

UTILIZATION OF Cr (VI) BY COMPOSITES CELLULOSE/POLYANILINE

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Purification of water from heavy metals and chromium is one of the important areas of modern research. It is known that Cr (VI) is 500 times more toxic than Cr (III) and may be present in natural reservoirs of water in the form of oxyanions, such as ($\text{Cr}_2\text{O}_7^{2-}$, HCrO_4^- and CrO_4^{2-}), formed due to the high electrostatic repulsion force between these ions and negatively charged ground particles. The main sources of chromium water pollution are wastewater from many industrial extractions, processing of chromium-containing ores, galvanic wastewater, leather processing, production of paints and wood preservatives, etc. All these sources are anthropogenic and related to human activities.

Polyaniline (PAN) is an important representative of electrically conductive polymers (CPs) and consists with a high content of amino ($-\text{N}(\text{H})-$) and imino ($-\text{N}=\text{}$) groups, which are the main adsorption centres of Cr (VI) ions. Among different conducting polymers, polyaniline indicates under certain conditions the largest number of mesostructured states, that it is extremely important property and distinguishes from other CPs. However, having a wide range of physical and chemical properties, PAN is brittle-powdery polymer, that it makes possible to apply polyaniline to various matrices-carriers of inorganic and organic polymer nature. Cellulose is successfully used to build such carrier matrices of PAN. It is well known that cellulose consists of fibrils with crystalline and amorphous regions. These cellulose fibrils may be individualized by various mechanical and chemical properties and have a significant demand for composite materials. Composites of PAN with biopolymers can be interesting materials for utilization of chromium compounds from water of various origins.

The composites of cellulose/polyaniline (Cel/PAN) were synthesized by chemical oxidation of aniline using ammonium peroxodisulphate as an oxidizing agent in aqueous 0,5 M hydrochloric acid solutions in the presence of suspension of microfibrillar cellulose. The ratio aniline : cellulose (g : g) in the reaction mixtures was 1,0 : 1,25 or 1,0 : 2,5 or 1,0 : 5,0 and 1,0 : 10,0 accordingly. We have employed bleached pulp of linters (TM Linters 1058, ADM, USA, melt pulp 1290 μm , viscosity 37050 mPa·s, degree of polymerization ($\text{DS}=20150$)). Distilled water was used as solvent.

The adsorption properties of Cel/Pan composites were investigated on model aqueous solutions of $\text{K}_2\text{Cr}_2\text{O}_7$ in a wide concentration range of 50–500 $\mu\text{g/l}$ Cr (VI). Determination of equilibrium concentrations of Cr (VI) was performed spectrophotometrically in the range of 350–600 nm by Cadas-100. The content of adsorbent was 0.1 g, and the volume of solution was 10ml. Indication of chromium content in the filtrate after adsorption was carried out by X-Ray fluorescence analysis by ElvaX Pro.

It was established, that the adsorption of Cr (VI) occurs as an adsorption-reduction of Cr (VI) to Cr (III) due to oxidation of emeraldine salt of PAN to pernigranilin and terminally almost complete adsorption of Cr (III) ions on polyaniline.