

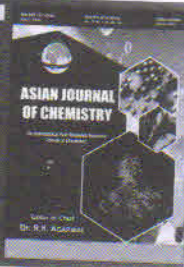


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Unveiling the Oxidation Dynamics of Mefenamic Acid by Chloramine-T Using MnO/Ag₂O/NiO Nanoparticles

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Green synthesis of sol-gel method was employed to synthesise MnO/Ag₂O/NiO nanoparticles. The synthesised nanoparticle showed an average crystalline size of 20-45 nm with semi-circular crystal structure. A combination of XRD, SEM, EDX and FTIR techniques provided insights into the material's size, shape and chemical composition. The data reveals the adverse catalytic property of the nanoparticle. The synthesised MnO/Ag₂O/NiO (MAN) nanoparticle was used as a catalyst to study the oxidation of mefenamic acid (MFA) by N-chloro-*p*-toluensulfonamide (CAT) in low pH solution at 298 K. A detailed analysis of the reaction stoichiometry and oxidation products was performed for both nano-catalyzed and non-nano-catalyzed reactions using LC-MS method. The influence of reaction rate on [CAT] is unimolecular, while the proportional to [MFA] is zero-order, for both nano-catalyzed and non-nano-catalyzed reactions. Influence of hydrogen ion concentration on reaction kinetics differs between the non-nanocatalyzed and nano-catalyzed reactions, with an inverse proportionality to a fractional power observed for the former and a non-integer order dependence observed for the latter. The reaction rate is not appreciably affected due to the accumulation of the resulting compound. A negligible negative correlation between the permittivity constant and reaction rate was found for both cases. The independence of the reaction rate on ionic strength implies that non-ionic species play a crucial role in the rate-limiting step. No evidence of free radical intermediates was found and kinetic studies at different temperatures enabled the calculation of thermodynamic parameters. A plausible mechanism was proposed to explain the observed kinetic parameters and rate laws were formulated for both catalyzed and nano-catalyzed reactions.

Keywords: Kinetics, Mefenamic acid, Chloramine-T, Nano-catalyzed, Mechanism, Stoichiometry.