Production of functional porous polymeric particles with CO_2 recognition properties and tuned morphology

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In this study, novel spherical molecularly imprinted polymer (MIP) microparticles containing amide-decorated nanocavities with CO_2 recognition properties in poly[acrylamide-co-(ethyleneglycoldimethacrylate)] mesoporous matrix were synthesized by suspension polymerization in an oil-in-water emulsion, using oxalic acid and acetonitrile/toluene as dummy template and porogen mixture, respectively [1,2]. The presence of nanocavities was revealed and quantified using Horvath-Kawazoe (HK) approach. The performance of MIP particles for CO_2 uptake was assessed by means of imprinting factor (IP), and a maximum IP of 3.7 was achieved. It was found that higher contents of functional monomer (acrylamide) and low-polar solvent (toluene) in the organic phase prior to polymerization led to higher CO_2 capture capacity of the particles due to stronger hydrogen bonding interactions between the template and the monomer during complex formation and larger number of CO_2-philic NH_2 moieties in the polymer network. The degradation temperature at 5% weight loss was 240–255 °C and the maximum equilibrium CO_2 adsorption capacity was 0.56 and 0.62 mmol/g at 40 and 25 °C, respectively, and 0.15 bar CO_2 partial pressure. The volume median diameter (120–211 μm) and density (1.3 g/cm^3) of the produced particles were within the range suitable for CO_2 capture in fixed and fluidized bed systems.

References:

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[2] Nabavi, S. A., Vladisavljević, G. T., Wicaksono, A., Georgiadou, S., Manović, V., Production of molecularly imprinted polymer particles with amide-decorated cavities for CO_2 capture using membrane emulsification/suspension polymerisation, *Colloids and Surfaces A: Physicochemical and Engineering Aspects* (2016).