Synthesis and characterization of polymeric microspheres template for a homogeneous and porous monolith

ABSTRACT

Monolith is an emerging technology applicable for separation, filtration, and chromatography due to its interconnected pore structure. However, the current templates used to form monolith pores are associated with poor heat dissipation, uneven pore size distribution, and relatively low mechanical strength during monolith scale-up. Templates made from polymeric microsphere particles were synthesized via a solvent evaporation technique using different types of polymer (polystyrene, polycaprolactone, polypropylene, polyethylene, and poly (vinyl-alcohol) at varied polymer (10–40 wt%) and surfactant (5–10%) concentrations. The resulting microsphere particles were tested as a monolith template for the formation of homogenous pores. Among the tested polymers, polystyrene at 10 wt% concentration demonstrated good particle morphology determined to around 1.94–3.45 μm. The addition of surfactant at a concentration of 7–10 wt% during microsphere synthesis resulted in the formation of well-shaped and non-aggregating microsphere particles. In addition, the template has contributed to the production of porous monoliths with enhanced thermal stability. The thermogravimetric analysis (TGA) indicated monolith degradation between 230 ◦C and 450 ◦C, implying the material excellent mechanical strength. The findings of the study provide insightful knowledge on the feasibility of polymeric microsphere particles as a pore-directing template to fabricate monoliths with desired pore structures.