CHEMICAL TECHNOLOGY

DOI: 10.32743/UniTech.2021.83.2-4.36-39

DEVELOPMENT OF EFFECTIVE DEMULSIFIERS ON THE BASIS OF LOCAL RAW MATERIALS

Ilkhom Abdirakhimov
Senior teacher,
Karshi engineering-economic institute
E-mail: abdirahimov.ilhom@mail.ru

ABSTRACT

For the destruction of highly resistant water-oil emulsions of heavy oils, cotton oil is obtained for technical purposes by extraction with a hydrocarbon solvent. Technical cotton oil, along with triacylglyceride, contains gossypol, chlorophyll and their derivatives, which have certain surface-active properties.

Part of heavy oils form highly stable water-oil emulsions, destruction for a long time (more than 10-12 hours) practically does not occur due to the high content of asphaltenes, resins, paraffins, ceresins, mechanical impurities, mineral salts, and others.

These substances, together with the formation of associates and micelles stick together into complicated complexes which form high-strength armor shells of water globules. The use of highly active demulsifiers, even with a high excess, does not always allow the destruction of a stable oil-water emulsion [1].

Therefore, research is currently carrying out to develop effective demulsifiers on the basis of local raw materials [2].

In order to prevent the formation, as well as to destroy the already formed oil emulsions, demulsifiers - surfactants, which, unlike natural emulsifiers, contribute to significant decrease in the stability of oil emulsions are widely used [3].

The effect of the demulsifier on the oil emulsion is based on the fact that the demulsifier which is being absorbed at the oil-water interface, displaces and replaces less active surface-active natural emulsifiers [4].

Natural emulsifiers are considered natural surfactants which are found in oil (asphaltenes, naphthenes, resins, paraffins) and in reservoir water. Demulsifiers should be more active than emulsifiers. The pellicle which is formed by the demulsifier, is less durable. As the demulsifier accumulates on the surface of the water droplets, forces of mutual attraction arise between the latter. As a result, small dispersed water droplets form large droplets (flakes), which pellicle around water globules are usually retained [5]. The process of formation of large flocs from finely dispersed water droplets as a result of the action of demulsifier is called flocculation. In the process of flocculation, the surface pellicle of water globules becomes sufficiently weakened, its destruction occurs and the water globules merge. The process of coalescence of water droplets is called

Bibliographic description: Abdirakhimov I.E. Development of effective demulsifiers on the basis of local raw materials // Universum: технические науки : электрон. научн. журн. 2021. 2(83). URL: https://7universum.com/ru/tech/archive/item/11293 (дата обращения: 25.02.2021).
Coalescence. Good demulsifiers should not only bring the dispersed water droplets in the emulsion closer together, but also destroy the surrounding pellicles and promote coalescence.

More than 25 large fat-and-oil enterprises are successfully operating in Uzbekistan, where cottonseed oil for technical purposes is obtained by the method of extraction with hydrocarbon solvent. Technical cottonseed oil, along with triacylglyceride, contains gossypol, chlorophyll and their derivatives, which have certain surfactant properties [6].

For example, the general formula of gossypol has the form $C_{30}H_{30}O_8$ in chemical reactions, it behaves like a strong dibasic acid, namely polyphenol. Gossypol, interacting with alkali, for example with NaOH, forms phenolates, namely, sodium gossypolates which is dissolving in water, exhibit surface-active properties during demulsification of water-in-oil emulsions of heavy oils [1].

The reaction of gossypol and alkali proceeds according to the following scheme:

$$\text{As you can see, saponification of gossypol with aqueous solution of alkali, for example, NaOH, makes it possible to obtain ionic surfactant, which has good wetting and foaming properties [7].}$$

![Diagram](image)

Figure 1. Block diagram of the production of sodium salts of sulfonated cottonseed oil for demulsification of stable VNE and NSHE heavy oils

Nowadays the development of demulsifier production is aimed at obtaining surfactants containing a sulfo group ($SO_3OH$) or sulfate group - $OSO_2OH$. Taking this into account, we have synthesized demulsifiers which contain the aforementioned sulfur-containing groups on the basis of technical extraction cottonseed oil. In fig. 1 is shown a block diagram of the preparation of demulsifier which contains group.

Sulfurization of the extraction cottonseed oil was carried out by treating it with sulfuric or sulfidic acid. Sulfonated surfactants exhibit good demulsifying properties after alkaline treatment. This can be obtained on the basis of high molecular weight unsaturated fatty acids or hydroxy acids, as well as using esters or alkylated amides.

Basically, many demulsifiers are obtained by sulfonation of alkylated aromatic hydrocarbons with their subsequent neutralization or esterification of the resulting sulfonic acids.

We have synthesized 2 types of sulfur demulsifier (SD-1 and SD-2), where the first was obtained using sulfate acid, and the second - sulfide (Table 1) in order to do this.
Table 1.

| Demulsifier name | Demulsifier consumption, g/t | Initial water content, % | Residual water content in VNE, % |
|------------------|------------------------------|--------------------------|-------------------------------|
| K-1 (KNR) (control) | 60                          | 31,0                     | 1,5                           |
| СД-1             | 40                          | 30,5                     | 1,0                           |
| СД-2             | 50                          | 30,8                     | 0,9                           |

From table 1 it is seen that the developed sulfurous demulsifier on the basis of extraction cottonseed oil removes water deeper than the well-known K-1 (KNR).

The specific consumption of demulsifier is considered the main technical and economic indicator of the processes of dehydration and desalination of water-in-oil emulsions, especially heavy oils.

| Figure 2. Change in the residual content of mechanical salts (ООС) depending on the consumption of demulsifiers (qо): 1 - for K-1 (КНР); 2 - for the developed sulfurized demulsifier (SD-1); 3 - for SD-2 |

As we can see from fig. 2, increasing the consumption of the known K-1 demulsifier (KHP) and the developed residual content of mineral salts (SD-1 and SD-2) in heavy oils exponentially decrease. At the same time, more removal of mineral salts is observed when using SD-2 and SD-1 than K-1 (KHP), which can be explained by the nature and chemical composition of the former.

We have studied the main colloidal-chemical characteristics of the known and developed demulsifiers. It can be seen from table 2 that the proposed demulsifier is more active in comparison with the known demulsifier, namely, it has a high surface tension, washing and foaming properties, which is very important in the destruction of stable VNE formed from heavy oils.
Indicators of the known K-1 and developed SD-1, SD-2 demulsifiers

| Name of demulsifier | pH    | Superficial tension, dyn/cm | Washing ability, % | Foaming capacity at 25° C, cm³ |
|---------------------|-------|------------------------------|--------------------|-------------------------------|
| K-1 (КНР) (Control) | 9,1   | 33                           | 78                 | 22                            |
| СД-1                | 8,3   | 37                           | 92                 | 28                            |
| СД-2                | 8,5   | 35                           | 90                 | 26                            |

Thus, carried out studies show that instead of the imported K-1 demulsifier (PRC), technical extraction cottonseed oil can be used as a base. The presence of sulfur compounds, gossypol, chlorophyll and their derivatives in it makes it possible to increase its demulsifying properties.

Practice shows that the selection of the optimal composition of the demulsifier composition for the destruction of each type of stable oil-water emulsions is very difficult. It becomes especially problematic if the emulsions contain such highly dispersed inclusions that were introduced into wells during oil production in order to increase their oil recovery. Such additives are more often chemicals (surfactants, soaps, etc.), mineral impurities (salts) in large quantities, which complicate the selection of demulsifier composition for oil demulsification.

It can be seen from table.1 and fig.1 that the amount of residual water in oil with increasing the consumption of demulsifiers within 40–60 g/t, decreases, which indicates increasing the degree of its demulsification.

In terms of demulsifying ability, the studied demulsifiers are arranged in the following decreasing row: SD-2 > SD-1 > K-1.

Therefore, we can assume that the developed demulsifier SD-1 is relatively more active than the other demulsifiers which are emphasized above.

References:
1. Abdiraximov I.E., Karimov M.U., Djalilov A.T. Synthesis and study of demulsifiers on the basis of polycarboxylate ethers. Aktualnyye problemy i innovatsionnyye tehnologii v oblasti yestestvennyx nauk // Sbornik nauchnyx trudov. Mejdunarodnaya nauchno-prakticheskaya on-line konferensiya.- Tashkent. TashGTU, 2020.87-92 st.
2. Lutoshkin G.S. Collection and preparation of oil, gas and water. -M. : TID Alliance, 2005.319 s.
3. Ploxova S.Ye., Sattarova E.D., Yelpidinskiy A.A. Izuchenie vliyaniya anionnyx i kationnyx PAV na deemulgiruyushchuyu effektivnost neionogennyx PAV // Vestnik Kazanskogo tehnologicheskogo universiteta. - 2012. - T. 15. - №. 16.
4. Uchayev A.Ya. Development of composite compositions on the basis of PAV for the development of resistant emulsion vodoneftyanyx. - dissertation. on soisk. three st. k.t.n. - g. Moscow -2013. - 121 s.
5. Buronov F.E., Abdiraximov I.E. Prirodnyye bitumy i tyajelyye nefti, problemy iksosvoyeniya.Fundamentalnyye i prakticheskiy materialy mezhdunarodnoy nauchno-prakticheskoy konferensii, pri-urolenovnyj / T.3. - Voronezh, 2018. - 286 p.
6. Абдирахимов И.Э., Курбанов. А.Т., Буронов.Ф.Э., Самадов.А.Х.Технология переработки тяжелых нефтей и нефтяных остатков путем применения криолиза научно-практический электронный журнал “Аллея Науки” Выпуск №12(39) (том 3), (Декабрь, 2019).