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Formation of nanosize water-soluble colloidal MnO2: A kinetic study

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Abstract
Upon the addition of permanganate to a solution of thioacetamide, yellow-brown colour species appeared within the time of mixing, which was unstable in excess [thioacetamide]. At higher [thioacetamide] (≥2.0×10-4M dm-3), the formation and decomposition of yellow-brown colour were not observed. Experiments have been done to confirm the nature of that colour. Mn(IV) (water-soluble colloidal MnO2) and Mn(III) were formed as intermediates. Conventional transmission electron microscopic (TEM) and spectrophotometric techniques were used to determine the size of colloidal MnO2 and oxidation rate of thioacetamide by MnO2, respectively. MnO2 nanoparticles are spherical and are of uniform particle size, and the average particle size is ca. 25 nm. The influence of different parameters was measured, i.e. [reactants], [HClO4] and temperature. A comparison was made of the oxidation rates of different organic reductants (acetamide and thiourea) by permanganate. The order of the effectiveness was as follows: thioacetamide»thiourea»acetamide. The presence of electron-donating CH3-group and sulphur atom is responsible for the higher reactivity of thioacetamide which easily transfers the proton to MnO-4. The mechanism of the observed kinetics has been proposed and discussed. © 2011 Taylor & Francis.

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