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# Composite sorbents for recovery of heavy metals: the results of the recent years

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**Abstract**

Domestic and foreign investigations of the recent decades, devoted to obtaining composite sorbents and applying them in purification of waste water from such nonferrous heavy metals as copper, zinc, nickel, and cadmium, were analyzed. It was shown that the set of the desired characteristics such as high capacity, selectivity, wide working pH range, chemical and mechanical resistance, and a possibility of multiple regeneration can be imparted to the sorption material through the synthesis of the composites from several compounds. The possibility of determination of the optimum synthetic conditions for the composite sorbents (temperature, pressure, process regime, necessary reagents, and proportions between them) with the help of the computations using the methods of quantum chemistry and chemoinformatics was indicated.

The composite sorbents were classified into the organic, inorganic, and organomineral ones, depending on the chemical nature of the compounds constituting them. The synthesis process for each type of composite sorbents was described briefly; the selectivity series of heavy metals and the capacity for them were given; where it was possible, the conditions of desorption and regeneration were given. The use of activated carbon, silica gel, zeolites, and other materials widely known for their sorption properties in a new role for them – the support of the active nanoscale phase of the composite sorbents – was considered. The influence of size factors in the interaction of the nanostructured composite sorbents with heavy metals was pointed out; and it was proved that the support pores act as nanoreactors in the process.

The data on the techniques of synthesis of composite sorbents were summarized, and the main lines of research were revealed. The importance of use of available materials, as well as industrial and consumer wastes, to produce sorbents was emphasized from an environmental and economic point of view. The focus was made on obtaining sorbents with active oxide and hydroxide phases, which show high selectivity in the recovery of heavy metals from the wastes with a complex saline composition, since the possibility of carrying out selective sorption will enable solving numerous problems connected with the pollution of the hydrosphere.