Adsorption arsenite from aqueous solutions by Cu/CuO loaded composite track-etched membranes

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Nanoscale structures of copper and its oxides are widely used in heterogeneous catalysis and demonstrate improved properties compared to bulk analogues [1]. Previously, we demonstrated the high potential of composite track-etched membranes with copper microtubules (MTs) as effective catalysts for p-nitrophenol hydrogenation and the Mannich reaction [2]. In addition, efficient sorption of ions of heavy metals, such as As, Pb, Cd, Ni, etc. is a promising application of CuO NPs [3].

The composites with the internal pore diameter of 280 nm and the copper microtubules wall thickness of 75 nm were obtained by chemical template synthesis in nano-channels of track-etched PET membranes. Upon the analysis of the data on the phase composition and degree of crystallinity of microtubules before and after annealing, it was found that the complete conversion of copper to copper(II) oxide is possible only at temperatures of 140 °C and higher, and 100% tenorite phase is formed after 10 hours of annealing at 140°C. The composites annealed at 140 °C were also tested in terms of their arsenic (III) ions sorption capacities in the flow mode. For the unannealed sample, the effect of flow-rate on sorption activity was studied and the optimal value of 10 mL/min was established. It was shown that the sorption capacity of composite membranes increases by 48.7% compared to the initial sample at 10 h of annealing and then decreases by 24% with an increase in the annealing time (24 h). Successfully combining mechanical strength, the possibility of repeated use, low cost and ease of production, such Cu/CuO/PET membrane composites can be considered as promising materials for sorption of arsenic ions from aqueous solutions.

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