Abstract

A sulfated titania-silica composite (S-TSC) was obtained through surface modification of mesoporous titania-silica composite synthesized using less expensive precursors; titanium oxychloride and sodium silicate as titania and silica sources respectively. A pre-formed Titania sol facilitated the synthesis of a mesoporous composite with a high BET surface area (520 m^2/g), suitable for surface modification using sulfuric acid to improve its catalytic performance. The materials synthesized via this process were examined by XRD, XRF, FTIR, SEM, TEM, TGA, and N_2 physisorption studies. FTIR analysis showed the vibration band of the Ti-O-Si bond at 943 cm^{-1}, suggesting the incorporation of titania into silica to form a composite. This vibration band was substantially shifted to 952 cm^{-1} after the attachment of the sulfate group. The catalytic activity of a series of as-prepared TSC, S-TSC calcined samples and pure H_2SO_4 were evaluated for esterification of oleic acid and transesterification of waste oil with methanol to yield methyl esters. It was observed that at these reaction conditions, S-TSC-450 and S-TSC-550 possessed high catalytic activity comparable to that of pure H_2SO_4 implying that surface modification of the titania-silica composite improves its acidic properties.