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Obtaining Sulfur-Containing Surfactants from Technical Cottonseed Oil for Emulsification of Drilling Fluids

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ABSTRACT: According to the results of studied research, it was found that sulfur compounds in surfactants (SAA) change the foaming, viscosity, emulsifying ability and water loss of the resulting drilling fluids. At the same time, a high content of mineral salts significantly worsens the aforementioned indicators of drilling fluids, and a smaller one is relatively small. Obtaining sulfur-containing surfactants (SAA) from industrial cottonseed oils fully meets the requirements for stabilizing the resulting drilling fluids.

KEY WORDS: Emulsion drilling fluids, surfactant species, fatty acids, triacylglycerine, gossypol, viscosity, shear stress of the drilling fluid, mineral salts, emulsifying ability, sulfur-containing compounds, water loss, mineralization, foaming.

I.INTRODUCTION

The advantages of emulsion drilling fluids over water, open up new possibilities for improving their quality and stability in thermal and salt conditions. Here great hope rests on emulsifiers obtained from high molecular fatty acids and their triacylglycerine modified with various additives.

Emulsion drilling fluids, unlike water fluids, lubricate the metal surface of the drill bit and drill string, reduce the corrosion rate, etc.

In this regard, interest in surface-active substances (surfactants) obtained on the basis of technical cottonseed oils containing gossypol and its derivatives is increasing daily. Of these, soap-like surfactants along with emulsification with lubricant carry out foaming, which is partially reduced by sulfur-containing compounds.

II. METHODOLOGY

The role of surfactants in drilling fluids is to stabilize the emulsion during the aggression of salts contained in reservoir water and high temperatures. Unfortunately, the deficiency of surfactant does not allow satisfying the needs of many industries, which requires the use of technical oils as raw materials. It is known that the main purpose of the use of surfactants is to decrease the viscosity and shear stress of the drilling fluid, which are considered important when cleaning the well.

III. EXPERIMENTAL RESULTS

Figure 1 shows the dependence of foaming on the content of sulphur-organic compounds.

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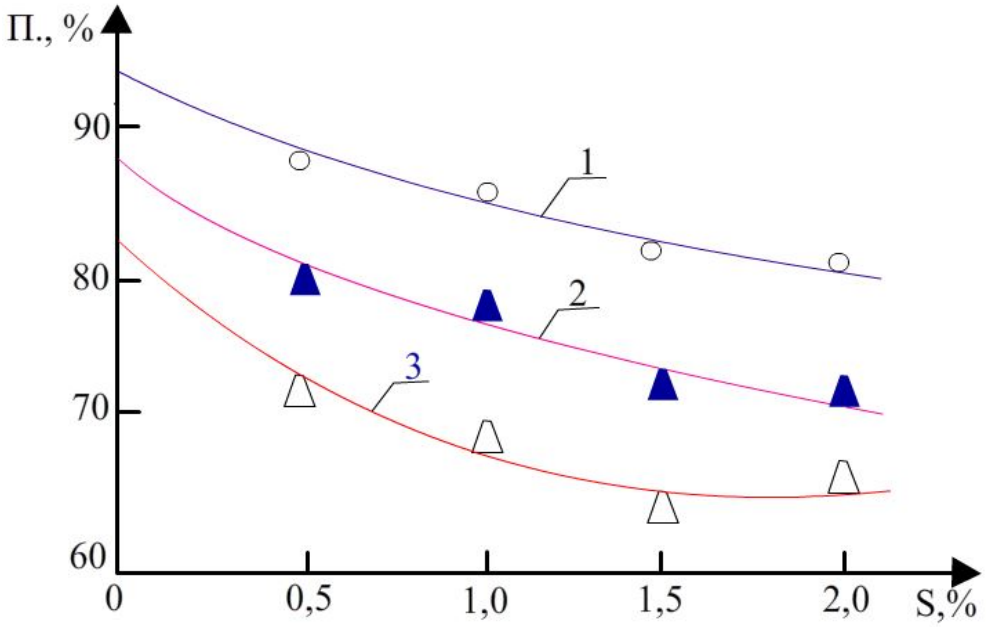

Fig. 1. Change in foaming (P) depending on the content of sulfur compounds in the drilling fluid (S): 1 - at a content of 0.5% - mineral salts; 2 - at a content of 1.0% and 3 - at a content of 1.5% - mineral salts.

From Fig. 1.it can be seen that with an increase in the content of sulfur compounds, the foaming of the drilling fluid in all three cases decreases. Moreover, the most decrease is observed at a content of 1.5% - mineral salts and the least - at a content of 0.5% - mineral salts in the drilling fluid.
In consideration of this, we investigated the effect of the content of sulfur compounds on the viscosity of the resulting drilling fluids.
The results obtained are illustrated in Fig. 2.

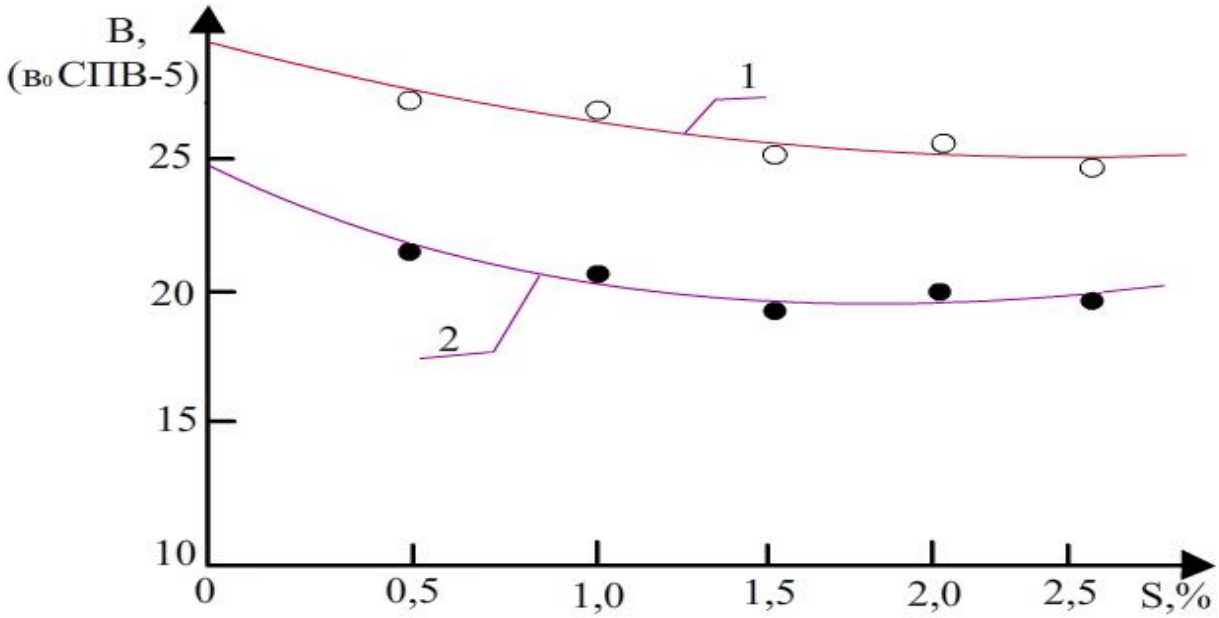

Fig. 2. Change in the viscosity (B) of the drilling fluid depending on the content of sulfur compounds (S): 1 - with a mineral salt content of 0.5% and 2 - with a mineral salt content of 1.0%.

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From Fig. 2.it is seen that with an increase in the content of sulfur compounds in the drilling fluid, its viscosity decreases exponentially. Moreover, the largest drop is observed with a salt content of 0.5%. This can be explained by the fact that both sulfur and mineral salts change the properties of surfactants in the direction of reducing the viscosity of drilling fluids.

Surfactants used in drilling fluids should have a high emulsifying ability, which allows you to maintain the stability of the drilling fluid.

We have studied the change in this indicator depending on the content of sulfur-containing compounds in the drilling fluid.

The results of the study are illustrated in Fig. 3.

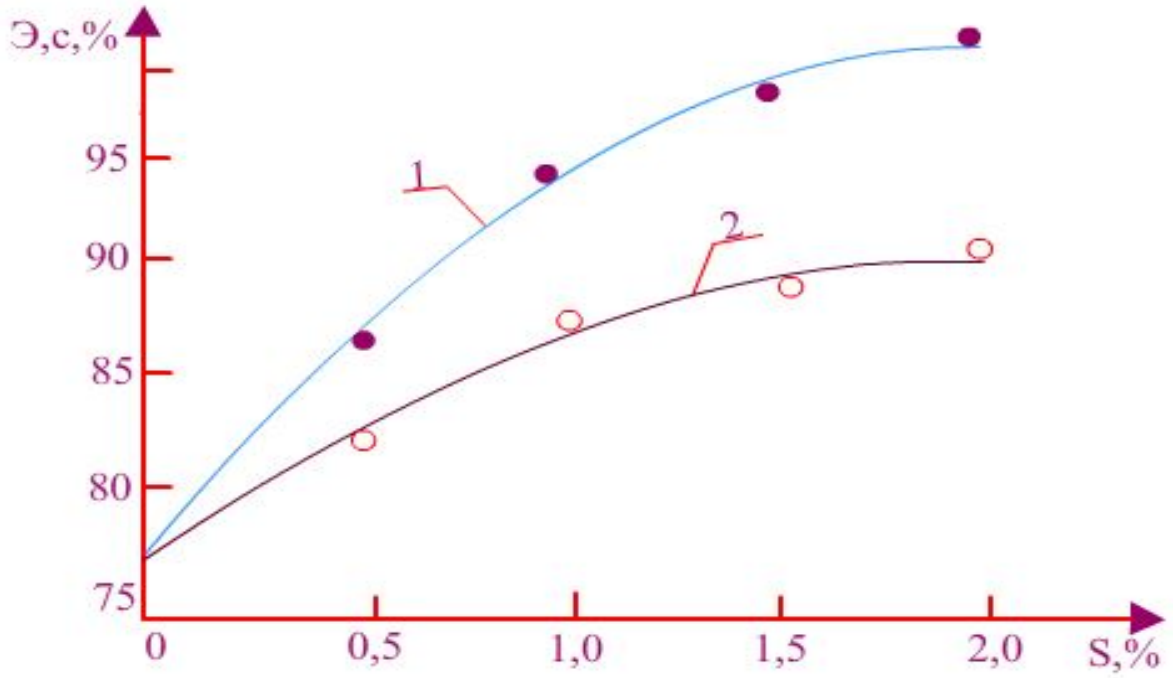

Fig. 3. Change in the emulsifying ability (em.a.) of the drilling fluid depending on the content of sulfur compounds: 1 - at a content of 0.5% mineral salts, 2 - at a content of 1.5% mineral salts.

From Fig. 3.it is seen that with an increase in the content of sulfur compounds, the emulsifying ability of the drilling fluid in both cases increases. Moreover, the more mineral salts, the lower the emulsifying ability of the drilling fluid and vice versa. This can be explained by the fact that sulfur-organic compounds in surfactants enhance the emulsifying ability of drilling fluids due to the formation of new chemical compounds with the presence of sulfur-containing compounds.

The water loss (WL) of drilling fluids is one of the important indicators that characterizes the release of water into the walls of the well and its destruction. This indicator changes depending on the nature and composition of the surfactant used to obtain the drilling fluid. The introduction of sulfur-containing compounds in the composition of the surfactant certainly changes the rate of water loss of the drilling fluid. In consideration of this, we have studied the effect of sulfur-containing compounds in surfactants on the water loss (WL) of a drilling fluid with various degrees of mineralization.

In Fig. 4 the changes in water loss (WL) are presented depending on the content of sulfur compounds and the degree of mineralization of the drilling fluid.

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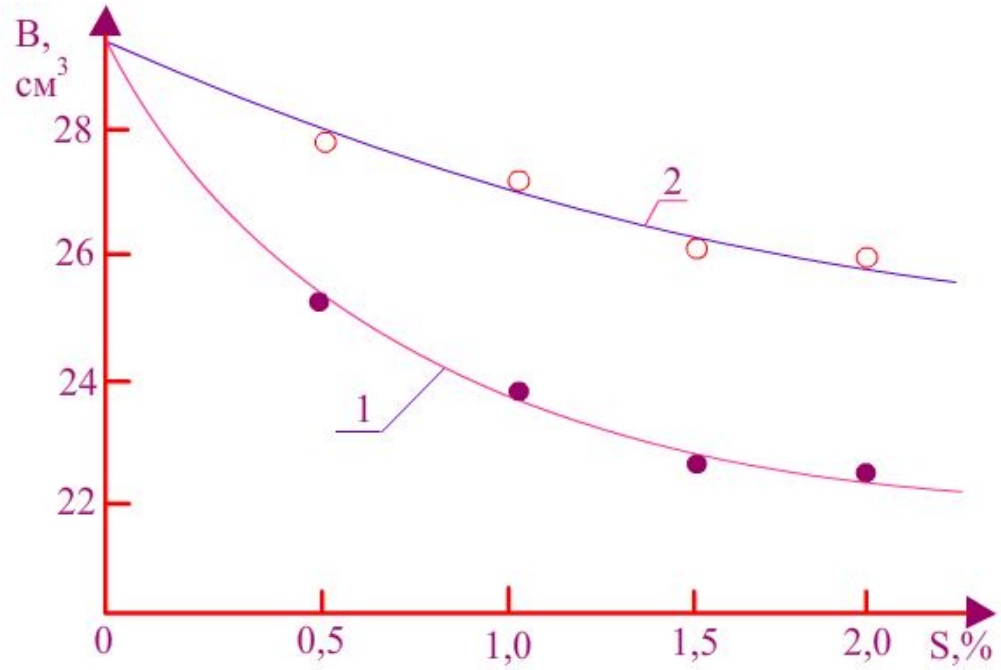

Fig. 4. Change in the water loss of the drilling fluid depending on the content of sulfur compounds in the surfactant: 1 - with a content of 1% mineral salts; 2 - when the content of 0.5% mineral salts in the surfactant.

From Fig. 4 it is evident that the increase in sulfur compounds in surfactants in both cases reduces the water loss of the resulting drilling fluids. Moreover, the more mineral salts in the drilling fluid its high fluid loss, and thus vice versa, the less salts, the lower the fluid loss of the drilling fluid. This confirms that sulfur compounds, being hydrophobic substances, prevent the penetration of water into the well and the destruction of its walls.

IV.CONCLUSION AND FUTURE WORK

According to the results of studied research, it was found that sulfur compounds in surfactants (SAA) change the foaming, viscosity, emulsifying ability and water loss of the resulting drilling fluids. Thus, the production of sulfur-containing (SAA) from industrial cottonseed oils fully meets the requirements for stabilizing the resulting drilling fluids.

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