Abstract

Manganese oxide octahedral molecular sieves exhibit good conductivity, tunable redox properties, high porosity and excellent thermal stability. Thus, these materials have several potential applications as cathodic materials in batteries, adsorbents, catalysts, sensors and electromagnetic materials. In this study, synthetic cryptomelane (K-OMS-2) and framework doped K-OMS-2 materials were synthesized using a facile reflux method. The synthesized materials were characterized using powder X-ray diffraction (XRD), Fourier Transform Infrared (FT-IR) spectroscopy, Field Emission-Scanning Electron Microscopy (FE-SEM), N2 sorption, X-ray fluorescence (XRF) and Thermogravimetric analysis (TGA). The synthesized materials were highly crystalline with the structure of tetragonal cryptomelane. Characterization data suggests that dopant cations were incorporated in the structure of K-OMS-2 without the formation of segregated dopant oxides or other impurities. Morphological analyses revealed that K-OMS-2 was composed of nanofibres of ca. 500 nm. The length of the nanofibres decreased significantly on doping K-OMS2 to form irregular aggregated nanoparticles of ca. 100 nm. Doped K-OMS-2 materials had higher surface areas and porosities but lower thermal stability than K-OMS-2. The V-Cu-Co-K-OMS-2 material exhibited the highest degradation capacity for methylene blue.