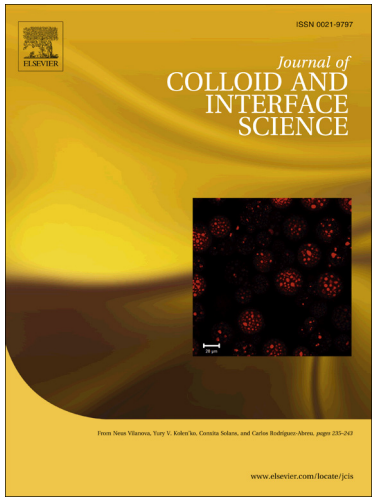

Regular Article

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Preparation of Magnetic Hierarchically Porous Microspheres with Temperature-controlled Wettability for Removal of Oils

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Abstract:

A series of monodispersed microspheres with hierarchically porous structures were prepared by microfluidic devices. Phase separation of the silica sol in microdroplets was adopted to construct these structures. The effects of velocity ratios (for both the continuous and the dispersed phases), collection solvents and calcination temperatures were investigated. The diameters of the microspheres were tuned from 148 μm to 940 μm by adjusting the velocity ratio. Tests revealed that the surface areas and pore volumes of the microspheres can reach 495 $m^2 g^{-1}$ and 0.6068 ml g^{-1}, respectively. The macroporous structure can be controlled by the collection solvents, and the wettability of the microspheres is determined by the calcination temperature. A calcination temperature of 450 ˚C leads to a hydrophilic surface property. Fe_3O_4 nanoparticles were added to the silica sol to form magnetic microspheres, and the porous structure was not affected. This kind of hybrid microsphere adsorbs 3.29 times its own weight in toluene. These spheres can adsorb oil on water surfaces, and then be removed from the water with an external magnetic field. The microspheres can be recovered and reused more than 10 times.

Keywords: Microfluidic; Monodispersed microspheres; Removal of oils