Production of functional porous polymeric particles with CO2 recognition properties and tuned morphology [Abstract]

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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:
