WASTE-FREE TECHNOLOGY FOR PRODUCING DEMULSIFIERS BASED ON LOCAL RAW MATERIALS FOR STABLE OIL-WATER EMULSIONS

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Abstract: The article describes the synthesis of high-efficiency demulsifiers for breaking oil-water emulsions based on local and secondary raw materials and the issues of their waste-free production technology. Glycerin, hexamethylenetetramine (HMTA), and oleic acid were used as the main components in the research.

Keywords: Oil-water emulsion, demulsifier, waste-free technology, synthesis, surfactant, glycerin, oleic acid, efficiency

Introduction: Currently, the high content of water and salts in oil and gas condensates extracted in Uzbekistan creates difficulties in their processing. Mostly imported demulsifiers are used today. Therefore, it is relevant to create import-substituting reagents based on local industrial waste and semi-finished products.

1. Formation and Stability of Oil-Water Emulsions

- Emulsion Types: Dispersed systems of oil and water mainly exist as "water-in-oil" (W/O) inverse emulsions or as coarse-disperse systems.

- Natural Emulsifiers: Asphaltenes, resins, naphthenic acids, paraffins, and mineral particles present in oil form durable "armored" protective layers around water droplets, increasing the emulsion's stability.

- Mechanical Impact: Emulsions are formed most intensively during extraction via Electric Submersible Pumps (ESP), and within valves and turbulent flows in pipelines.

2. Classification of Demulsification Methods According to the literature analysis, there are three primary groups of methods for breaking emulsions:

- Mechanical Methods: Separation through centrifugal force (centrifugation), sedimentation, and filtration.

- Electrical Methods: Polarization and coalescence of water droplets under an alternating current (AC) field. This method is more effective than direct current (DC).

- Physicochemical Methods: Using chemical demulsifiers (Surfactants) to displace natural emulsifiers from the phase interface.

3. Key Requirements for Demulsifiers A high-efficiency demulsifier must possess the following characteristics:

- Higher surface activity compared to natural emulsifiers.

- Maximum reduction of the adsorption layer's strength at the phase interface.

- Ability to promote coagulation in formation waters without causing equipment corrosion.

4. Imported Demulsifiers and Local Opportunities

- Currently, Uzbekistan primarily utilizes foreign reagents such as Dissolvan-4411, K-1, and Dipramin-157.

- Broad opportunities exist for synthesizing import-substituting reagents based on local products from Navoiyazot (HMTA, formalin), Kokand plant (oleic acid), and Maxam-Chirchiq (urea).

Methodology: Glycerin, HMTA, and oleic acid were selected for the synthesis of the demulsifier. The synthesis process was carried out in a 250 ml 4-necked flask using a thermostat (oil bath), equipped with a stirrer and a reflux condenser. The reaction proceeds in two stages:

1.First stage: Glycerin and HMTA interact to form polyalkylene ethers.

2.Second stage: The resulting product is esterified with oleic acid to obtain complex esters – the final demulsifier (provisionally named "CD" - carboxyl demulsifier).

Results and Discussion:

- The synthesized "D" demulsifier is a non-ionic surfactant and showed high efficiency in breaking oil-water emulsions.

- Optimal process conditions were determined: temperature 260-280°C, reaction time 180-300 minutes.

- A 0.5% solution of the obtained product has a surface tension of 48.5 dyn/cm, and the demulsification efficiency reached 88%.

- The technology is waste-free; all components fully react, and after filtration, the obtained product is sent directly to the technological system.

Conclusion: A technology for obtaining a new demulsifier based on local raw materials (from Navoiyazot, Kokand plant, and Maxam-Chirchiq) has been

developed. This method not only replaces expensive imported reagents but also increases economic efficiency in the oil preparation process.

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