

Adsorptive Separation of Carbon dioxide by Amine Modified and Pelletized Mesoporous Materials: An Advanced Approach

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Utilization of carbon dioxide (CO₂) has become an important global issue due to significant and continuous rise in atmospheric CO₂ concentrations. Working with the aim of this, three types of mesoporous materials, MCM-41, MCM-48 and SBA-15 were synthesized, pelletized and further pellets were impregnated with 50 wt% of polyethyleneimine (PEI) in methanol to evaluate the performances of the materials in terms of CO₂ adsorption. The powdered mesoporous materials were also impregnated with 50wt% of PEI. The materials were characterized by XRD, TGA, FT-IR, TEM, SEM, N₂-physisorption and BET techniques. All the PEI-loaded pelletized materials exhibited substantially higher reversible CO₂ adsorption desorption behaviors with >99% recovery. The results indicate pellets containing methyl cellulose and activated carbon shows better mechanical strength and CO₂ adsorption. The above study also proved that MCM-48 is a better material as compared to MCM-41 and SBA-15 for pelletization and loading of PEI. The material with 50wt% loading of PEI on MCM-48, showed maximum adsorption of 1.094 W/W₀ at 80°C.