In-Situ Synthesis of Hollow Magnetic Carbon Microbeads Based on Core-Shell Alginate Hydrogel for Water Purification

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Dyes usage in the industries have led the water pollution, affecting human health. Addressing this issue, many studies have been made with the combination of carbon material including activated carbon, carbon nanotube or ordered mesoporous carbon due to their high surface area. However, formal studies had difficulties like high cost, removal after the filtration and complicated synthesis. Here, we designed a core-shell hydrogel bead composed of iron oxide precursor as a core and a shell of ionically-crosslinked alginate hydrogel using electrostatic droplet generator. After surface passivation with silica, direct carbonization followed by the removal of silica resulted in hollow magnetic carbon microbeads with unique morphologies. Exclusive wrinkle has higher surface area compared to smooth-beads, providing more adsorption sites for the organic dyes. The dye-adsorbed carbon was simply removed by an external magnetic field. This fabrication can be extended to control the size of core and shell, the number of the cores in a single shell, and the components of core and shell, which may be useful to prepare for various application.