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Superhydrophobic, Heteroporous Flexible Ceramic for Micro-Emulsion Separation, Oil Sorption, and Recovery of Fats, Oils, and Grease from Restaurant Wastewater

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Abstract : Flexible ceramic sorbent material can be a viable technology to capture and recover emulsified fats, oils, and grease (FOG) that often cause sanitary sewer overflows. This study investigates the sorption capacity and recovery rate of ceramic material in surfactant-stabilized oil-water emulsion by synthesizing silica aerogel: SiO_2–X via acid-base sol-gel method followed by ambient pressure drying. The SiO_2–X is amorphous, microstructured, lightweight, flexible, and highly oleophilic. It displays spring-back behavior apparent at 80% compression with compressive strength of 0.20 MPa and can stand a weight of 1000 times its own. The contact angles measured at 0° and 177° in oil and water, respectively, confirm its oleophilicity and hydrophobicity while its thermal stability even at 450 °C is confirmed via TGA. In pure oil phase, the qe,AV. of 1x1 mm SiO_2–X is 7.5 g g^{-1} at tqe= 10 min, and a qe,AV. of 6.05 to 6.76 g g^{-1} at tqe= 24 hrs in O/W emulsion. The filter ceramic can be reused 50 x with 75-80 % FOG recovery by manual compression.

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