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The Studies of the Sorption Capabilities of the Porous Microspheres with Lignin

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Abstract : Lignin is one of three main constituents of biomass together with cellulose and hemicellulose. It is a complex biopolymer, which contains a large number of functional groups, including aliphatic and aromatic hydroxyl groups, carbohylic groups and methoxy groups in its structure, that is why it shows potential capacities for process of sorption. Lignin is a highly cross-linked polymer with a three-dimentional structure which can provide large surface area and pore volumes. It can also posses better dispersion, diffusion and mass transfer behavior in a field of the removal of, e.g., heavy-metal-ions or aromatic pollutions. In this work emulsion-suspension copolymerization method, to synthesize the porous microspheres of divinylbenzene (DVB), styrene (St) and lignin was used. There are also microspheres without the addition of lignin for comparison. Before the copolymerization, modification lignin with methacryloyl chloride, to improve its reactivity with other monomers was done. The physico-chemical properties of the obtained microspheres, e.g., pore structures (adsorption-desorption measurements), thermal properties (DSC), tendencies to swell and the actual shapes were also studied. Due to well-developed porous structure and the presence of functional groups our materials may have great potential in sorption processes. To estimate the sorption capabilities of the microspheres towards phenol and its chlorinated derivatives the off-line SPE (solid-phase extraction) method is going to be applied. This method has various advantages, including low-cost, easy to use and enables the rapid measurements for a large number of chemicals. The efficiency of the materials in removing phenols from aqueous solution and in desorption processes will be evaluated.

Keywords : microspheres, lignin, sorption, solid-phase extraction
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