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HUMIC ACID ADSORBED ONTO SILICA GEL SURFACE, MODIFIED WITH A QUATERNARY AMMONIUM SALT, FOR THE ZINC REMOVAL FROM NATURAL WATERS

Humic substances are naturally occuring, biogenic organic matter that promote the detoxification both organic and inorganic compounds in aquatic ecosystems. They have not been widely used in remediation of natural waters due the fact that it is difficult to separate from the solution. An adsorbent based on silica gel sequentially modified with a quaternary ammonium salt, tetradecylammonium nitrate, and humic acids was proposed for the removal of Zn(II) from the tap water. The optimal conditions of the humic acids immobilization on modified silica gel were studied. The maximum amount of humic acids onto sorbent was from 7.1 to 11.4 mg/g depending on the method of producing (sorption at pH 7.0 or 3.0 respectively). The stability of sorbent in solution with different pH and concentration of background electrolyte was studied. The humic acids immobilized are stable to dissolution in a wide range of pH and KCl concentration. Desorption of humic acids from sorbent surface at pH 5–7 is not more than 15%. Functional groups of immobilized humic acids are available for metal ions binding, that by the example with Zn(II) was found. Effect of pH, concentration of metal ions on the Zn(II) interaction with solid-phase humic acids was investigated. The removal of Zn(II) from solution reaches 94–97% at pH 5.0–6.0. A sorption isotherm of Zn(II) on silica modified with humic acids at low initial concentration of metal ions as H-type can be described. The uptake of Zn(II) was relatively rapid, and the equilibrium conditions were reached during 20–25 min. The modified sorbent for the Zn(II) removal from tap water was used. The sorbent, based on silica gel sequentially modified with tetradecylammonium nitrate and humic acids, can be regarded as prospective materials in remediation technologies and for metal ions determination in natural waters.

Keywords: humic acids, tetradecylammonium nitrate, noncovalent immobilization, silica gel, zinc.