Polymer-inorganic composites containing immobilized poly[8-hydroxyquinoline-formaldehyde-resorcinol] and their sorption properties against Cu(II), Cd(II), Pb(II), and Fe(III) ions

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Intensive human activity, particularly military activity, leads to the release of toxic metal ions into water bodies and soil, where they cause long-term damage to ecosystems. To address this problem, there remains a pressing need to identify effective, inexpensive, and environmentally friendly sorbents, particularly through physical treatments and chemical surface modifications of porous natural minerals.

In this study, new polymer–inorganic composites were obtained through in situ polycondensation of 8-hydroxyquinoline, resorcinol, and formaldehyde on the surface of clinoptilolite and through physical adsorption of the [8-hydroxyquinoline-formaldehyde-resorcinol] copolymer on the surface of bentonite, clinoptilolite, saponite from Ukrainian deposits, and silica gel.

The presence of a polymer phase on the surface of inorganic matrices was confirmed by IR spectroscopy. Thermogravimetric analysis of the obtained composites demonstrated the thermal decomposition of the immobilized polymer in the range of 200–590 °C and allowed its mass fractions in the synthesized composites to be determined.

Changes in the surface properties of the original natural minerals and silica gel following immobilization with the selected polymer were determined by analyzing low-temperature nitrogen adsorption-desorption isotherms, while changes in surface morphology were assessed using scanning electron microscopy.

Studies of the adsorption capacity of the synthesized composites against Fe(III), Cu(II), Pb(II), and Cd(II) ions revealed that the composites based on clinoptilolite and saponite exhibited an increase in adsorption capacity against all the selected ions compared to the parent minerals.