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Sodium dodecyl sulphate-assisted synthesis, optical properties and catalytic activities of silver/manganese dioxide nanocomposites

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Abstract

A sodium dodecyl sulphate (SDS)-assisted approach was used for the synthesis of α -MnO₂ nanorods by aerial oxidation of MnCl₂ in the presence of NaOH. The mixing order of reactants (Mn²⁺ + OH⁻, Mn²⁺ + SDS, Mn²⁺-OH⁻ + SDS and Mn²⁺-SDS + OH⁻), their molar ratios and pH have significant impacts on the pseudo-first-order kinetics of the redox system. Use of SDS decreases the Mn²⁺ reduction potential and avoids the formation of Mn(OH)₂ as an intermediate in alkaline medium. α -MnO₂ nanorods were further used in the preparation of Ag@MnO₂ nanocomposites by a wet chemical method. The morphologies of α -MnO₂ and Ag-doped MnO₂ were determined by transmission electron microscopy (TEM), energy dispersive spectroscopy (EDX), X-ray diffraction (XRD) and dynamic light scattering (DLS) measurements, which show that the α -MnO₂ nanorods are successfully converted into Ag-doped MnO₂. The complex formation constant, $K_C = 26 \text{ mol}^{-1} \text{ dm}^3$, and difference in absorption, $\Delta\varepsilon = 5.5 \text{ mol}^{-1} \text{ dm}^3 \text{ cm}^{-1}$, were calculated. The optical band gap energy was calculated and found to be 2.4 and 2.0 eV for MnO₂ and Ag@MnO₂, respectively.

Key words: SDS; MnO₂ ; Morphology; Aggregation

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