

APPLICATION OF SURFACTANT BASED ON SILK INDUSTRY WASTE IN THE  
BREAKDOWN OF WATER IN OIL EMULSIONS

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**Annotation.** The article covers thermochemical method of breakdown of stable water-oil emulsions of local oil fields of Republic of Uzbekistan. The surface-active substance used is binary compositions of imported emulsion breaker and local emulsion breaker, which is obtained based on silk-winding plant waste by synthesis method. With this, the import emulsion breaker has been reduced, and commodity oil meeting the requirements of standard has been obtained.

**Keywords:** water-oil emulsion, sericyne, surface-active substances, serikoin, breakdown

I. Introduction

Composition of base oils, occurring in nature, differs from each other, which, in turn, is directly related to their physical-chemical properties and technological processes of preparation for their introduction into commercial condition, as well as selection of oil transfer indicators. Optimal use of the equipment used in oil preparation and minimal consumption of technological resources is one of the urgent problems of the modern oil industry.

The fact that almost all fields in Uzbekistan are at the final stage of their use at present is conditioned by that formation water increases in the composition of the produced oil, as a result of which complex water-oil emulsions (WOE) are formed, and their breakdown requires a special approach (Table 1) [1-2].

Table 1

Physical and chemical properties of stable oil emulsions of oil fields

Indicator	Kuruk	Southern Kemachi
1. Density at 20 °C, kg/m <sup>3</sup>	880	864
2. Viscosity, cSt		
At 20 °C	6.3	5.7
At 50 °C	3.8	4.2
3. Content in oil, wt%.		
chloride salts	1.3	1.1
mechanical impurities	10.2	9.6
water	12.4	11.2
4. Group hydrocarbon composition, wt%		
paraffins (heavy)	6.12	5.87
naphthene-aromatic	87.37	88.13
tar	2.66	2.52
asphaltenes	3.85	3.48
5. Fractional composition:		

initial boiling temperature, °C	35	32
10% is distilled off at t, °C	68	66
20% is distilled off at t, °C	120	118
30% is distilled off at t, °C	158	152
40% is distilled off at t, °C	216	198
50% is distilled off at t, °C	260	254
60% is distilled off at t, °C	298	286
70% is distilled off at t, °C	342	334
80% is distilled off at t, °C	396	379
90% is distilled off at t, °C	431	425
98% is distilled off at t, °C	457	449
final boiling temperature, °C	485	470
6. Pour point, °C	-20	-22
7. Flash point, °C	28	30

## II. Methods

Taking into count that the use of thermochemical methods in practice of breakdown of water-oil emulsions is somewhat effective, a synergistic result can be achieved by using composition of emulsion breaker (surface-active substance) for dehydration of oil raw materials of deposits in the region (Kuruk, South Kemachi, etc.) [3-5].

Sericyne can be used as a surface-active substance, which comes out in large quantities from silk-winding factories. Sericyne (silk glue) belongs to the class of albuminous protein bodies and is found together with another similar substance, i.e. fibroin, in raw silk. Sericyne is obtained by digestion of raw silk with water, where fibroin does not dissolve, but only sericyne passes into the solution. The hot solution obtained in this way solidifies in the form of a jelly when cooled. Pure dried sericyne is a colorless and odorless powder, swelling in cold water and readily soluble in hot water. Formula  $C_{15}H_{25}N_5O_8$  even has been derived for its composition, but it is unlikely that it is a homogeneous body, but rather there is a mixture of a substance close to glutin with some ordinary protein substance (Fig. 1). During hydrated by boiling with dilute sulfuric acid, among many other products leucine, tyrosine and serine are formed; glyocol is not formed, which makes sericyne sharply different from *serikoin*, which is an albuminoid formed from fibroin under the influence of strong hydrochloric acid in the cold. During this process, 1% of nitrogen (in the form of ammonia) is split off from fibroin and a solution is obtained from which, when poured into a large amount of alcohol, serikoin is precipitated in the form of a white powder. When boiled with diluted sulfuric acid, glyocol, tyrosine and alanine are found among the decomposition products of serikoin (leucine is not formed).

Method of obtaining silk sericyne and fibroin consists in hydrolysis of shell of silkworm cocoons at a temperature of 103-105 °C for 2.5-3.0 hour with aqueous solution of 2.6-2.8% potassium hydroxide, taken in mass ratio to hydrolyzed raw material equal to 6: 1

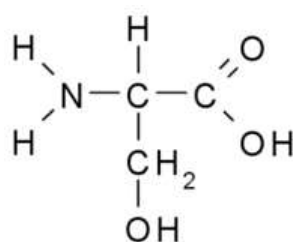


Fig.1. Chemical formula of sericyne

Table 2 presents the properties of sericyne obtained from local waste, which can be used as surface-active substance.

Table 2

## Properties of sericyne

<u>Systematic name</u>	2-amino-3-hydroxypropanoic acid
Abbreviation	Ser, S
<u>Chemical formula</u>	HO <sub>2</sub> C-CH(NH <sub>2</sub> )CH <sub>2</sub> OH
<u>Empirical formula</u>	C <sub>3</sub> H <sub>7</sub> N <sub>1</sub> O <sub>3</sub>
Physical properties	
<u>Molar mass</u>	105.09 g/mole
<u>Density</u>	1.537 g/cm <sup>3</sup>
Thermal properties	
<u>Melting temperature</u>	228 °C

Good

solubility of sericyne in water and aqueous solutions means that it is similar to other emulsion breakers when used for oil dehydration.

In our research, we used a surface-active substance synthesized from industrial waste (silk waste emulsion breaker), due to the characteristics of emulsion breakers used in the local oil dehydration. We obtained three different types of the composition of the emulsion breaker Dissolvan-4411 and silk waste emulsion breaker for the binary system, the percentage of components of which was 25:75, 50:50, and 75:25. Resulting composition was used in the process of breakdown of water-oil emulsions (initial water content is 32%, emulsion breaker consumption is 60 g/t) [6-8]. First, we added the emulsion breaker to the emulsion and mixed it well, heating the first time to 60 °C, the second time to 80 °C, waiting for the separation into two phases (oil and water). To intensify the separation of water from oil, we used a combined method, that is, a water-oil emulsion subjected to thermochemical treatment was kept for 10 minutes at a frequency of 2000 rpm by introducing a centrifuge device that operates under the action of centrifugal force. Then, at the end of the settling time, the emulsion was separated into phases [9].

### III. Results

Following results were obtained after applying the mentioned methods:

Table 2

#### Indicators of residual water content in water-oil emulsion achieved based on Dissolvan-4411 and its compositions with silk waste emulsion breaker

IV.

Emulsion breaker	Process temperature, °C	Emulsion setting time, h	The share of emulsion breaker transferred to water, %	Dynamic viscosity, MPa *sec	Residual water content in water-oil emulsion before and after centrifugation, %	
					Before	After
Dissolvan-4411 (control)	60	6.2	7.3	9.3	1.8	1.5
	80	5.9	5.1	6.4	1.4	0.9
<b>Composition of emulsion breakers (silk waste emulsion breaker + Dissolvan-4411)</b>						
25:75	60	6.1	4.4	7.1	1.7	1.3
	80	5.7	3.8	5.9	1.5	0.9
50:50	60	5.8	4.2	7.7	1.4	1.1
	80	5.4	3.5	6.3	0.8	0.4
75:25	60	6.3	4.3	8.6	1.6	1.2
	80	6.1	3.7	6.9	0.9	0.6

### Discussions

Table 3 shows that temperature is also considered an important parameter when using emulsion breakers; the process carried out at 80 °C is more effective compared to process at 60 °C. It was established that the binary composition, which was formed by adding equal amount (50:50) of imported emulsion breaker (Dissolvan-4411) and emulsion breaker synthesized from the waste of local silk enterprises (silk waste emulsion breaker), is more effective than the others [10].

Low solubility in water based on the solubility properties of emulsion breakers, in turn, cause an improvement in the quality of wastewater extracted from oil, that is, a decrease in the level of its mineralization [11-12].

Experiments conducted with a water-oil emulsion at 80 °C with different rotation speeds after thermochemical treatment showed that the result obtained at a frequency of 2000 rpm is considered the most optimal and that the dehydration rate for the same oil is high (Fig. 2).

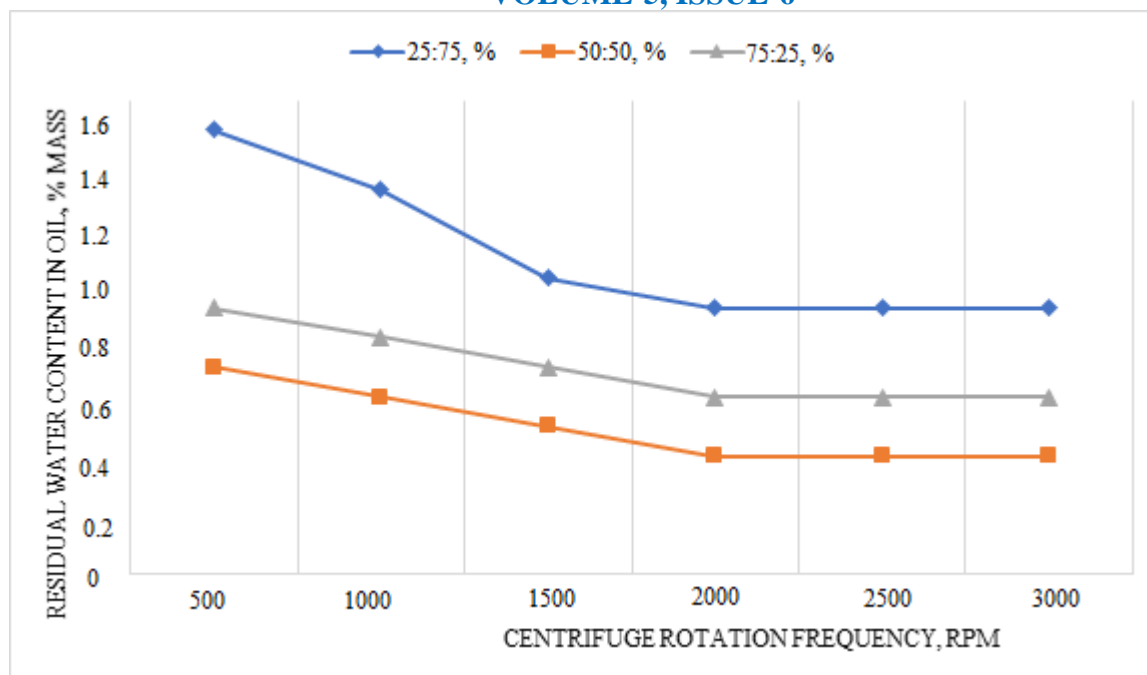


Fig. 2. Dependence of residual water content in oil on the centrifuge rotation frequency

## V. Conclusions

The conclusions of the research were as follows.

1. It has been established that optimal temperature of breakdown of stable oil-water emulsions makes 80 °C.
2. Effectiveness of the use of composition of imported emulsion breaker Dissolvan-4411 and synthesized emulsion breaker (silk waste emulsion breaker), formed in the ratio of 50:50, for local oils has been proven.
3. Level of oil dehydration was increased to 99.6% at these conditions.
4. Reduction of imported surface-active substances has been achieved.

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