A STUDY USING ELECTRON PARAMAGNETIC RESONANCE SPECTROSCOPY (EPR) TO ASSESS THE QUALITY OF HYDROPHILIC POLYMER COATINGS BASED ON CARBOXYMETHYL CELLULOS

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This study is devoted to developing a new method of qualitative analysis of hydrophilic polymer coatings on fiber glass utilized for separation oil in water emulsions.

Membrane technologies are widely used in the separation of oil-in-water emulsions. Compared to other methods of water filtration. The utilization of membranes provides multiple benefits, including advanced technology, reusability, and sustainability [1, 2]. Currently, there are many materials available for creating membranes, including metal mesh and ceramics [3, 4], yet they fail to meet safety and biodegradability requirements. Consequently, research organizations investigating water purification have shifted their attention towards membranes constructed from biopolymers in the last few decades [1]. Another practical technique has attracted the scientific research is coating fabrics and nonwovens with hydrophilic polymers [5].

The separation of oil and water emulsions is heavily influenced by the quality of the hydrophilic polymer coating on the fibers. Moreover, fiber density and adhesive strength are significant factors. Electron paramagnetic resonance (EPR) provides an opportunity to observe the effects of the gel on the fiber surface, fiber density, and adhesion strength.

In this study, the surface of glass fiber was coated with layers of two polymers: carboxymethylcellulose and polyvinylamine. A spin label was introduced into the polyvinylamine composition, which made it possible to determine the mobility of polymer chains in the film on the surface of the fibers. During the formation of films on the surface, various conditions were varied, such as temperature and the amount of cross-linking reagent. This made it possible to obtain films with different densities. This study determined the effect of the carboxymethylcellulose/polyvinylamine gel preparation method on spin-label mobility. The mobility of the spin label changes from 3.5 ns for the polyvinylamine solution to 12.8 ns with the cross-linked gel on the fiberglass surface. The resulting materials were treated with crude oil to determine the rate of spreading over the surface. A qualitative relationship was observed between the mobility of the spin label in the gel applied to the glass fiber and the spreading speed of the oil on the surface. Thus, the method based on the use of spin labels can be successfully used to determine the quality of the coating of hydrophilic membranes for the separation of oil-in-water emulsions.

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