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TECHNOLOGY FOR OBTAINING CHEMICAL REAGENT FOR DRILLING FLUIDS BASED ON LOCAL RAW MATERIALS

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Abstract

In this article, chemical reagent formulations and technology have been developed based on local raw materials and industrial waste. This study demonstrates that it is of significant scientific and practical importance in the development of resource-saving technologies, the recycling of industrial waste, and the production of high-value chemical reagents and lubricating materials for drilling oil and gas wells.

Keywords: *chemical reagent, drilling fluid, fatty acids, lubricant, technology, pH, water, viscosity*

Introduction

In Uzbekistan, the annual demand for chemical reagents amounts to 2,500–3,000 tons. Chemical reagent drilling agents are specialized additives used to optimize drilling fluid (mud) performance, ensuring efficient borehole drilling, cuttings transport, and wellbore stability. Key types include viscosity regulators (PAC), clay inhibitors, lubricants, weighting agents, and shale inhibitors. These chemicals manage fluid loss, reduce friction, control pH, and protect drilling equipment. Chemical reagents perform several key functions in the drilling process. Drilling lubricants are specialized chemical additives added to drilling fluids (mud) to reduce torque, drag, and friction between the drill string and borehole walls. They enhance drilling efficiency, prevent sticking or jamming of pipes, and protect equipment from wear. Types include water-based (ester-based), oil-based, and glycols (Ahmet et al, 2013). The volume of oil production is around 350–400 thousand tons, and in this process an average of 30–60 kg of soapstock is generated per 1,000 kg of refined oil. Annually, 7–10 thousand tons of soapstock waste are generated nationwide. In percentages, approximately 8–12% is soapstock, 3–5% gossypol resin and 25–30% is meal waste. In recent years, a number of scientific research projects have been carried out to improve soapstock recycling technology. In this context, the recovery of valuable products – particularly surfactants – from the waste through recycling is of significant scientific and practical importance.

Surfactants are play important role for obtaining lubricants. Surfactants (surface-active agents) are organic substances that exhibit activity at the interface between liquids or between a liquid and the gas phase. They form structures between water and oil, or between a gas and a liquid, influencing the physicochemical processes in these environments. An SAA molecule consists of two parts: a hydrophilic (water-attracting) and a hydrophobic (water-repelling, oil-attracting) part. Due to the presence of these two parts, they can effectively control the processes of emulsification, wetting, dispersion and adsorption (Amiril et al., 2017).

Materials and methods

For obtaining lubricant were used following ingredients: Cotton oil and pistachio oil industry waste – soapstock, sodium hydroxide, sodium carbonate and other ingredients were selected. The industrial by-products of cottonseed and peanut oil contain high-molecular-weight fatty acids, glycerine and polyphenolic compounds, which serve as the primary raw materials for SAA (Surface active agent) synthesis.

The SAA derived from pistachio oil soapstock, being rich in oleic acid, exhibits high foam stability and cleansing ability.

Both types of surfactants are well-soluble in water, reducing the surface tension from 70 mN/m to 37–40 mN/m, which demonstrates their effective surfactant properties.

Determining the foaming ability of surfactants is an important indicator in assessing their technological and functional properties (Dina Kania et al., 2015). The following outlines the sequence of the determination method and the procedure for assessment:

1. A 0.1% solution is prepared (1 g of SAA is dissolved in 1 litre of water).
2. 50 ml of the solution is poured into the cylinder.
3. The cylinder is capped and shaken vigorously 25 times (or mixed in a special mixer) to form a foam.
4. After the foam has formed, the total volume (solution + foam) is determined by the marks on the side of the glass.
5. After the foam has formed, the volume of the foam is recorded after 1, 3, and 5 minutes.

The stability is assessed by the rate of volume reduction over time.

$$F = V_2 - V_1$$

where:

F is the foaming capacity (ml); V_2 is the total volume after foaming (ml); V_1 is the initial solution volume (ml).

Foam stability (***S***):

$$S = V_1 / V_0 \cdot 100\%$$

where:

V_1 – the volume of the foam at a given time (after 5 minutes);

V_0 – the initial volume of the foam.

Results and discussion

Cotton seed oil soapstock is a by-product of the oil and fat industry, primarily generated during the processing, i.e. refining, of oils. Its composition includes various fatty acids, neutral fats, phosphatides and other organic substances. Cotton seed oil soapstock is inexpensive yet a highly valuable raw material.

Pistachio oil soapstock is a fatty by-product of the pistachio oil production process, consisting mainly of unsaponifiables, insoluble fractions, and soluble fatty acid salts. Its composition is similar to that of soya, sunflower or cottonseed soapstocks, but it also contains substances characteristic of pistachio oil.

Due to the high content of fatty acids and soaps in pistachio oil soapstock, its processing yields surfactants, emulsifiers, or biodegradable fatty acid esters (Kobilov et al., 2023).

The main physicochemical parameters of the surfactant include the following:

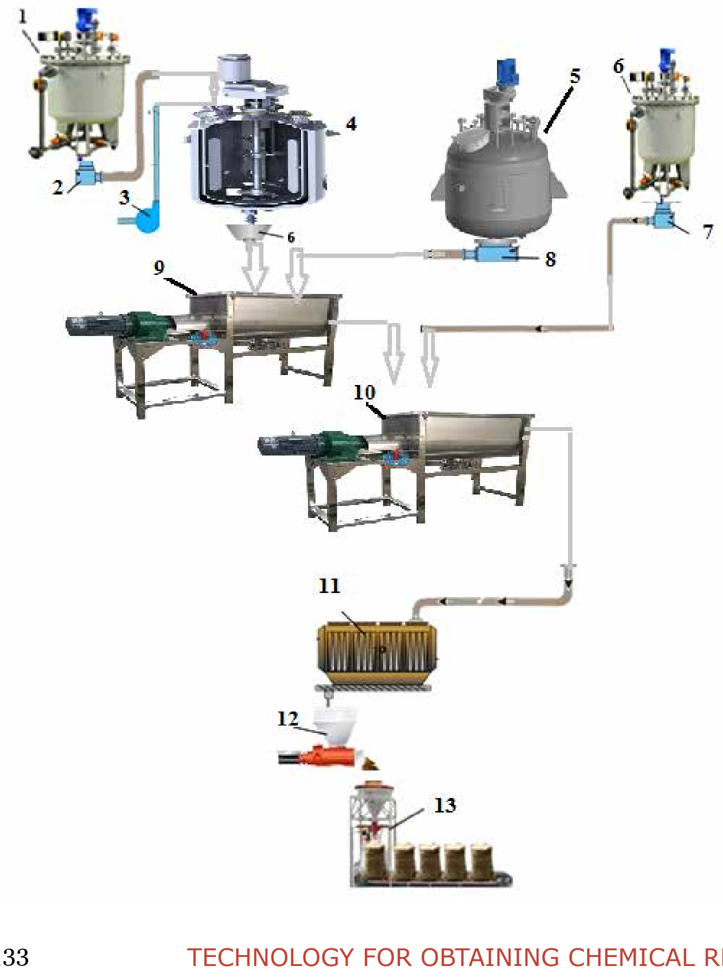
1. Surface tension is a physical phenomenon associated with the force of interaction between molecules at the surface of a liquid. In other words, the surface of a liquid is different from its bulk, and some of its molecules are in contact with air or another medium. Reducing surface tension indicates the efficiency of the SAA.
2. Rheological properties – the viscosity and stratification ability of the substance are of particular importance. The flow of SAA in a liquid depends on its concentration, temperature, and molecular composition. High-viscosity SAAs keep emulsions sta-

ble, whereas low-viscosity ones disperse quickly.

3. Set time and stability are the long-term properties of the SAA in response to air and temperature, representing the time taken for the emulsion, suspension, or coating material based on it to transition from a liquid to a solid state. Drying time and stability depend on the composition, concentration, temperature and humidity of the environment. Stability is the ability of the SAA to retain its physical and chemical properties over time.
4. The stability of a phase emulsion is the ability of the substance on which it is based to keep its oil and water phases from separating for a long time. The oil droplets are dispersed in water, or the water droplets are dispersed in oil. The function of the SAA is to stabilise this dispersion and prevent the phases from separating. This layer weakens the attractive forces between the oil and water molecules, resulting in a stable emulsion. The molecules are located in hydrophilic and hydrophobic regions.
5. Chemical stability is the ability to retain its properties despite changes in pH, temperature, and ionic concentration. The functional molecules of the SAA (hydrophobic and hydrophilic groups) are sensitive to chemical influences. A stable surfactant does not lose its effectiveness under various conditions. In acidic or basic media, the surfactant's particles and molecules can alter their strength. A stable surfactant can maintain an emulsion across different pH conditions. Ions such as sodium, potassium, and calcium can cause the SAA particles to aggregate and reduce their activity. The stable SAA is not harmed by ionic effects and maintains the emulsion (Cao-Romero-Gallegos et al., 2024).

Below is a comparative presentation of the physicochemical parameters of the surfactants obtained from cottonseed oil soapstock and pistachio oil soapstock, based on scientific data and laboratory results. These data are typical of anionic surfactants derived from oil and fat waste.

Figure 1. *Technological scheme for the production of a chemicals-lubricant*



1 – Caustic soda tank;
2, 6, 7, 8, 10, 12 – Dosers;
3 – tap for water;
4 – reactor;
5 – soapstock container;
6 – sodium carbonate container;
9–10 – screw mixer;
11 – drying chamber;
13 – finished product packaging

The surfactant obtained from peanut oil soapstock produces good foam and has high stability (75–83%), whereas the surfactant from cottonseed oil soapstock shows a slightly lower value (60–74%).

A surfactant that produces stable foam is highly soluble in water and has a high molecular weight.

At low concentrations, there is almost no foam. As the concentration increases, the foam volume grows rapidly and stability improves. Surfactants are substances in liquid or dispersed form that exhibit activity at the water–oil interface. Their efficiency depends on their physical and chemical properties, as well as the production technology (Figure 1).

The technological stages for producing a surfactant based on soapstock consist of the following:

1. Preparation of the raw material.
2. The resulting polymeric fatty compounds are treated with an caustic solution, resulting in the formation of sodium salts of surfactants.
3. The product is treated with Na_2CO_3 to convert it into a powder.
4. Analysis of the finished product. Surface tension is determined (droplet counting method). Foaming capacity, emulsion stability, and biodegradability are assessed.

Surfactants obtained from the recycling of waste oil and grease are not only economically efficient but also an environmentally sustainable solution. They can be used in various fields – as cleaning agents, emulsifiers, and in textile and agricultural product processing.

Furthermore, based on the research findings, it was determined that the physicochemical properties of SAA can be controlled by varying its concentration. This makes it possible to create new composite materials, develop resource-saving technologies and increase the efficiency of waste recycling. Refining soapstock not only yields economic benefits but also reduces waste and protects the environment. The development of soapstock recycling technologies in Uzbekistan makes a significant contribution to enhancing the country's industrial potential and producing import-substituting products.

Conclusion

Recycling waste from the oil and fat industry to obtain surfactants is an ecotechnological and economically efficient method. This technology ensures that the waste is harmless to the environment and enables its recycling. A sample derived from soapstock was observed to significantly reduce surface tension, indicating its good emulsifying and wetting properties. Furthermore, the rheological and thermodynamic stability of the obtained substances was determined, ensuring their long-term activity in an aqueous medium. This method is of significant importance for the introduction of resource-saving and environmentally friendly technologies in the oil and fat industry.

References

Ahmet Sönmez, Mustafa Verşan Kök, Reha Özel. (2013). Performance analysis of drilling fluid liquid lubricants // Journal of Petroleum Science and Engineering – 108. – P. 64–73. URL: http://dx.doi.org/10.1016/j.petrol.2013.06.002

Amiril, S.A.S., Rahim, E.A., Syahrullail, S. (2017). A review on ionic liquids as sustainable lubricants in manufacturing and engineering: recent research, performance, and applications. J. Clean. Prod. – 168. – P. 1571–1589. URL: https://doi.org/10.1016/j.jclepro.2017.03.197.

Cao-Romero-Gallegos, J.A.; Taghizadeh, S.; Aguilar-RoSAA, O.A.; Dwyer-Joyce, R.S.; Farfan-Cabrera, L.I. (2024). The Effect of Electrical Current on Lubricant Film Thickness in Boundary and Mixed Lubrication Contacts Measured with Ultrasound. *Friction – (12).* – P. 1882–1896.

Dina Kania, Robiah Yunus, Rozita Omar, Suraya Abdul Rashid, Badrul Mohamad Jan.(2015). A review of biolubricants in drilling fluids: Recent research, performance, and applications. Journal of Petroleum Science and Engineering. – Volume 135. – P. 177–184. URL: https://doi.org/10.1016/j.petrol.2015.09.021

Kobilov N. S., Xamidov B. N., Shukurov A. Sh., Qodirov S. A., Jurayev Q. (2023). New composition of chemical reagents and weighted drilling fluids for drilling oil and gas wells.// E3S Web of Conferences, – (401). – 05077 p. URL: https://doi.org/10.1051/e3sconf/202340105077

Nodirbek Kobilov, Bosit Khamidov, Khudoyor Rahmatov, Tashmurza Yuldashev, Sharifov Gulomjon, Sharipov Shavkat, Malohat Tukhtasheva. (2025). Development of effective chemicals for drilling fluid based on local and raw materials // Nafta-Gaz, – No. (7). – P. 446–452. URL: https://doi.org/10.18668/NG.2025.07.03

Nodirbek Kobilov, Bosit Khamidov, Khudoyor Rakhmatov, Oybek Daminov, Sayyora Ganieva. (2025). Development of effective chemicals for drilling fluid based on local and raw materials of Uzbekistan// *AIP Journal article*. – 3304. – 040077 p. URL: https://doi.org/10.1063/5.0269403

Negmatova K. S., Negmatov S. S., Salimsakov Yu.A., Kobilov N. S., Rakhimov H. Y., Negmatov J. N., Isakov S. S. Structure And Properties of Viscous Gossypol Resin Powder // AIP Advances. American Institute of Physics, USA, 2012. – P. 300–302. URL: https://doi.org/10.1063/1.4738476

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