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SCIENTIFIC PAPER

UDC

INVESTIGATION OF THE EFFICIENCY OF DEMULSIFIERS IN BREAKING STABLE WATER-OIL EMULSIONS

Highlights

- Emulsion stability decreased as temperature increased from 40 to 70 °C
- DR-1502 showed maximum demulsification at 1000 ppm and 70 °C
- YK-1 achieved high efficiency at 500 ppm within 50–60 °C
- YK-1 matched DR-1502 performance at lower temperature and concentration

Abstract

The article explores the mechanism of the effect of reagents used for the demulsification of stable water-oil emulsions, which are widespread in oil production and transportation processes. In this regard, the demulsifying properties of the DR-1502 demulsifier used in SOCAR and the new YK-1 composition prepared on its basis are comparatively studied at different temperatures. The studies are conducted in laboratory conditions, and the reduction in the residual water content and the rate of emulsion separation into phases are taken as the main evaluation criteria for each system. The experiments conducted show that the temperature factor directly affects the stability of the emulsion. Thus, when the temperature increases, the emulsion breakdown intensifies, and the separation of the water phase significantly increases. The highest effectiveness of the DR-1502 demulsifier is achieved at a temperature of 70 °C and a concentration of 1000 ppm, and at this time the residual water content decreases to the minimum. YK-1 shows the same performance at lower temperatures and at half the concentration, as the acetone enhances diffusion and surface activity. The results show that YK-1 synergistically enhances DR-1502, increasing its interfacial activity and enabling demulsification with lower energy use.

Keywords: demulsification process, DR-1502 reagent, YK-1 composition, optimal concentration, synergistic effect, water content.

INTRODUCTION

The formation of stable water-oil emulsions is one of the major technological and economic challenges encountered during crude oil production, transportation, and processing. Such emulsions are especially characteristic of heavy and highly viscous crude oils containing elevated concentrations of natural surface-active compounds, including asphaltenes, resins, paraffins, and naphthenic acids. These components adsorb at the water-oil interface and form mechanically stable interfacial films around dispersed water droplets, thereby preventing coalescence and significantly increasing emulsion stability [1–4]. The

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persistence of stable emulsions negatively affects dehydration efficiency, increases energy consumption during crude oil treatment, complicates transportation operations, and reduces the productivity of industrial separation systems. The problem becomes more severe in heavy crude oils because of their high viscosity and elevated resin-asphaltene content. In addition, surfactants introduced during enhanced oil recovery processes may further stabilize dispersed systems under thermobaric production conditions [5–7]. Consequently, the development of efficient demulsification technologies remains an important scientific and industrial objective in petroleum chemistry and oil-processing engineering. Among currently available physical and chemical treatment methods, chemical demulsification is considered one of the most efficient and economically practical approaches for destabilizing stable water-oil emulsions. Conventional demulsifiers mainly act through adsorption at the water-oil interface, reducing interfacial tension, weakening protective adsorption films, and accelerating the coalescence of

dispersed water droplets [8-10]. Previous studies have demonstrated that the efficiency of phase separation strongly depends on the physicochemical properties of crude oil emulsions, including viscosity, droplet-size distribution, interfacial film strength, and the concentration of resin-asphaltene compounds [11-13]. Several investigations have shown that the incorporation of low-viscosity organic solvents into demulsifying systems can significantly improve diffusion properties, enhance penetration into interfacial films, and reduce reagent consumption during dehydration processes [14-16]. In recent years, increasing attention has also been devoted to nanostructured demulsifiers and surfactant-based nanocomposite systems capable of improving emulsion destabilization efficiency and accelerating water-phase separation in crude oil treatment systems [17-20]. Nevertheless, the demulsification behavior of highly stable Azerbaijani heavy oil emulsions and the application of solvent-assisted DR-1502-based systems remain insufficiently investigated. Heavy oils produced from the Muradkhanli field in Azerbaijan are characterized by high viscosity and elevated concentrations of resin-asphaltene compounds, resulting in the formation of highly stable water-oil emulsions during production and transportation. Previous investigations have shown that Muradkhanli crude oil requires increased reagent consumption during dehydration and creates significant technological difficulties during industrial treatment processes [15,16]. Therefore, Muradkhanli oil represents an appropriate model system for investigating demulsification mechanisms and evaluating the efficiency of new demulsifier compositions under laboratory conditions.

Despite the considerable number of studies devoted to crude oil demulsification, limited information is available regarding the synergistic influence of acetone on the interfacial activity, diffusion behavior, and demulsification efficiency of DR-1502-based systems. Therefore, the aim of the present study is to comparatively investigate the demulsification efficiency of the industrial DR-1502 reagent and a newly prepared YK-1 composite system based on DR-1502 and acetone using stable water-oil emulsions formed by Muradkhanli crude oil.

The influence of reagent concentration and temperature on emulsion breakdown was systematically evaluated using the bottle test methodology. Particular attention was devoted to the role of acetone in enhancing interfacial activity and improving dehydration efficiency at reduced reagent consumption and lower processing temperatures. The scientific novelty of the study lies in the development of a solvent-assisted demulsifying composition capable of providing highly efficient phase separation under comparatively moderate thermal conditions.

Research methodology

Table 1 presents the physicochemical properties of the heavy oil of the Jafarli part of the "Muradkhanli" field, which is used in the research process under laboratory conditions and has a hydration degree of 28%.

It should be noted that the composition and properties of the oil extracted from the Muradkhanli field are

characteristic of heavy oils of Azerbaijan. Its high viscosity, high content of paraffin and resin-asphaltene compounds, as well as stable water-oil emulsions formed during production, make this oil an ideal laboratory model for studying demulsification processes. Moreover, Muradkhanli oil is distinguished by high reagent consumption during demulsification under industrial conditions and difficulties in processing lines. This creates a convenient research object for testing new and effective demulsifiers and evaluating the mechanism of action of both individual and complex compositions. Thus, the choice of Muradkhanli oil is both a scientifically justified and practically important decision, because the results of the research conducted on it will create a methodological basis that can be generalized for the demulsification of heavy and high-viscosity oils in industrial conditions.

Table 1. Physical and chemical characteristics of the Muradkhanli oil sample.

Indicators	Muradkhanli (Jafarli)
Density 20 °C, kg/m ³	896
Viscosity 20 °C, mP·sec,	2600
Water content, mass, %	28
Chlorine salts content, mg/l	354.6
Amount of mechanical mixtures, mass, %	4.25
Resins content, mass, %	10.2
Asphaltenes content, mass, %	4.8
Paraffins content, mass, %	8.4
Freezing temperature, °C	+15
Sulfur content, %	0.32

In the present study, the industrial demulsifier DR-1502 was used as the primary reagent for destabilizing stable water-oil emulsions. DR-1502 is a commercially applied demulsifying surfactant system used in crude oil treatment processes in Azerbaijan. Acetone was used as the organic solvent component in the preparation of the YK-1 formulation. Since DR-1502 is a commercially applied industrial reagent, its exact proprietary composition and active ingredient percentage were not fully disclosed by the supplier. The reagent belongs to the class of nonionic surface-active compounds capable of reducing interfacial tension and promoting the coalescence of dispersed water droplets. The reagent was obtained from industrial application sources and was not synthesized within the scope of the present study.

Laboratory investigations were performed at temperatures of 40, 50, 60, and 70 °C using DR-1502 concentrations in the range of 200-1000 ppm. To improve demulsification efficiency, composite formulations based on DR-1502 and acetone were prepared at different volume ratios and investigated under various temperature conditions. The prepared compositions were conventionally designated as YK-1 systems.

The YK-1 composition was investigated at concentrations of 100-500 ppm. Acetone was used as an organic solvent to improve reagent diffusion, enhance interfacial

penetration, and increase the surface activity of the demulsifying system.

In laboratory studies, the efficiency of the oil dehydration process was determined using the "Bottle Test" methodology widely applied in international petroleum practice [11,12].

The investigated samples consisted of naturally formed stable water-oil emulsions obtained from Muradkhanli crude oil with an initial water content of 28%. No artificial emulsification procedure was applied during the experiments. In the Bottle Test procedure, a predetermined amount of demulsifier was added to the emulsion sample, followed by intensive mixing and thermostatic treatment under specified temperature conditions. After settling for a fixed period of time, the separated water phase and residual water content in the oil phase were determined.

The demulsification efficiency (DE, %) was calculated using the following equation:

$$DE = [(W_0 - W_r) / W_0] \times 100 \quad (1)$$

where W_0 is the initial water content of the emulsion (%), and W_r is the residual water content after treatment (%).

RESULTS AND DISCUSSION

During the research process, the effect of the DR-1502 demulsifier as an individual reagent on the breakdown of stable water-oil emulsions of Muradkhanli field oil at temperatures of 40, 50, 60, and 70 °C was first studied in laboratory conditions. All demulsification experiments were performed in triplicate under identical laboratory conditions, and the reported values represent the average results of repeated measurements. The deviation between parallel experiments did not exceed $\pm 2\%$, indicating good reproducibility and reliability of the obtained experimental data. The

relatively small deviation between repeated measurements confirmed the reproducibility of the experimental data under the investigated laboratory conditions.

As a result of laboratory tests, the dynamics of water separation and the degree of residual hydration of the oil phase were evaluated at temperatures of 40 °C, 50 °C, 60 °C, 70 °C, and the dependence of the concentration of the DR-1502 demulsifier on the residual water content was determined. It should be noted that "since the efficiency of the demulsifier at temperatures of 40 and 50 °C is low, only the results obtained at 60 °C and 70 °C were taken into account in the analysis and are reflected in Figs. 1 and 2.

Fig. 1 shows the dependence of the concentration of the DR-1502 demulsifier at a temperature of 60 °C on the percentage of water content. The results show that increasing the reagent concentration significantly enhances emulsion breakdown and reduces the water content. At concentrations of 800-1000 ppm, the residual water content decreased to 4%, indicating high demulsification efficiency under elevated temperature conditions. The observed behavior is associated with improved interfacial activity and accelerated coalescence of dispersed water droplets.

Fig. 2 shows the dependence of the concentration of the DR-1502 demulsifier on the percentage of water content at a temperature of 70 °C. These results prove that the DR-1502 demulsifier shows very strong effectiveness at high-temperature conditions.

Compared with 60 °C, higher temperature conditions significantly improved the demulsification efficiency of the reagent. At concentrations of 800-1000 ppm, the residual water content decreased to 0.14%, indicating almost complete phase separation. The increase in temperature enhanced molecular diffusion and facilitated faster destabilization of the emulsion system.

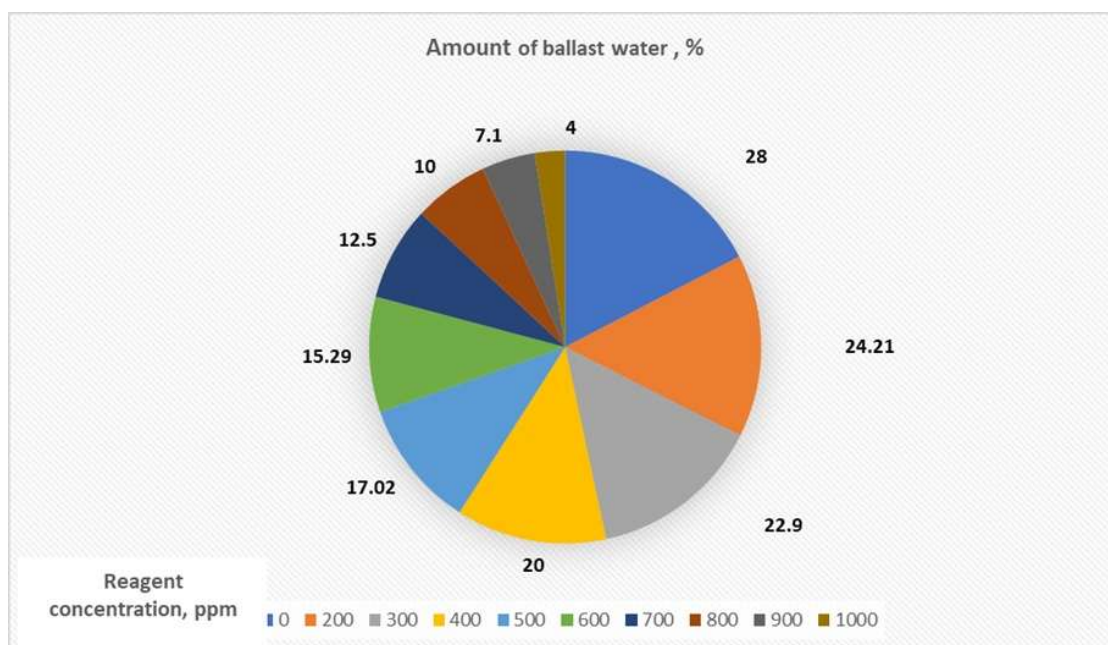


Figure 1. Effect of the DR-1502 concentration on the residual water content at 60 °C.

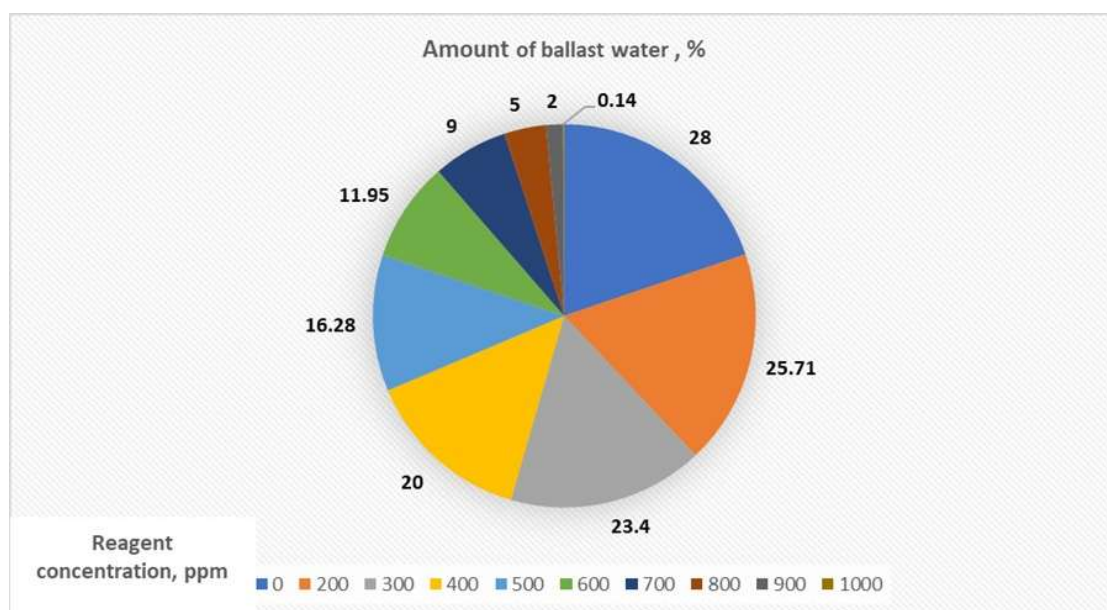


Figure 2. Effect of the DR-1502 concentration on the residual water content at 70 °C.

Table 2. Results of Muradkhanli oil demulsification with the YK-1 composition at 50 °C (mean \pm SD, n = 3).

Reagent concentration, ppm	Oil, %	Water, %	30min	60 min	90 min	120 min	30 min	60 min	90 min	120 min
0.0	72.00 \pm 0.40	28.00 \pm 0.40	0.00 \pm 0.00	0.00 \pm 0.00	0.00 \pm 0.00	0.00 \pm 0.00	0.00 \pm 0.00	0.00 \pm 0.00	0.00 \pm 0.00	0.00 \pm 0.00
100	77.58 \pm 0.52	22.42 \pm 0.45	8.0 \pm 0.08	13.5 \pm 0.15	17.5 \pm 0.18	19.91 \pm 0.38	3.1 \pm 0.05	5.0 \pm 0.06	6.5 \pm 0.08	7.74 \pm 0.15
200	83.15 \pm 0.61	16.85 \pm 0.38	17.5 \pm 0.18	27.0 \pm 0.24	34.0 \pm 0.30	39.83 \pm 0.56	6.0 \pm 0.08	9.7 \pm 0.10	12.5 \pm 0.14	15.49 \pm 0.27
300	88.73 \pm 0.73	11.27 \pm 0.31	26.5 \pm 0.22	41.5 \pm 0.35	51.0 \pm 0.42	59.74 \pm 0.72	9.5 \pm 0.10	15.0 \pm 0.16	19.3 \pm 0.20	23.23 \pm 0.35
400	94.30 \pm 0.81	5.70 \pm 0.22	36.0 \pm 0.30	55.5 \pm 0.44	68.0 \pm 0.55	79.66 \pm 0.84	12.8 \pm 0.12	20. \pm 0.20	25.8 \pm 0.26	30.98 \pm 0.41
500	99.88 \pm 0.09	0.12 \pm 0.01	45.0 \pm 0.35	70.5 \pm 0.58	86.5 \pm 0.65	99.57 \pm 0.21	15.3 \pm 0.15	25. \pm 0.24	32. \pm 0.30	38.72 \pm 0.48

This indicates the maximum activity range of the DR-1502 demulsifier at a temperature of 70 °C. Increasing temperature enhances molecular diffusion and surface activity of the reagent, which leads to a faster destabilization of the water-oil interface and almost complete breakdown of the emulsion. Thus, the experiment conducted at 70 °C shows that the DR-1502 reagent is particularly effective at high temperatures. The residual water content decreased from the initial 28% to 0.14%, which proves that the demulsification process is almost complete.

Based on the results of preliminary tests with the DR-1502 demulsifier, its functional composition was improved, and a new YK-1 composition was prepared and separately evaluated under laboratory conditions. Among the investigated composite formulations, the DR-1502:acetone ratio of 9:1 demonstrated the highest demulsification efficiency under the studied experimental conditions. Therefore, this formulation was selected for detailed comparative investigation in subsequent laboratory experiments. The obtained results indicate that the incorporation of acetone significantly improved the interfacial activity and diffusion properties of the demulsifying system, leading to enhanced separation of the

water phase from the crude oil emulsion.

The effect of the YK-1 composition on the Muradkhanli stable water-in-oil emulsion was studied at temperatures of 40, 50, and 60 °C. Since the efficiency achieved at 40 °C was relatively low, the main focus of the study was placed on the experimental results obtained at 50 and 60 °C. Table 2 presents the demulsification indicators of Muradkhanli oil in the presence of the YK-1 composition at 50 °C.

The results obtained on the efficiency of the YK-1 composition at a temperature of 50 °C are given in Table 2. It is clear from the indicators that the demulsifying properties of the YK-1 composition increase even more when the temperature is slightly increased. Thus, at a concentration of only 100 ppm of the reagent, the water content in the emulsion decreased to 22.42%, 19.91% dehydration, and 7.74% oil increase were ensured. When the concentration was in the range of 200–400 ppm, the intensity of the process increased significantly; respectively, a water reduction rate of 39.83–79.66% and an oil increase of 15.49–30.98% were observed. The highest result was obtained at a concentration of 500 ppm. Under these conditions, the water content in the emulsion decreased to 0.12%, i.e., a deep dehydration of 99.57% and an oil increase of 38.72% occurred. This result is

almost the same as that of the previous individual DR-1502 reagent at 70 °C and 1000 ppm. Thus, the YK-1 composition allows achieving the same effect at a temperature of 50 °C and with half the reagent consumption. This fact shows that the acetone in the composition enhances the surface activity of DR-1502 and its ability to reduce interfacial tension. Consequently, the process of coalescence of droplets and separation of the water phase occurs more easily.

Fig. 3 shows the dependence of the concentration of the YK-1 composition on the percentage of water content at a temperature of 50 °C. These results show that the demulsifying properties of the YK-1 composition further enhance with increasing temperature. In the absence of reagent addition, the residual water content is 28%, which represents strong emulsion stability. When the density is in the range of 100-200 ppm, the residual water content decreases from 23.78% to 18.91%. Under these conditions, the surfactants of YK-1 adsorb to the water-oil interface, reducing the surface tension and activating the initial decomposition process of the emulsion.

Fig. 3 demonstrates the influence of YK-1 concentration on the residual water content at 50 °C. The obtained results show that the YK-1 composition provides effective demulsification even at relatively low temperatures and reduced reagent concentrations. At 500 ppm, the residual water content decreased to 0.04%, confirming the strong synergistic effect of acetone on the demulsifying activity of DR-1502.

The results of evaluating the effect of the YK-1 composition at a temperature of 60 °C (Table 3) show that an increase in temperature further enhances the demulsifying activity of the composition. Thus, already at a concentration of 100 ppm, the amount of water in the emulsion decreased to 22.4%, dehydration of 19.98%, and an increase in oil of 7.77% were observed.

As the amount of reagent increased in the range of 200-400 ppm, the kinetics of the process became faster; the water reduction was recorded at 39.96-79.91%, and the oil increase was recorded at 15.54-31.08%. The highest result was obtained at a concentration of 500 ppm. Under these conditions, the amount of water in the emulsion decreased to only 0.03%, that is, practically complete dehydration (99.89%) was ensured. This result can be considered an indicator that is completely equal to, or even superior to, the results initially obtained by the DR-1502 reagent at a temperature of 70 °C and a concentration of 1000 ppm. Consequently, the YK-1 composition allows obtaining the same or higher demulsification effect at a relatively low temperature of 60 °C and with half the reagent consumption. This fact proves that the acetone component in the composition significantly improves the distribution of DR-1502 in the dispersed medium, its surface activity, and the coalescence of droplets.

Fig. 4 shows the dependence of the concentration of the YK-1 composition on the percentage of water content at a temperature of 60 °C. Under these conditions, the YK-1 system demonstrated nearly complete dehydration efficiency. The residual water content decreased to 0.12% at 500 ppm, indicating effective destabilization of the water-oil interface and accelerated coalescence of water droplets in the presence of the solvent-assisted demulsifying system.

Hence, based on the results of numerous experiments conducted in laboratory conditions, a comparative analysis of the newly prepared YK-1 composition with the DR-1502 demulsifier can be justified on scientific grounds as follows.

According to the results of numerous laboratory studies, both the industrial DR-1502 demulsifier and the new YK-1 composition prepared on its basis in a 9:1 ratio with acetone demonstrated high activity in the breakdown of stable water-in-oil emulsions of Muradkhanli oil.

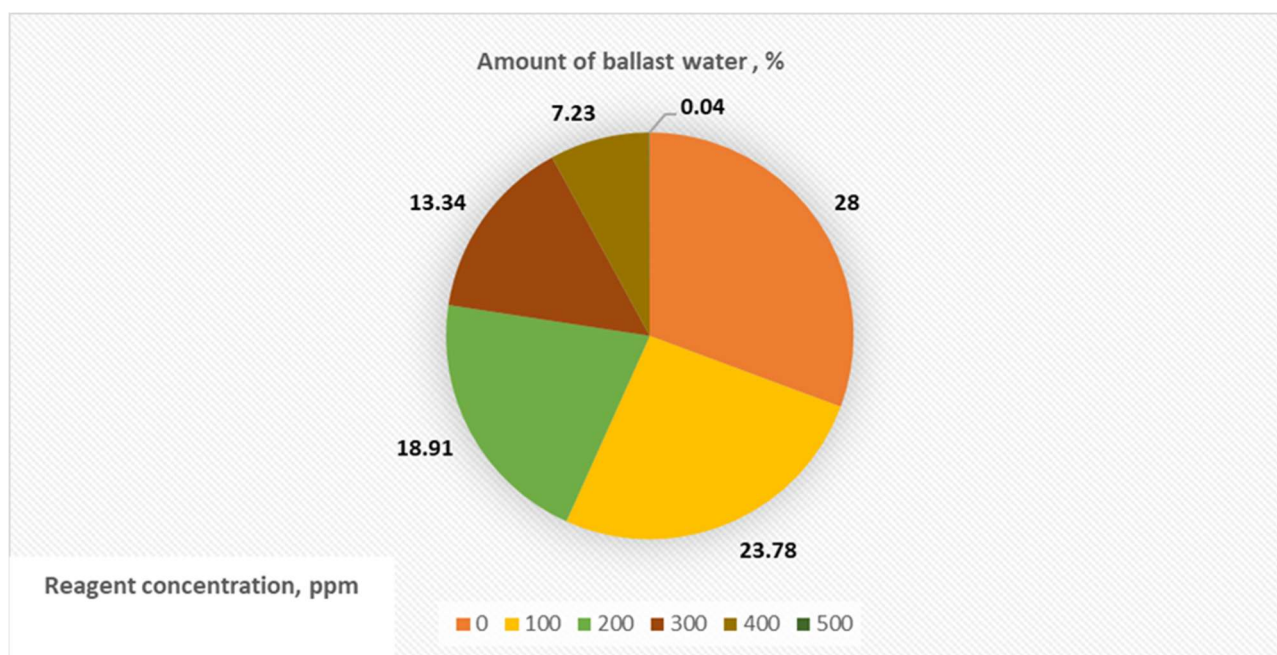


Figure 3. Effect of the YK-1 concentration on the residual water content at 50 °C.

Table 3. Results of Muradkhanli oil demulsification with the YK-1 composition at 60 °C (mean \pm SD, n = 3).

Reagent concentration, ppm	Oil, (%)	Water, (%)	30 min	60 min	90 min	120 min	30 min	60 min	90 min	120 min
0.0	72.00 \pm 0.40	28.00 \pm 0.40	0.00 \pm 0. 00	0.00 \pm 0. 00	0.00 \pm 0. 00	0.00 \pm 0.00	0.00 \pm 0. 00	0.00 \pm 0. 00	0.00 \pm 0. 00	0.00 \pm 0.00
100	77.59 \pm 0.51	22.40 \pm 0.44	9.0 \pm 0.09	13.5 \pm 0.15	17.5 \pm 0.18	19.98 \pm 0.37	3.4 \pm 0.05	5.2 \pm 0.06	6.5 \pm 0.0 8	7.77 \pm 0.15
200	83.18 \pm 0.60	16.81 \pm 0.37	18.0 \pm 0.18	27.0 \pm 0.24	33.5 \pm 0.30	39.96 \pm 0.55	6.5 \pm 0.08	9.8 \pm 0.10	12.4 \pm 0.14	5.54 \pm 0.26
300	88.78 \pm 0.72	11.21 \pm 0.29	27.0 \pm 0.22	42.0 \pm 0.35	52.0 \pm 0.42	59.94 \pm 0.71	9.7 \pm 0.10	15.2 \pm 0.16	19.3 \pm 0.20	23.31 \pm 0.34
400	94.37 \pm 0.80	5.62 \pm 0.20	38.0 \pm 0.30	56.5 \pm 0.45	68.5 \pm 0.55	79.91 \pm 0.83	13.5 \pm 0.13	20.5 \pm 0.20	25.5 \pm 0.25	31.08 \pm 0.40
500	99.97 \pm 0.03	0.03 \pm 0.01	47.0 \pm 0.36	72.0 \pm 0.58	86.0 \pm 0.64	99.89 \pm 0.12	16.8 \pm 0.15	25.8 \pm 0.25	32.6 \pm 0.31	38.85 \pm 0.46

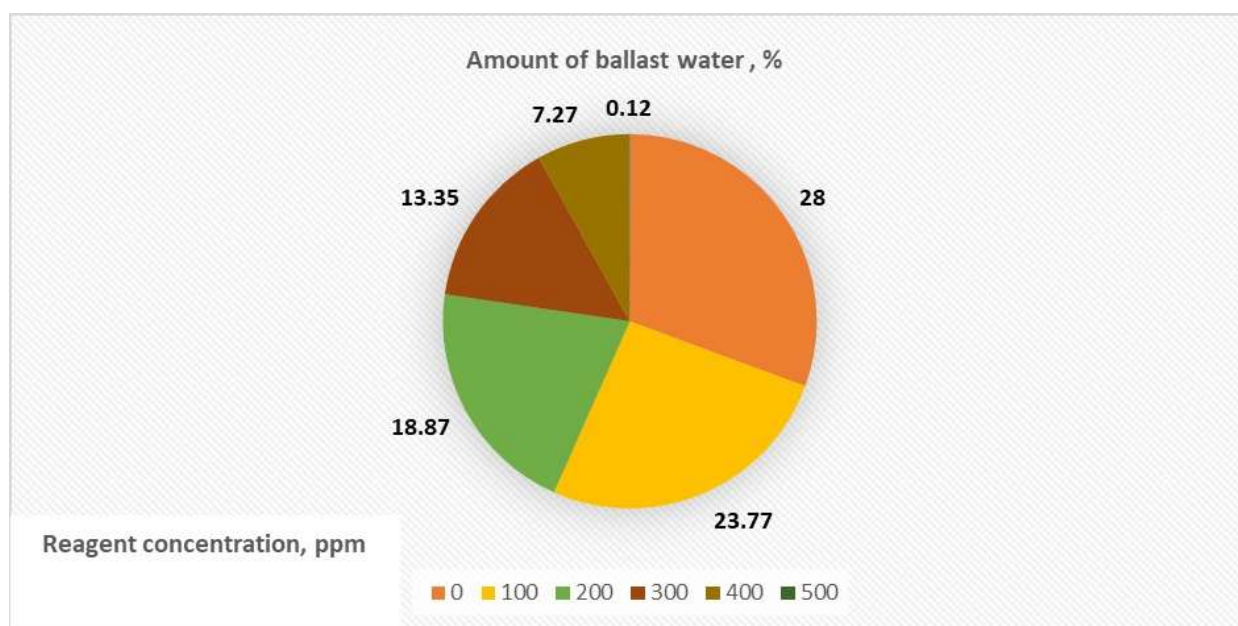


Figure 4. Effect of the YK-1 concentration on the residual water content at 60 °C.

However, comparative analyses show that the YK-1 composition had a higher demulsifying efficiency than the DR-1502 reagent in all temperature ranges, especially at 50 and 60 °C. Thus, at a temperature of 60 °C, the residual water content decreased by a maximum of 89.3% within 120 minutes, while the increase in the oil phase was 20.6%. Under the same conditions, the application of the YK-1 composition almost completely eliminated water content; the water reduction rate was 98-99%, and the increase in the oil phase was 25-27%. This difference is explained by the composition and structural features of the YK-1 system, namely, the fact that acetone increases the dispersion degree of DR-1502 molecules, enhances molecular diffusion, and increases the number of surfactants. The mechanism of action of the DR-1502 reagent is mainly based on the typical properties of non-ionic surfactants. Its molecules are adsorbed at the water-oil interface, reducing the surface tension, weakening the energy barrier at the inter-droplet interface, and promoting coalescence. However, this process fully activates only in a certain temperature range and at an optimal concentration (800-1000 ppm). As a result, both higher thermal energy and longer time are required for the complete decomposition of the emulsion. In the YK-1 composition, the demulsification process occurs based on two parallel mechanisms. The first is the physical mechanism caused by acetone. The presence of acetone increases the

dispersion of DR-1502 in the solvent medium, accelerates its diffusion into the active phase, and partially solvates the resin-asphaltene complexes in the oil phase of the emulsion. At this time, the colloidal layer protecting the water droplets weakens. Second, the chemical-electrostatic mechanism of action provides faster molecular orientation of DR-1502 molecules due to acetone. Accordingly, polar functional groups ($-\text{OH}$, $-\text{O}-$, $-\text{CO}-$) disrupt the electrostatic stability of the water phase, reduce the mutual repulsion forces between water droplets, and facilitate their easier coalescence. Thus, in the YK-1 system, both chemical weakening of adsorption barriers and kinetic strengthening of the surfactant phase occur simultaneously. For both reagents, the demulsification process accelerated with increasing temperature, but the YK-1 composition showed a complete separation effect even at a lower temperature (50 °C). This is due to a significant increase in the diffusion capacity of the active components of DR-1502 in a low-viscosity environment caused by acetone. That is, YK-1 molecules reach the water-oil emulsion layer faster, adsorb, and activate coalescence at an early stage, even at relatively low temperatures, such as 50 °C. While the optimal concentration for DR-1502 is observed in the range of 800-1000 ppm, this indicator for the YK-1 composition is stabilized at 400-500 ppm. This fact confirms that YK-1 shows the same or higher efficiency even at lower

concentrations. Such a property is explained by the synergistic effect caused by acetone, that is, by the strengthening of the surface-active potential of DR-1502 molecules. At the molecular level, the obtained results suggest the possible formation of hydrogen-bonding and dipole-dipole interactions between DR-1502 and acetone molecules in the YK-1 system. As a result of these interactions, the orientation of molecules in the solvent medium was homogenized, the hydrophilic-hydrophobic balance optimized, and the observed behavior may be associated with a reduction in interfacial tension. Under these conditions, the energy spent on the coalescence of water droplets was reduced; as a result, the kinetics of demulsification were 1.3-1.5 times faster than in DR-1502. Comparative analysis shows that the YK-1 composition provides the same or higher degree of separation of water-oil phases at a lower temperature, in a shorter time and with a smaller amount of reagent than in DR-1502. This, in turn, acts as a more technologically efficient system by reducing energy and reagent consumption. Furthermore, the use of acetone gives the YK-1 composition multifunctionality, and it has both demulsifying and easy-dissolving properties. Thus, the scientific advantage of the YK-1 composition is that, as a result of the synergistic interaction of acetone with DR-1502, adsorption barriers broke at the molecular level, diffusion and coalescence kinetics were optimized, and a high degree of separation of water-oil phases occurred in a short time.

It should be noted that the proposed explanations regarding intermolecular interactions and interfacial phenomena are based on theoretical interpretation of the observed experimental behavior. Detailed physicochemical investigations involving adsorption measurements, interfacial energy analysis, and rheological characterization were beyond the scope of the present study and may be considered in future research.

CONCLUSION

The results of the study showed that an increase in temperature directly affects the stability of the emulsion. As the temperature increased from 40 °C to 70 °C, the residual water content in both DR-1502 and YK-1 reagent systems decreased consistently. This is explained by the decrease in interfacial tension with increasing thermal energy, the weakening of the boundary between the water and oil phases, and the easier breakdown of the emulsion.

The demulsifying effect of the DR-1502 reagent increased sharply depending on the temperature, showing maximum effectiveness at a concentration of 1000 ppm at 70 °C. Under these conditions, the separation of the water phase was almost complete, and the stability of the emulsion was almost destroyed.

The YK-1 composition showed a stable and effective effect in a wider temperature range. In particular, the maximum demulsifying degree was achieved at a concentration of 500 ppm at temperatures of 50 °C and 60 °C. The presence of acetone in the composition increased interphase diffusion and enhanced the surface-directed activity of DR-1502.

Comparative analysis showed that although DR-1502 showed a high effect at high temperature and concentration, the YK-1 composition provided the same efficiency at lower temperature and half the concentration.

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ISPITIVANJE EFIKASNOSTI DEEMULGATORA U RAZBIJANJU STABILNIH EMULZIJA VODA-ULJE

U radu je analiziran mehanizam delovanja reagenasa koji se koriste za deemulgovanje stabilnih emulzija voda-ulje, koje su široko zastupljene u procesima proizvodnje i transporta nafte. U tom smislu, uporedno su ispitana deemulgujuća svojstva deemulgatora DR-1502, koji se koristi u kompaniji SOCAR, i nove kompozicije YK-1 pripremljene na njegovoj osnovi, pri različitim temperaturama. Ispitivanja su sprovedena u laboratorijskim uslovima, a smanjenje sadržaja rezidualne vode i brzina razdvajanja emulzije na faze uzeti su kao glavni kriterijumi za ocenu svakog sistema. Sprovedeni eksperimenti pokazali su da temperaturni faktor direktno utiče na stabilnost emulzije. Naime, sa povećanjem temperature intenzivira se razbijanje emulzije, a izdvajanje vodene faze značajno se povećava. Najveća efikasnost deemulgatora DR-1502 postignuta je na temperaturi od 70 °C i pri koncentraciji od 1000 ppm, pri čemu se sadržaj rezidualne vode smanjuje na minimum. YK-1 pokazuje isti učinak na nižim temperaturama i pri dvostruko manjoj koncentraciji, jer aceton poboljšava difuziju i površinsku aktivnost. Rezultati pokazuju da YK-1 sinergijski pojačava dejstvo DR-1502, povećavajući njegovu međupovršinsku aktivnost i omogućavajući deemulgaciju uz manju potrošnju energije.

NAUČNI RAD

Ključne reči: proces deemulgovanja, reagens DR-1502, kompozicija YK-1, optimalna koncentracija, sinergijski efekat, sadržaj vode.