction in the daily flow rate of the demulsifier

Differentiated intervals by the values of the concentrations of chloride salts (mg/dm^3) in oil of VST No. 6			
20-40	41-80	81-100	101-150
the number of analyzes (n_i) for differentiated intervals of chloride concentrations			
1	85	17	5
the percentage contribution (V) of each differentiated interval from the total value of the number of analyzes (no): $V = (n_i/n_o) \times 100$, %			
1	78.7	15.7	4.6

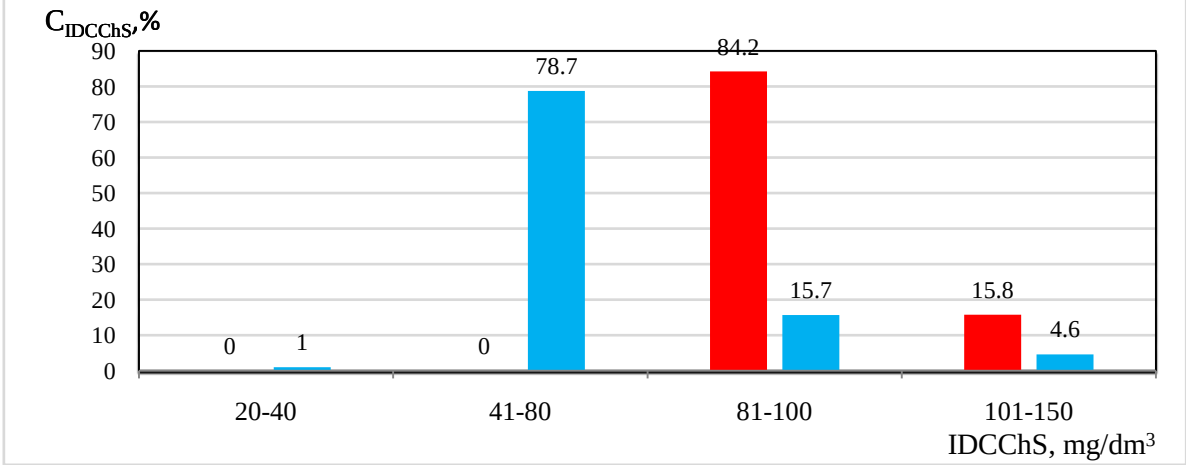

Figure 3: Comparative diagrams for C_{IDCChS} (red: "Dissolvan"-4397, "Dissolvan"-4795; blue: "IKHLAS"-1 after a two-fold reduction) in oil VST No. 6 at the ShPPO of the OGPD "Zhaikmunaigas".

Table 11 shows the results of analysis of oil samples from the "Gran" field. Samples were selected at the deposit, then sent to the laboratory of the ShPPO for analysis.

Table 11: Results of analysis of oil samples from the "Gran" field

Demulsifier	Date	Daily consumption of demulsifier, kg	Daily oil production, t	Specific flow rate (S_{fr}), г/т	Water, %	Chloride salts, mg/dm^3
"Dissolvan"-4397, 4795	06.01.17	11.700	123	95.1	3.5	5247
"Dissolvan"-4397, 4795	10.01.17	11.700	148	79.1	3.4	4571
"Dissolvan"-4397, 4795	14.12.17	11.700	148	79.1	1.2	-
"Dissolvan"-4397, 4795	18.12.17	23.400	142	164.8	7.0	4850
"Dissolvan"-4397, 4795	22.12.17	23.400	138	169.6	4.2	6990
"Dissolvan"-4397, 4795	26.12.17	23.400	136	172.1	10.0	-
"Dissolvan"-4397, 4795	29.12.17	23.400	140	167.1	12.0	25208
"IKHLAS"-1	12.01.18	23.400	144	162.5	0.8	2735
"IKHLAS"-1	13.01.18	23.400	138	169.5	0.9	2860
"IKHLAS"-1	14.01.18	23.400	136	172.0	0.6	1368
"IKHLAS"-1	15.01.18	23.400	134	174.6	0.4	1817
"IKHLAS"-1	16.01.18	23.400	100	234.0	0.4	624
"IKHLAS"-1	17.01.18	23.400	-	-	0,3	636

Note: the table is presented in abbreviated form management of the ShPPO, problems arose in the process tank at the “Gran” deposit (17.01.18 after 22.00) when determining the boundary between the oil and water layers. On 19.01.18 and 20.01.18 technological monitoring was carried out on site, as a result of which it was determined that the temperature in the process tank does not comply with the regulations, therefore, the coalescence and sedimentation of water microglobules significantly slows down in the reservoir after demulsification. Tables 12 and 13 are compiled with the help data of the Table 11. Tables 12 and 13 show the intervals of the dominant concentrations water (C_{IDCW}) in the composition of oil of the “Gran” deposit for the period of the basic technology (06.12.17-29.12.17), as well as for the period of the EIT IKHLAS-1 (12.01.18-16.01.18). C_{IDCW} for the base technology is 4.1-10%, and for "IKHLAS"-1 C_{IDCW} = 0.51-1.0. Consequently, the efficiency of the "IKHLAS"-1 nanodemulsifier is on average 9 times higher than the efficiency of the basic technology. These results unambiguously confirm the fast-acting ability of "IKHLAS"-1 in comparison with the basic demulsifiers. This is a very important factor at the primary preparation of oil (PPO).

The diagrams shown in Fig. 4, also demonstrate a significant advantage of "IKHLAS". "IKHLAS"-1 and its other modification "IKHLAS"-2 also showed high efficiency at the others oil fields («YZK», «YVK»,

Table 12: Calculated values of C_{IDCW} in oil of the “Gran” deposit for the period of the basic technology ("Dissolvan"-4397 and "Dissolvan"-4795)

differentiated intervals by values of the water concentrations (in %) in the oil of Gran deposit on the period of the basic technology (06.12.17-29.12.17)						
0-0.5	0.51-1	1.1-2	2.1-4	4.1-10	10.1-14	14.1-30
the number of analyzes (n_i) for differentiated intervals of chloride concentrations						
0	0	6	6	8	3	1
the percentage contribution (V) of each differentiated interval from the total value of the number of analyzes (no): V = (n_i/n_o) × 100, %						
0	0	25	25	33.3	12.5	4.2

Table 13: Calculated values of C_{IDCW} in oil "Gran" on the period EIT of "IKHLAS"-1

differentiated intervals by values of the water concentrations (in %) in the oil of Gran deposit on the period of EIT (12.01.18-17.01.18)						
0-0.5	0.51-1	1.1-2	2.1-4	4.1-10	10.1-14	14.1-30
the number of analyzes (n_i) for differentiated intervals of chloride concentrations						
27	38	5	1	0	0	0
the percentage contribution (V) of each differentiated interval from the total value of the number of analyzes (no): V = (n_i/n_o) × 100, %						
38.1	53.5	7.0	1.4	0	0	0

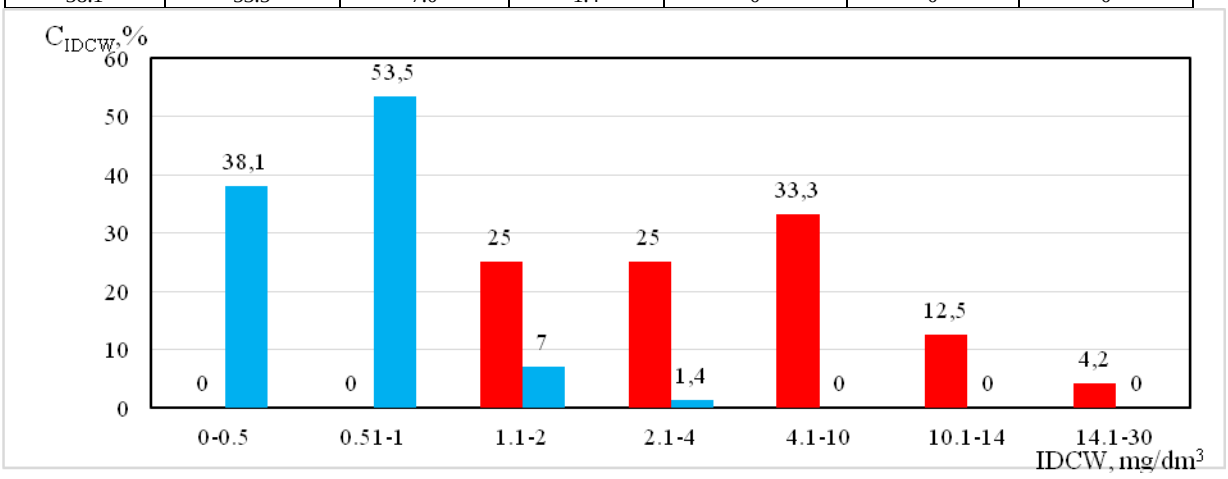

Figure 4: Comparative diagrams for C_{IDCW} (red: "Dissolvan"-4397, "Dissolvan"-4795; blue: "IKHLAS"-1 after a two-fold reduction) in the oil of the "Gran" deposit of OGPD "Zhaikmunaigas".

«YVN», «Zhanatalap», «Zaburunye») during the EIT. At the same time, it should be noted some features of the fields of "YVK" and "YZK". For the "YVK" and "YZK" deposits, the formation of viscoelastic systems (VES) and the manifestation of hydrate formation (HF) due to the powerful gas factor are characteristic phenomena. Indeed, in the winter period (including before and during the EIT "IKHLAS"-1 12.01.18-13.01.18), negative consequences of VES and HF were observed. During the EIT, as already noted, the problem was solved using "IKHLAS"-2. As it was noted on the Gran field, in connection with the violation of the thermal treatment of oil, VES is formed. The absence of phase separation of the VES makes it difficult to determine the levels of water and oil in tanks, even with a water-sensitive tape. In such situations, the VES, in our opinion, are colloid barns with respect to the gas component and water-oil emulsions. The main negative consequences of HF are clogging and plugging of valves, pumps and other installations of the ShPPO with solid products of hydrate formation. Therefore, more promising are demulsifiers possessing with side effects of inhibitors of formation of VES and HF. In Fig. 5 presents the comparative diagrams for C_{IDCW} in the oil of the oilfield "Gran" before a thermal violation of oil preparation. As follows from the diagrams presented, the effectiveness of "IKHLAS"-1 is 6.4 times that of "Dissolvan"-4397, "Dissolvan"-4795.

As follows from the comparison diagrams for C_{IDCChS} in the control commercial oil at the ShPPO, for basic demulsifiers C_{IDCChS} = 46-70 mg / dm^3, and for the nano-emulsifier "IKHLAS"-1 C_{IDCChS} = 31-45 mg / dm^3 (Fig. 6). Consequently, "IKHLAS"-1 due to the nanostructure shows a higher efficiency on the degree of dehydration and desalting of crude oil at all stages of oil preparation at the ShPPO of OGPD "Zhaikmunaigas" JSC "EmbaMunaiGas". All of the above-mentioned unique properties of the "IKHLAS"-1, 2 nanodemulsifiers are protected by the patent of the Republic of Kazakhstan [1]. As can be seen from Fig. 7, the nanodemulsifier "IKHLAS"-1shows high efficiency also at oil preparing from third parties ("AB Petroleum Capital"). As can be seen from Fig. 7, the nanodemulsifier "IKHLAS"-1shows high efficiency also at oil preparing from third parties ("AB Petroleum Capital"). On maximal values of concentration of chloride salts (C_{MVCChS}) in oil TPS, "IKHLAS"-1 has 60% advantage relative to the basic technology.

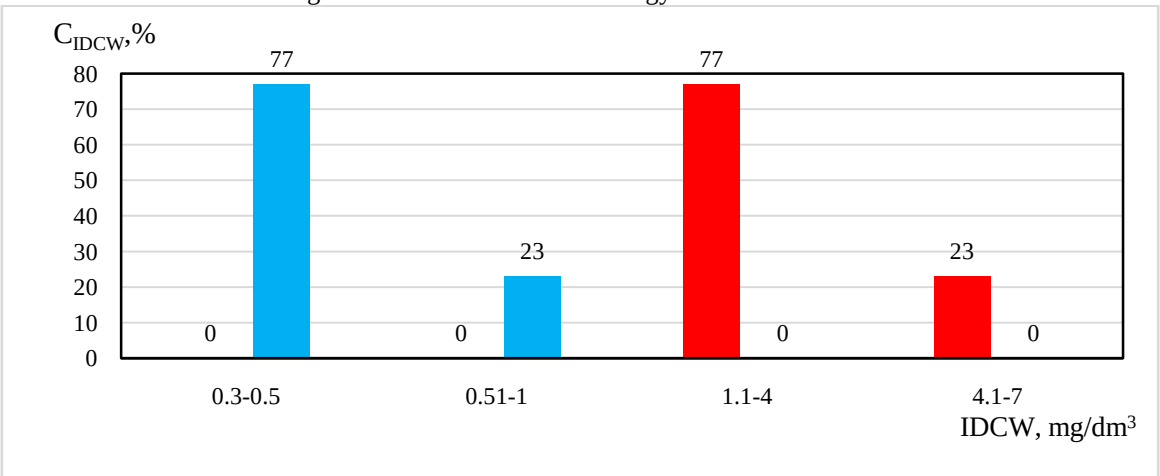

Figure 5: Comparative diagrams of C_{IDCW} in the oil of the "Gran" field before a thermal violation of oil preparation for the base technology (red) and for EIT of "IKHLAS"-1 (blue).

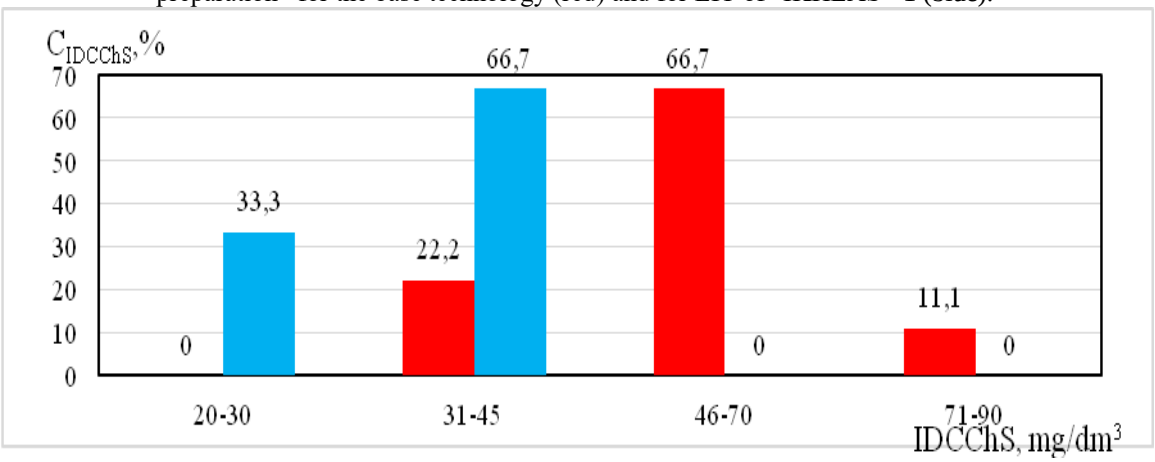

Figure 6: Comparative diagrams for SIDKHS in control commercial oil at the ShPPO for basic demulsifiers (red color) and for the "IKHLAS"-1 nanodeemulsifier (blue).

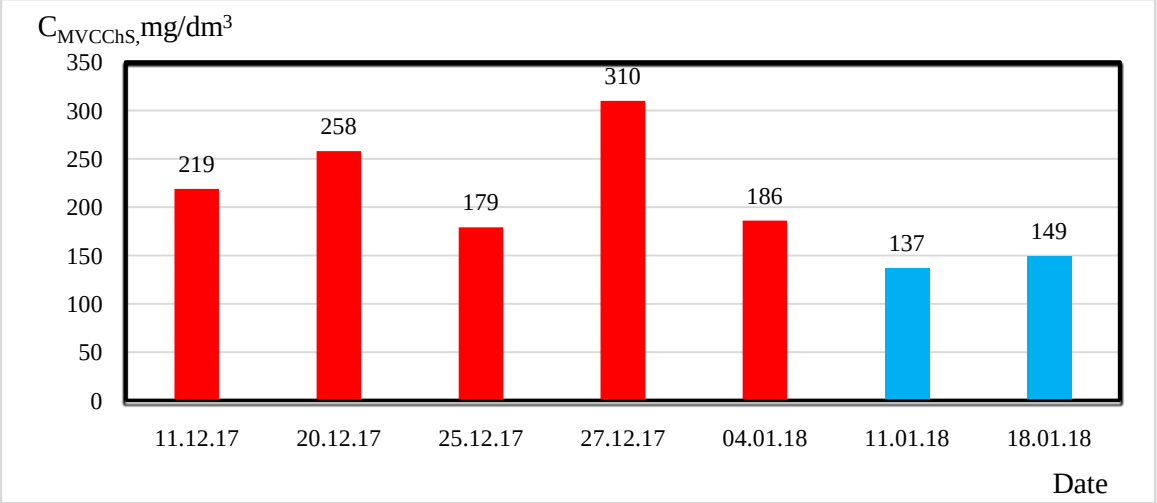

Figure 7: Comparative diagrams for C_{MVCChS} in TPS oil as a result of oil injection of third party ("AB Petroleum Capital").

Tables 14 and 15 show data on the values of the intervals of the dominant concentration of residual oil (C_{IDCRO}) in the wastewater, respectively, for the base demulsifiers "Dissolvan-4397"; "Dissolvan"-4795 (06.12.17-29.12.17) and "IKHLAS-1" (01.06.2018-25.01.18)

Table 14: Calculated values of interval of dominant concentration of residual oil (C_{IDCRO}) in the wastewater sampls for "Dissolvan-4397" and "Dissolvan"-4795 (06.12.17-29.12.17)

C_{IDCRO}, mg/dm^3						
15-20	20,1-45	45,1-50	50,1-100	100,1-170	170,1-270	270,1-400
the number of analyzes (n_i) for C_{IDCRO}						
0	0	0	2	2	7	1
B= (n_i/n_o)·100, %, where n_o is the total number of analyzes						
0	0	0	16,7	16,7	58,3	8,3

Table 15: Calculated values of interval of dominant concentration of residual oil (C_{IDCRO}) in the wastewater sampls for "IKHLAS"-1 during EIT (06.01.2018-25.01.18)

C_{IDCRO}, mg/dm^3						
15-20	20,1-30	30,1-50	50,1-100	100,1-170	170,1-270	270,1-400
the number of analyzes (n_i) for C_{IDCRO}						
1	10	1	0	0	0	0
B= (n_i/n_o)·100, %, where n_o is the total number of analyzes						
8,35	83,3	8,35	0	0	0	0

The data of tables 14 and 15 unequivocally confirm the significant advantage (8.8 times) of the "IKHLAS-1, 2" nanoemulsifiers compared to the basic demulsifiers "Dissolvan-4397" and "Dissolvan"-4795.

The Most Important Results, Scientific Novelty, Propositions and Prospects:

Important Results:

At the ShPPO during the EIT "IKHLAS"-1 (06.01.18-22.01.18) was performed a two-fold decrease in daily expenses demulsifier (from 89.94 kg to 44.97 kg) for S. Balgimbaev oil (for the period 15.01.18-22.01.), as well as on a mixture of oils from other deposits (for the period 17.01.18-22.01.18). The results were quite highly effective in comparison with the results of the basic demulsifiers "Disolvan"-4397 and "Dissolvan"-4795. Thus, the authors for the first time attempted to show, that the development and implementation of innovative polyfunctional nanoeemulsifiers, imparting properties of highly effective demulsifiers, desuspenders, depressants, dispersants, dehydrators, inhibitors in relation to all types of oil emulsions (reverse W/O; direct O/W; medium W/O/W), suspensions, oil colloids [intermediate layers or hard destroyed water-oil emulsions (HDWOE); hard destructible water-oil suspensions (HDWOS); barn oil; trap oil slimes; bottom sediments of technological and commodity reservoirs based on a mixture of HDWOE and HDWOS; viscoelastic systems (VES); gas hydrates, etc.] is one of the priorities direction of oil-field nanotechnology. The results of the EIT unequivocally confirm the significant advantage (8.8 times) of the "IKHLAS-1, 2" nanoemulsifiers compared to the basic demulsifiers "Dissolvan-4397" and "Dissolvan"-4795. Nanodemulsifier "IHLAS"-1 since 2017-2019 is implemanted on in the oil fields JSC "Phystech II", LLP "Tenge Oil & Gas", "Akkulka" of "Tetis Aral Gaz" LLP, OGPD "Zhaikmunaigas" JSC "Emba Munai Gas", on the Karsak ShPPO and the "Botaxan" field OGPD Dossormunayqaz" of JSC "Emba Munai Gas".

Scientific Novelty:

1. Polyfunctional nanodeemulsifiers, imparting the properties of highly efficient demulsifiers, desensitizers, depressants, dispersants, dehydrators, inhibitors to all types of oil emulsions (inverse W / O; direct O / W; medium W / O / W), suspensions, oil colloids [intermediate layers or hard destroyed

water-oil emulsions (HDWOE); hard destructible water-oil suspensions (HDWOS); barn oil; trap oil slimes; bottom sediments of technological and commodity reservoirs based on a mixture of HDWOE and HDWOS; viscous-elastic systems (VES); gas hydrates and others].

2. Viscous-elastic systems, in the conditions of primary oil preparation, were for the first time called colloidial barns on the ability to absorb oil, gas, water and solid nanoparticles of inorganic and organic origin;
3. The high efficiency of "IKHLAS" demulsifiers is related to the double nanostructure of the respective compositions: nanomicellar structure; nanocrystalline structure. In the work on the examples of liquid-crystalline nanoemulsifiers Ikhlas, the hybrid aggregative state of organic substances was first noted.

Proposition:

By the solutions of acceptance commission, results of experimental-industrial tests of nanodemulsifiers "IKHLAS"-1 and "IKHLAS"-2, at the ShPPO and some oilfields of OGPD "Zhaikmunaigas" JSC "EmbaMunaiGas", under conditions of a twofold reduction of daily consumption of demulsifiers estimated very positive, therefore nanodemulsifiers "IKHLAS"-1 and 2 were recommended as innovations of the Republic of Kazakhstan for the wide implementation at the OGPD "Zhaikmunaigas" of JSC "EmbaMunaiGas" (currently being implemented).

Prospects:

In the near future, 5 experimental-indastrial tests are expected at the large oil fields of Kazakhstan.

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