Obtaining the hybrid fibrous materials with adsorption properties

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Contamination of wastewater with heavy metal ions is an important environmental problem and occurs in many industries. The use of polymeric materials as sorbents of metal ions has become quite widespread due to their high efficiency and lack of secondary contamination [1-3]. Polymer adsorption composites based on fibrous materials have several advantages over other structural forms of adsorbents. They have an extremely high reaction surface area, which can be adjusted in a wide range, changing the type, linear density and shape of the surface of the fibers in the material. All mentioned factors intensify the adsorption process, increases the rate of removal of various contaminants and reduces the cost of water treatment. Fibrous waste from the textile industry can be a quite acceptable raw material for the production of nonwoven fibrous materials with adjustable physical and mechanical properties [4]. By modifying such materials with different types of dispersed mineral fillers, it is possible to create sorption-active fibrous composites.

The purpose of the work is to create hybrid materials by modifying the nonwoven fibrous base with powdered mineral adsorbents to treat wastewater from heavy metal ions.

Non-woven materials obtained from textile industry elastic fibrous waste were used as a basis in the work. They consisted of complex fibers Lycra 162C (linear density 4.4 tex) (PU), and fibers Nylon 6.6 f20/1 (linear density 3.3 tex) (PA-6.6) in a ratio of 70/30 wt. %. As an adsorbent used powders of clays of montmorillonite and paligorskite type in the amount of up to 30% by weight of nonwoven material.

Determined the sequence of separate stages and rational parameters of the process of introduction of powder adsorbents into nonwoven fibrous materials. Determined the type and characteristics of the binder solution, which provides satisfactory fixation of adsorbent particles in the fibrous structure of the nonwoven material. Shown the effectiveness of the use of cationic surfactants in this process. Performed a comparative analysis of the sorption capacity (Cr^{3+}) of the obtained samples of hybrid fibrous materials with different types of adsorbents. The highest efficiency of extraction of Cr^{3+} ions from solutions is demonstrated by samples containing clay adsorbent of paligorskite type when used as a binding aqueous-alcoholic solution (5 wt.%) copolyamide.

Thus, the expediency of using the clay minerals of the palygorskite type as fillers for obtaining the fibrous materials with sorption properties using an aqueous-alcoholic copolyamide solution as a binder has been proved. Further research in this direction may be aimed at optimizing individual stages and the use of other types of adsorbents.

References

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