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Determination OF SORPTION ABILITY OF ACETATE CELLULOSE MEMBRANE AND POLYMER ADDITIVES

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Abstract. he purpose of this work was to investigate and develop a method for the formation of effective DM-legnine and Na-КМЦ on the acetate-cellulose membrane of the UAM-100 tank, as well as to measure the adsorption equilibrium of a solution with variable concentrations of the substances under study, shaking with a suspension of the acetate-cellulose membrane for the time necessary to establish the adsorption equilibrium. The obtained experimental data shows that, venichen is the maximum specific adsorption of a direct pure-blue dye on the cellulose acetate membrane. Thus, the presence in the system of the membrane-forming compound Na-CMC, as well as the sulfate lychnine, wakes up the sorption of the dye on the cellulose acetate membrane.

Introduction: Purification of waste water containing a multicomponent mixture of surfactants (surfactants) and dyes of various chemical structures by the method of membrane filtration is complicated by the interaction of the components of the mixture with each other and with the membrane material. Controlling the process of forming a dynamic membrane (DM) from sewage impurities or specially introduced additives (sulphate lignin or Na-КМЦ) will make it possible to purposefully influence the efficiency of wastewater treatment in textile production by membrane filtration. Therefore, in studies of membrane purification from surfactants and dyes, sulfate lignin and Na-CMC were used as membranes.

Materials and Methods: To clarify the mechanism of separation of colored solutions by reverse osmosis and ultrafiltration, the selectivity of adsorption of the main components of wastewater (surfactants and dyes) on a UAM-100 cellulose acetate membrane was studied. The selectivity of the adsorption of dyes on additives used to form DM-lignin and Na-КМЦ was also studied. To measure the adsorption equilibria of a solution with varying concentrations of the test substances, the cellulose membrane acetate was shaken with a weighed portion for the time required to establish adsorption equilibrium.

After the establishment of adsorption equilibrium, the equilibrium concentrations of solutions were determined, the corresponding values of specific adsorption were calculated, and adsorption isotherms were plotted to study the selectivity of adsorption from aqueous solutions of nonionic surfactants on a cellulose acetate membrane, the dependence of specific adsorption on the equilibrium concentrations of individual oxyethylated nonylphenol $C_9H_{19}C_6H_4O(C_2H_4O)_{10}H$.

The adsorption isotherm is shown in Figure 1.1. It can be seen from the figure that the specific value of the adsorption of nonylphenol on the acetate of the cellulose membrane is insignificant. The standard differential decrease in molar free energy upon adsorption from an aqueous solution (-ΔFads), calculated from the initial section of the isotherm, was 17.3 kJ / mol. Fig. 1.2 shows the adsorption isotherm of purified direct pure blue dye on a cellulose acetate membrane. The inflection on the adsorption isotherm corresponds to the region of the critical micelle concentration (CMC), and a subsequent increase in concentration leads to an increase in the adsorption value, up to saturation. The free differential adsorption energy was 23.8 kJ / mol. Particular interest is paid to the study of the joint adsorption of a dye and a nonionic surfactant.

Figure 1.3 shows a partial isotherm of a purified direct pure blue dye from a mixture with ethoxylated nonylphenol on an acetate cellulose membrane. As can be seen from Fig. 1.3, the presence of a nonionic surfactant almost does not affect the adsorption of the dye, while in the presence of the dye, the adsorption of the surfactant was not detected in the entire given range of concentrations. This fact can be explained on the basis of the value (ΔFads) for the dye is 6.5 kJ / mol more than for the surfactant, then it can be assumed that with such a difference in ΔFads, the adsorption of a more strongly adsorbing dye completely suppresses the adsorption of the surfactant.

It should be noted that in real wastewater, along with dyes and surfactants, there is a large amount of mineral salts (sodium chloride, soda ash, sodium hydrosulfite). It is known that the presence of salts has a significant effect on both the amount of adsorption and the energy of adsorption. The adsorption of an industrial dye direct pure blue, as well as an industrial dye active bright red 5CX from 0.1 N NaCl solution on a UAM-IOO cellulose acetate membrane was measured.

The obtained isotherms are shown in Figure 1.4. As can be seen from the figure, even a small salt pressure leads to a sharp increase in the maximum specific adsorption of the direct pure blue dye, as well as to an increase in (-ΔFads), which in this case is equal to 30 kJ / mol. We also measured the specific adsorption of stearox-6 from 0.1 and NaCl solution on an acetate cellulose membrane UAM-100 (in Fig. 1.5).

The significant effect of NaCl additives on the specific adsorption value can be traced when considering the adsorption isotherm of the NF dispersant on the acetate cellulose membrane (fig 1.6). curve 1 corresponds to the adsorption of the NF dispersant / obtained by purifying the technical product from impurities. As can be seen from the figure, the specific adsorption value is practically zero. The presence of impurities in the technical product (curve II) leads to the fact that the specific adsorption of the NF dispersant becomes quite noticeable, and the addition of NaCl (curve III) leads to a significant increase in the specific adsorption value and an increase in the value of the standard differential decrease in free energy at adsorption (-ΔFads).

Along with the measurement of the adsorption equilibria on the cellulose acetate membrane, similar measurements of the adsorption equilibria of dyes were carried out on the substances used for the formation of DM - lignin and Na-КМЦ. Figure 1.7

shows the adsorption isotherms of industrial dyes of direct pure blue and active bright red 5CX on lignin. The figure shows that the carbon adsorption of these dyes on lignin is quite significant and comparable with the specific adsorption of these substances on the acetate cellulose membrane.

However, of greater interest to us is the use of Na-CMC as an additive that forms a dynamic membrane. In the course of preliminary experiments, the adsorption of the purified direct pure blue dye on Na-CMC was investigated. The adsorption isotherm of straight pure blue on Na-CMC is shown in Fig. 1.8. As can be seen from the figure, the value of the maximum specific adsorption of direct pure blue on Na-CMC is an order of magnitude higher than the value of the maximum specific adsorption of the same dye on the acetate cellulose membrane.

Results and Discussions:

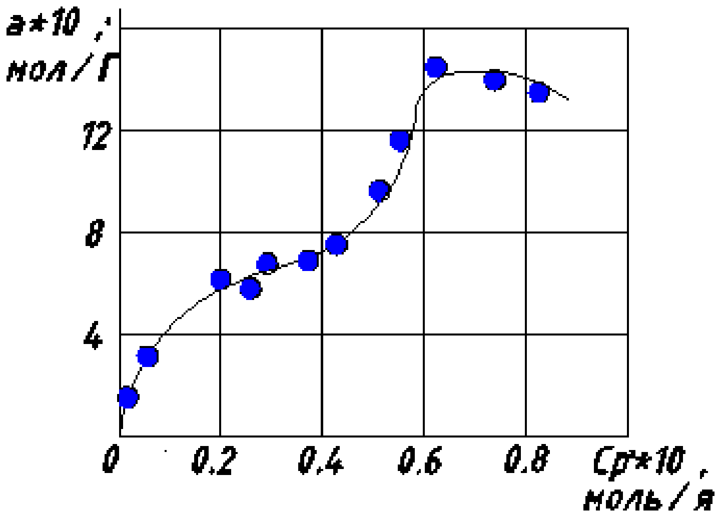

Figure 1.2. Isotherm of adsorption of purified pure blue dye on a cellulose acetate membrane from an aqueous solution.

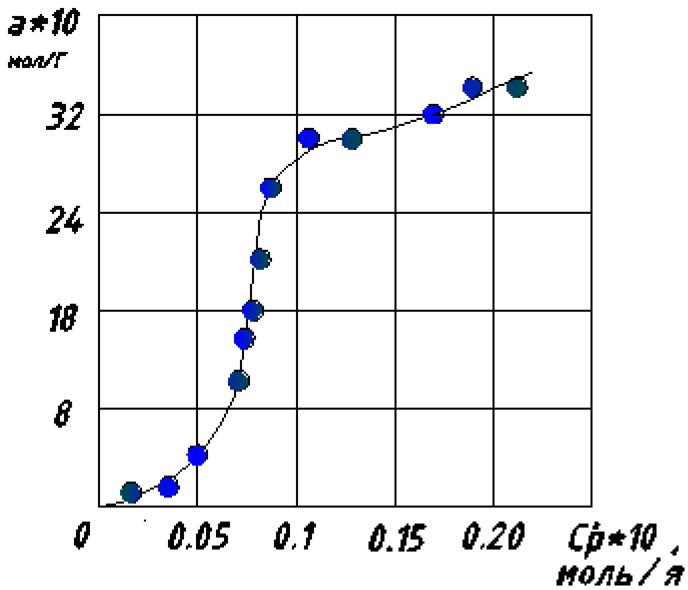

Figure 1.1. Isotherm of the adsorption of oxyethylated nonylphenol on an acetate cellulose membrane from an aqueous solution.

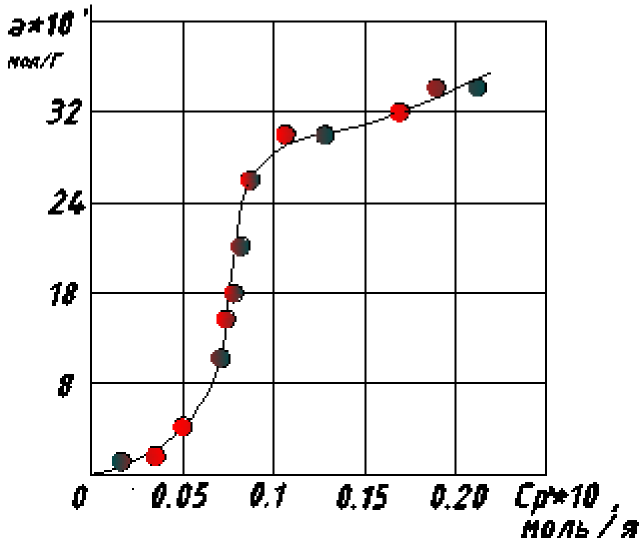

Figure 1.3. Partial isotherm of adsorption of purified direct number blue dye on a cellulose acetate membrane from a mixture with ethoxylated nonyl phenol.

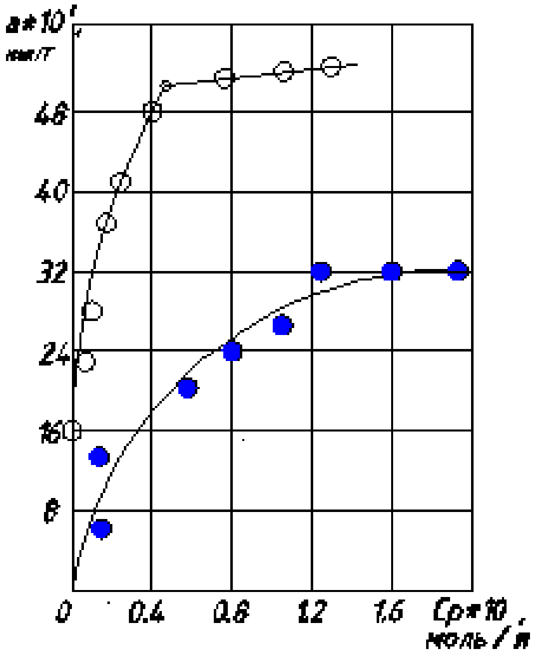

Figure 1.4. Isotherms of adsorption of direct pure blue (1) and active bright red 5CX (2) on an acetate cellulose membrane from a 0.1 N aqueous solution of NaCl

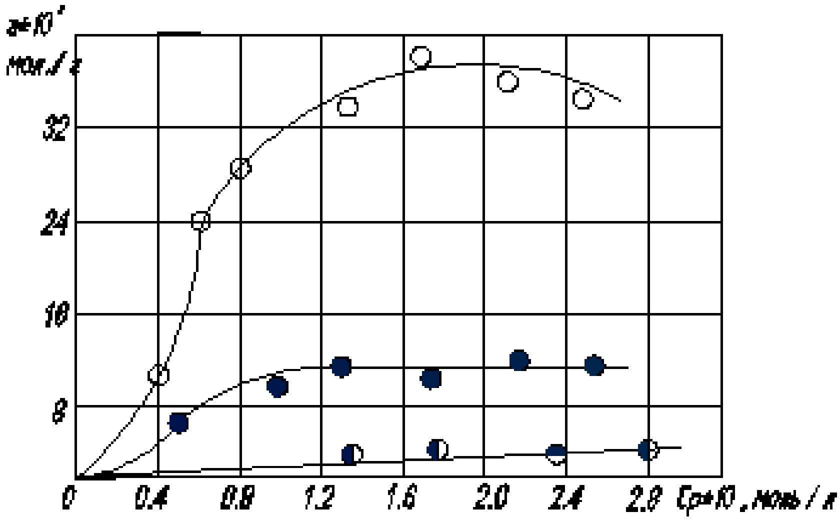

Figure 1.5. Isotherm of adsorption of dispersant NF on cellulose acetate membrane: I - NF dispersant purified from an aqueous solution; II - dispersant NF from an aqueous solution; III - NF dispersant from 0.1 N NaCl solution

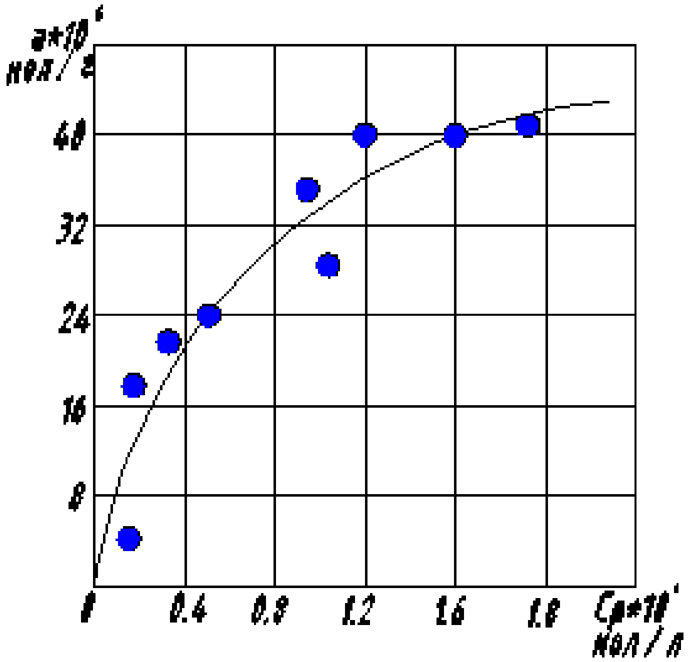

Figure 1.6. Isotherm of adsorption of stearox-6 on an acetate cellulose membrane from a 0.1 N aqueous solution of NaCl.

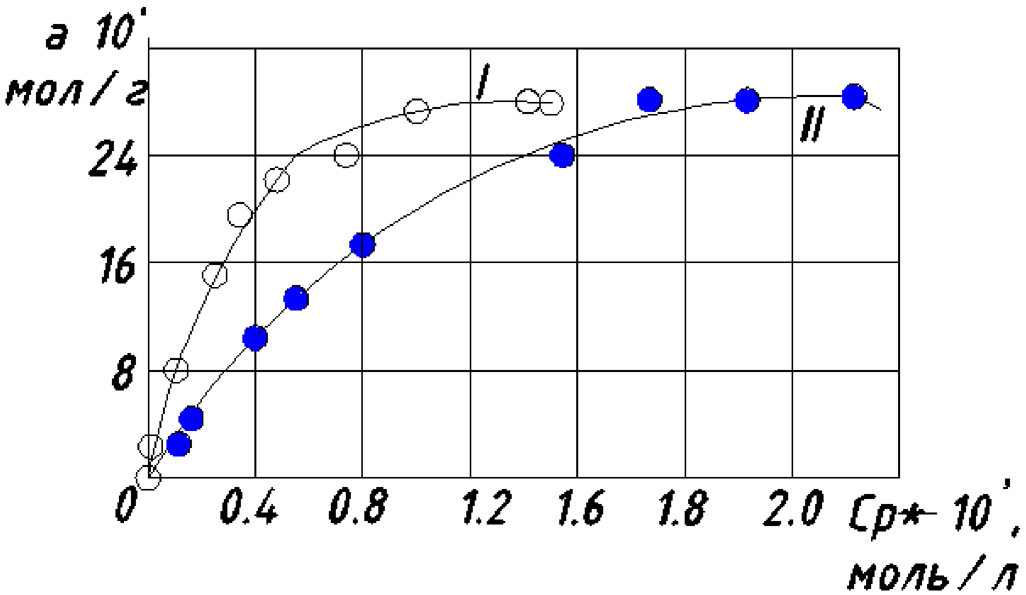

Figure 1.7. Isotherm of adsorption of dyes direct pure-blue I and active bright red 5CX (II) on lignin from aqueous solutions.

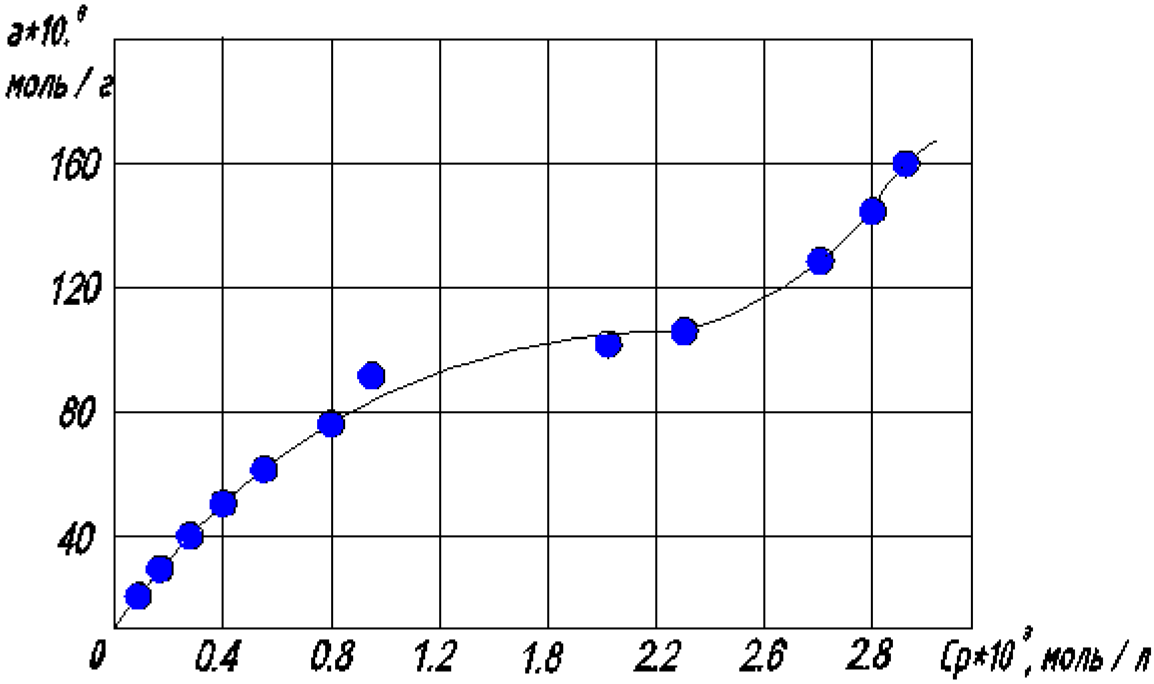

Fig. 1.8. Isotherm of adsorption of a direct pure blue (purified) dye on Na-CMC from an aqueous solution.

Thus, the presence of Na-CMC in the system, as well as sulfate lignin, will most likely prevent the sorption of the dye on the cellulose acetate membrane. Conclusion: On the basis of a set of laboratory studies in the development of membrane technology for treating wastewater from textile production using DM based on sulfate lignin and Na-CMC, the possibility of improving the performance of typical cellulose acetate membranes during the separation of colored wastewaters due to the formation of DM on them has been established.

Conclusions

The purpose of this work was to study and develop a method for forming effective DM on commercially produced ultrafilters and to create a membrane technology for treating wastewater after dyeing on their basis.

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