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Hybrid biosorbents for removal of pollutants and remediation

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For remediation of soils and purification of polluted waters, wastewaters, biosorbents might be considered as prospective groups of materials. Amongst them peat have a special role due to low cost, biodegradability, high number of functional groups, well developed surface area and combination of hydrophilic/hydrophobic structural elements. Peat as sorbent have good application potential for removal of trace metals, and we have demonstrated peat sorption capacities, sorption kinetics, thermodynamics in respect to metals with different valencies - Tl(I), Cu(II), Cr(III). However, peat sorption capacity in respect to nonmetallic (anionic species) elements is low. Also peat mechanical properties do not support application in large scale column processes thereby, to expand peat application sphere, the approach of biomass based hybrid sorbents has been elaborated. The concept “hybrid sorbent” in understanding of biosorbent means natural, biomass based modified material, covered with another sorbent material, thus combining properties of both such as sorbent functionalities, surface properties etc. As the “covering layer” both inorganic substances, mineral phases (iron oxohydroxides, oxyappatite) and organic polymers (using graft polymerization) were used. The obtained sorbents were characterised by their spectral properties, surface area and elemental composition. The obtained hybrid sorbents were tested for sorption of compounds in anionic speciation forms, for example of arsenic, antimony, tellurium and phosphorous compounds in comparison with weakly basic anionites. The highest sorption capacity was observed when peat sorbents modified with iron compounds were used. Sorption of different arsenic speciation forms onto iron-modified peat sorbents was investigated as a function of pH and temperature. It was established that sorption capacity increases with a rise in temperature as the calculation of sorption process thermodynamic parameters indicates the spontaneity of sorption process and its endothermic nature. The recycling options of obtained compounds after their saturation with metal or non-metallic species are suggested.