Abstract

A rapid, direct sonochemical method has successfully been developed to synthesize cryptomelane-type manganese octahedral molecular sieve (OMS-2) materials. Very high surface area of 288 ± 1 m^2/g and small particle sizes in the range of 1–7 nm were produced under nonthermal conditions. No further processing such as calcination was needed to obtain the pure cryptomelane phase. A cosolvent system was utilized to reduce the reaction time and to obtain higher surface areas. Reaction time was reduced by 50% using water/acetone mixed phase solvent systems. The cryptomelane phase was obtained with 5% acetone after 2 h of sonication at ambient temperature. Reaction time, temperature, and acetone concentration were identified as the most important parameters in the formation of the pure cryptomelane phase. OMS materials synthesized using the above-mentioned method were characterized by X-ray diffraction (XRD), nitrogen sorption, scanning electron microscopy (SEM), transmission electron microscopy (TEM), and Fourier transformation infrared spectroscopy (FTIR). OMS-2 materials synthesized using sonochemical methods (K-OMS-2_{SC}) possess greater amounts of defects and hence show excellent catalytic performances for oxidation of benzyl alcohol as compared to OMS-2 synthesized using reflux methods (K-OMS-2_{REF}) and commercial MnO_2.