꧁OB13꧂ Kinetic analysis of 2-chlorophenol photodegradation over α-FeOOH nanoparticles prepared in cationic surfactant electrolyte

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2-Chlorophenol (2-CP) which widely used in various chemical processes such as in agriculture, paper, cosmetic, biocide, and public health industries, presents serious threats to the surrounding ecosystem. In recent years, photocatalytic treatment system was found to be the most promising alternative for the abatement of this recalcitrant pollutant[1]. α–FeOOH as a semiconductor catalyst, has been widely used in the degradation of many chlorinated compounds due to its unique electrical, optical and photoluminescence properties[2]. Owing to the advantages of using electrochemical as a catalyst preparation method[3], this study reports the electrosynthesis of α–FeOOH nanoparticles in a cationic surfactant, IS (IS−FeOOH). IS that acts as an only electrolyte is capable in producing IS−FeOOH nanoparticles without any agglomeration[4]. Its crystallinity and morphology were analyzed using an X–ray diffractometer and a transmission electron microscope, respectively. The characterization results verified that IS plays an important role in the miniaturization of the α–FeOOH nanoparticles, with a diameter range of 5–10 nm (Figure 1). The activity of IS–FeOOH was tested on a photodegradation of 2–chlorophenol (2–CP). Results showed that at nearly neutral condition of pH 5 was able to completely degrade 2–CP within 180 min of reaction at 50°C, using 0.03 g L^{-1} of catalyst dosage and 50 mg L^{-1} of 2–CP initial concentration. Kinetic analysis indicates that the apparent rate constant, k_{app} increased with increasing initial concentration of 2–CP up to 50 mg L^{-1} and then reduced as the initial concentration increased to 70 mg L^{-1}. The calculated k_r and K_{LH} were 8.3 mg L^{-1} min^{-1} and 2.8×10^{-4} L mg^{-1}, respectively, suggesting a surface reaction was the controlling step of the process. The results provide strong evidence to support the potential use of IS as an alternative electrolyte to synthesize nanosized photocatalyst that can be used to treat organic pollutants.

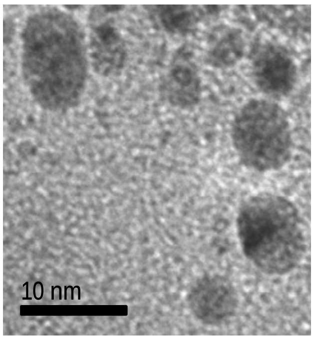

Figure 1 TEM image of IS−FeOOH

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