

IMPROVING THE TECHNOLOGY FOR PRODUCING MEMBRANES FROM MODIFIED CELLULOSE FIBER

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In the context of the growth of production capacities of industrial enterprises, the agricultural complex and the increase in household waste, the problem of water and wastewater treatment becomes acute [1, 2]. One of the main factors in the implementation of water treatment technology at the industrial level is its profitability and environmental friendliness. Within the framework of the development and improvement of membrane water treatment technology, the actual problems are the utilization of membranes and reducing their cost. The search for new materials and their modifications for membrane purification methods is an urgent task today.

From the point of view of environmental friendliness and cost-effectiveness, cellulose is a promising material for the production of membranes, as it is an affordable and environmentally friendly natural polymer material. In addition, in the context of global challenges to reduce environmental pollution and transition to a green economy, the use of cellulose membranes is promising and relevant. Cellulose fibers have unique physicochemical properties, such as high hydrophilicity, good mechanical strength and chemical stability in aqueous environments, which makes them ideal for the manufacture of filtration and separation membranes. Due to the possibility of modifying the cellulose surface (for example, by chemical functionalization), it is possible to achieve the necessary filtration characteristics, in particular selectivity.

Previous studies were aimed at developing a method for modifying cellulose fibers in order to improve the functional and operational characteristics of membrane materials [3]. In particular, the effect of modifiers on the structure and properties of cellulose membranes was studied. Epichlorohydrin and ethanolamine were used as modifying agents, which perform the function of plasticizers. The parameters of the modification process were investigated, including the consumption of reagents, the processing temperature, the method of formation of membranes and their drying conditions.

The results of the experiments indicate that the selected modifiers are able to improve the flexibility and elasticity of the cellulose structure, depending on the temperature regime of the process. It was found that while using a modifier with a flow rate of 15% to the mass of cellulose fibers, high selectivity of membranes is achieved in the processes of decolorization of sodium humate solutions, the selectivity of colour removal exceeds 98%.

Although the obtained membranes demonstrate high efficiency in reducing the colour of aqueous solutions, which makes them promising for use in water treatment and wastewater treatment, however they are characterized by low productivity.

The purpose of the work is to develop a method of obtaining membranes from modified cellulose fiber with improved productivity.

The goal was achieved due to the introduction of an additional reinforcing component in the form of a synthetic fiber with different flow rate into the membrane composition. Polyethylene terephthalate fiber was used as a synthetic filler, which was previously crushed to a particle size of about 3 mm for uniform distribution in the membrane structure. The introduction of synthetic fiber made it possible to improve the structural integrity of the membranes, reduce their tendency to deformation during operation, and also contributed to the formation of a porous structure, which provides better filtering capacity.

The consumption of polyethylene terephthalate fiber in the composition varied from 3% to 15% of the total mass of the membranes. This ensured an increase in the permeability of the membranes without a significant loss of selectivity.

The obtained results show that the approach, which consists in the combination of natural and synthetic fibers, is fully justified to ensure the production of membranes with the necessary structural and filtering characteristics.

References:

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INTEGRATION OF ARTIFICIAL INTELLIGENCE INTO ENVIRONMENTAL MONITORING SYSTEMS: CURRENT STATE AND PROSPECTS

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The rapid development of artificial intelligence (AI) technologies and sensor systems creates unprecedented opportunities for environmental monitoring, providing previously unattainable levels of accuracy, efficiency, and scalability