Abstract

The dissertation entitled "**Syntheses of Mesoporous Materials through Soft Template Assisted Routes**" attempts to prepare mesoporous Fe_3O_4@mZrO_2 core/shell, mesoporous SnO_2/WO_3 composite, mesoporous $Zr_6Nb_2O_{17}$, mesoporous α-Fe_2O_3/SiO_2 composite, mesoporous $NbOPO_4$ and mesoporous $TaOPO_4$ with surface area ranging from 107- 427 m^2/g by technically simple aqueous-based soft template assisted routes. In the present work, water soluble precursors such as metal salts, metal complexes have been used for the preparations avoiding expensive and readily susceptible-to-hydrolysis metal alkoxide precursors. Generally, the adopted synthesis processes involve mixing of aqueous solution of suitable precursors and surfactant in desired amounts followed by aging of the mixture and then removal of surfactant either by calcination or by solvent extraction of the as-synthesized material.

In the present thesis, the synthesis of mesoporous ZrO_2 coated magnetite nanoparticles with core/shell structure (Fe_3O_4@mZrO_2) have been reported for the first time. The synthesized Fe_3O_4@mZrO_2 exhibits ~90% phosphate adsorption capacity. The mesoporous ZrO_2 shell imparts adsorption capacity towards phosphate ions while magnetite core participates in an easy and fast magnetic separation of the sorbent.

Mesoporous SnO_2/WO_3 composite synthesized by a coprecipitation method shows its catalytic activity towards esterification of oleic acid with ethanol to produce ethyl oleate by exhibiting 90% conversion of oleic acid within 2 h at 80°C.

The synthesis of mesoporous $Zr_6Nb_2O_{17}$ using aqueous solution of niobium tartrate has been reported here. The amorphous mesoporous $Zr_6Nb_2O_{17}$ obtained after calcination of as-synthesized material at 500 °C, exhibits catalytic activity towards bromination of phenol red to produce bromophenol blue. The mesoporous nanocrystalline $Zr_6Nb_2O_{17}$ is formed when mesoporous amorphous $Zr_6Nb_2O_{17}$ is heat treated at 550°C.

In the present work, a tartaric acid mediated sol-gel route for the synthesis of mesoporous α-Fe_2O_3/SiO_2 composite has been described. When a cosurfactant is used, synthesized material possesses mesopores of two different sizes (3.1 nm and 5.1 nm).

Mesoporous $NbOPO_4$ and $TaOPO_4$ have been prepared using tartrate solution of Nb and Ta as precursors respectively and both the materials are found to possess both Lewis (due to Nb^{5+} and Ta^{5+}) and Brønsted acid sites (due to P-OH) on the surface.