Int. J. Chem. Sci.: 12(4), 2014, 1337-1344
ISSN 0972-768X
www.sadgurupublications.com

TECHNOLOGICAL BASIS DESALTING HIGHLY OILS

ORYNGOZHIN ERNAZ SOVETOVICH* and
BISENGALIEVA DINA IBRAEMOVNA

Institute of Geology and Oil Gas Business after K. Turysova,
Kazakh National Technical University after Name of K. I. Satpayev,
ALMATY, REPUBLIC OF KAZAKHSTAN

ABSTRACT

In the process of desalting, not only salts and water was removed from crude oil, but also mechanical impurities, oxides and sulfides of iron, and a significant amount of arsenic compounds, which poisons the platinum catalysts in reforming organic compound of vanadium and other metals, which reduce the quality of the oil. With a significant salt content, the performance is reduced of factory settings, shortened time between repairs, increased downtime, increased corrosion, increasing the cost of repair and cleaning aids. High content of salts in the oil deteriorates the quality of commodity oil processing.

Key words: Crude oil, Highly oils, Viscosity, Surfactants.

INTRODUCTION

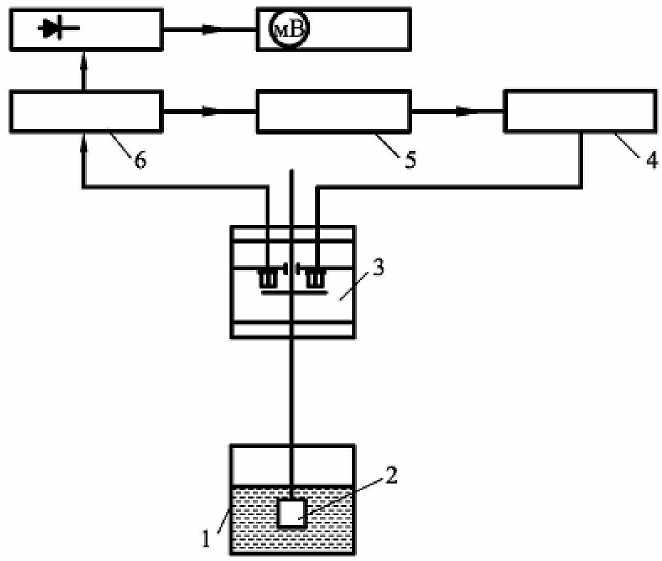
The low-frequency vibro viscometer was designed and manufactured to investigate the viscosity of the oil-in-water emulsions in the range of 0.5-30 cps. For low viscosity, it is the most appropriate method based on the functional dependence of the amplitude oscillating probe at a constant driving force to the viscosity and density of the medium, in which it is placed[1]. The resonance vibration calculation formula has been provided to determine the viscosity of the form:

$$A/C - B = \sqrt{\mu\rho} \qquad \ldots(1)$$

Where μ – Dynamic viscosity, cp; ρ – Density of the fluid, g/cm^3; A – Amplitude of the oscillations and C and B – constants.

Block diagram of the cars resonant vibration amplitude low-frequency viscometer is shown in Fig. 1.

*Author for correspondence; E-mail: oryngozhine@yahoo.com

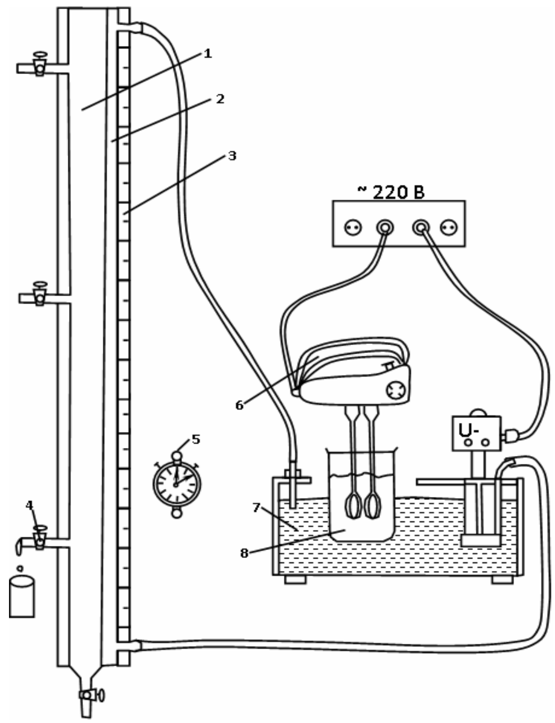


1-Glass investigated emulsion; 2-Sensor; 3-Exciter; 4-Voltage amplifier; 5-Stop; 6-Power amplifier

Fig. 1: Block diagram of the cars resonant vibration amplitude low-frequency viscometer

It consists of electronic and mechanical parts, which are magnetically coupled to each other. To control the operation of the electronic unit in the electronic circuit, it is provided with a control probe. This system has a high degree of stability, sensitivity and good quality. The Q-factor of the circuit 500, sensitivity of the instrument at this setting corresponds to 30 mV/cps. Frequency resonant vibration of the system-82 Hz. As a reference liquid for constructing the calibration curve, the data for the dependence of the viscosity of water-glycerol mixtures at different temperatures have been used.

To study the demineralization and destruction of oil-water emulsions, it was collected the laboratory bench setup as shown in Figure 2. The main part is a long glass column 1 of 25 mm diameter and a height of 1000 mm, equipped with a thermostatic water jacket 2, a measuring scale 3 and 4 four samplers located at the bottom and at different levels of the height of the column. The separation of water and oil phases were fixed with a stopwatch 5. The emulsification of the oil-water mixture was carried out in a turbulent regime by using the mixer 6 with two rotary stirrers rotating in opposite directions. Mixer provides five fixed speeds that allow us to achieve different degrees of fineness emulsions. The desired temperature in the column was maintained using a thermostat 7, baseband viscometer, which is at the same temperature and reservoir is 8 located for cooking oil emulsion.



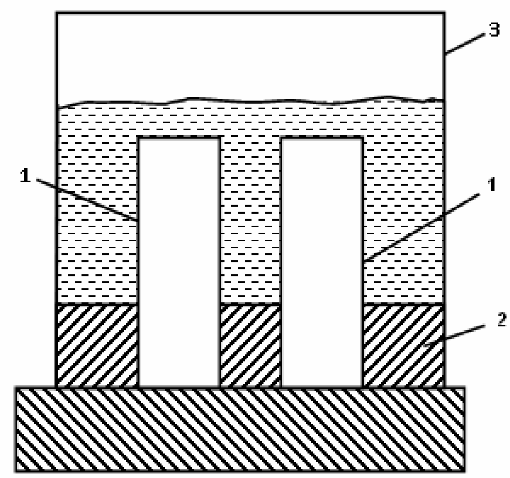
1- Glass column; 2- Thermostatic water polo; 3- Measuring scale; 4- Samplers; 5- Stopwatch; 6- Mixer; 7- Thermostat; 8- Capacity

Fig. 2: Diagram of apparatus for the study of demineralization and destruction of oil-water emulsions

All experiments were performed at 50°C that corresponds to the actually achievable separation parameters and providing water emulsions of oil-water emulsions in the operating conditions of most petroleum products.

Determination of the effectiveness of demulsifiers and surfactants

Determination of the effectiveness of demulsifiers and surfactants was performed by floating oil[2], based on the ability of these substances to destroy film that forms at the interface between the oil-water. Tests were carried out with the setup shown in Figure 3. A glass tube with an inner diameter of 1 to 5 mm, a height of 20 mm was filled with oil up to the edge, mounted on a stand 2, which is placed on the bottom of the glass 3 with capacity of 20-30 mL. Reproducibility data on the stand immediately strengthened 3 tubes. In a glass (by a glass rod) gently a 2% aqueous solution of the test surfactant is poured in the beaker before label. The label must be at least 3-5 mm above the oil level in the tube. Then, a stopwatch is used to note the time during, which all of the oil comes out of the tube to the surface of an aqueous solution. The more effective demulsifier spent less time is on the floating oil.



1- Glass vial with oil; 2- Stand for tubes; 3- A glass with a solution of the surfactant

Fig. 3: Scheme of installation to determine the effectiveness of demulsifiers and surfactants

To select the optimal composition, dewatering and desalting using methods of mathematical planning of the experiment, namely the simplex lattice plans (Scheffe[2]) according to which the degree of dehydration and desalting of the composition can be described by a polynomial given the general form:

$$y = \sum_{lsisq} b_i x_i + \sum_{lsi<jsq} b_{ij} x_i x_j + \sum_{lsi<jsq} y_{ij} x_i x_j (x_i - x_j) + \sum_{lsi<jsq} \delta_{ij} x_i x_j (x_i - x_j)^2 +$$

$$\sum_{lsi<j<ksq} b_{iilk} x_i^2 x_j x_k + \sum_{lsi<j<ksq} b_{ijjk} x_i x_j^2 x_k + \sum_{lsi<j<ksq} b_{ijkk} x_i x_j x_k^2 + \sum_{lsi<j<k<lsq} b_{ijkl} x_i x_j x_k x_l \quad \ldots(2)$$

As the regression equation was chosen given fourth-order polynomial:

$$\begin{aligned} y = {} & b_1x_1 + b_2x_2 + b_3x_3 + b_{12}x_1x_2 + b_{13}x_1x_3 + b_{23}x_2x_3 + \gamma_{12}x_1x_2 (x_1 – x_2) \\ & + \gamma_{13}x_1x_3 (x_1 – x_3) + \gamma_{23}x_2x_3 (x_2 - x_3) + \delta_{12}x_1x_2 (x_1 - x_2)^2 + \delta_{13}x_1x_3 (x_1 - x_3)^2 \\ & + \delta_{23}x_2x_3 (x_2 - x_3)^2 + b_{1123}x_1^2x_2x_3 + b_{1223}x_1x_2^2x^3 + b_{1233}x_1x_2x_3^2 \quad \ldots(3) \end{aligned}$$

For building, which used the following planning matrix (Table 1), the number of experiments in the matrix is 15.

To check the adequacy of the obtained regression equation, it was further experimented in control points, whose coordinates are determined by the conditions of the experiment. Adequacy test was performed using the student t-test:

$$t = \frac{У_{эксп} - У_{расч}}{S_y^2 \sqrt{1 + \xi}} \sqrt{n} < t_{табл} \qquad \ldots(4)$$

Where n-Number of replicates at each point; S_y^2 – Standard error of the experience; ξ – Contour, depending on the position of the alloy on the concentration triangle; t_{table} – Tabular value of student's t test at a significance level for all cases, p = 0,05.

Table 1: Planning matrix for {3, 4} – Lattice

No. of experience	x_1	x_2	x_3	y
1	1	0	0	y_1
2	0	1	0	y_2
3	0	0	1	y_3
4	½	½	0	y_{12}
5	½	0	½	y_{13}
6	0	½	½	y_{23}
7	¾	¼	0	y_{1112}
8	¼	¾	0	y_{1222}
9	¾	0	¼	y_{1113}
10	¼	0	¾	y_{1333}
11	0	¾	¼	y_{2223}
12	0	¼	¾	y_{2333}
13	½	¼	¼	y_{1123}
14	¼	½	1/4	y_{1223}
15	¼	¼	½	y_{1233}

Determination of chloride salts in the oil and water production from different deposits Mangistau region- Based on the concentration of chlorides, coming refinery oil are classified into three groups[2]:

	Group I	Group II	Group III
The salt content, mg/L	< 100	< 300	> 300
Water content %	< 0.5	< 1.0	> 1.0
Content of mechanical impurities, %	< 0.05	< 0.05	> 0.05

Good dehydrated and desalted crude oil at a temperature below 260°C has virtually no corrosive effect on the metal and the corrosion rate of carbon steel in contact with it does not exceed 0.05 mm/year. Thus, it is clear that refiners have desirability to produce the entire oil group I, since it simplifies the task of penetrating desalting and reduced corrosion of the equipment, as well as provided a significant reduction in pollution of fresh water rivers and lakes chlorides.

In connection with the above, an important problem is the determination of chloride salts in the field and barn oils of different fields in Mangistau region. For this study sampling was carried out and commodity barn oil on these oil fields: Karajanbas; Borankol, Zhetybai, Ozen, Kalamkas and JV "Arman". Commercial oil was taken up in areas of oil treatment, after demulsification and separation of oil-water emulsion entering the items from the wells. In selected samples, density, kinematic viscosity and content of chloride salts was determined. The data obtained are presented in Table 2.

Table 2: Characteristics of commercial oil Mangistau region

S. No.	Sampling (field)	density, g/cm^3	Kinematic viscosity	The chloride content, NaCl, mg/L
1	«Arman»	0,900	1,37	42,2
2	«Borankol»	0,899	1,42	79,5
3	«Ozen»	-	-	587,6
4	«Zhetybai»	-	-	115,7
5	«Kalamkas»	0,909	1,15	49,5
6	«Karajanbas»	0,911	1,08	20,8

From the analysis of the data, it is clear that commercial oil from oilfields JV "Arman" Karajanbas, Kalamkas Borankol has a fairly low chloride content and corresponds to the first class of commercial oil allocated for processing. Oil oilfield Zhetybai, especially

Ozen is characterized by increased chloride and requires additional desalting before sending it to refineries.

Analysis of the IR spectra of samples of commercial oil showed that regardless of the location of sampling, all the spectra contain bands in the region 2850-2950 cm^{-1}, corresponding to stretching vibrations of the CH groups in the Balkans ($\nu_s = CH_3$ и $\nu_{as} = CH_3$), and bands at 1380 and 1460 cm^{-1}, belonging to the vibrations of the methyl groups. The absorption bands of alkenes in 2950 cm^{-1} may overlap the absorption of alkanes. IR spectra of barn oils differ from the IR spectra of commercial oil of the same fields. Bands appear in the 550, 700-800 cm^{-1}, characteristic stretching vibrations of the C-S, which may indicate the presence of sulfoxides, mercaptans, etc.

All known desalting methods are based on its fresh rinsing water. However, in regions, where the oil field in Kazakhstan noted an acute shortage of fresh water, which flow to the same very height due to the need for repeated washing and large amounts of oil. In this case, all fields are vast reserves of water production - the so-called produced water, which are formed on the training points in the separation of oil-water emulsions. Produced water is typically brine containing 1-10% NaCl. Furthermore, they may have considerable quantities of salts of Ca, Mg, Ba, sulfates or other components.

Study of the salt composition of formation waters of oil fields in Mangistau region has been shown (Table 3). They contain mainly sodium, calcium and magnesium, the total concentration of which varies widely from 5,000 to 28,000 mg/L, which limits their use in the process of desalting without prior extraction of chloride ions.

Table 3: Concentration of chloride salts (in terms of NaCl) in production waters of oil fields in Mangistau region

Field	Zhetybai CPF	Ozen shop UPN and software	Kalamkas CPF	Karajanbas CPF	"Arman" CPF
Concentration Cl^-, mg/L	17500	27200	15700	15100	15500

CONCLUSION

The enormous reserves of reservoir water and scarcity of fresh water is extremely important and urgent task for the Republic of Kazakhstan are studies aimed at the creation of new technologies for effective desalination of highly mineralized water, and their continued use in the processes of preparation and processing of oils including barn.

REFERENCES

1. B. K. Nurabaev, Improving Processes for the Preparation of Oil in the Sharing of Chemical and Physical Effects, Sb.dokl. Eighth mezhd.nauch.Nadirovskie Reading on the Issue of Scientific and Technological Development of the Oil and Gas Industry, Almaty, 16-17 September (2010).
2. Patent Russia, № 2098165, Method of Dehydration and Desalting Water Emulsion, R. R. Valshin, G. N. Dark, R. M. Salikhov, F. M. Samigullin, Appl. 03/15/93. Publ. 12/10/96.

Accepted : 31.08.2014