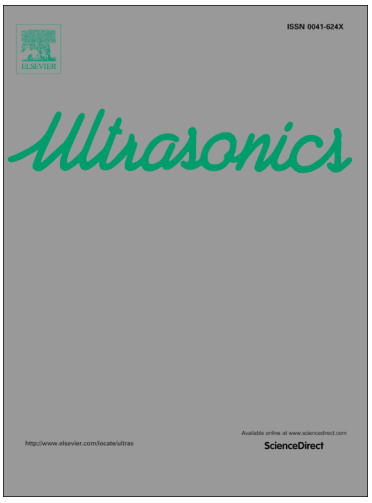

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Sonochemical Synthesis of Highly Crystalline Photocatalyst For Industrial Applications

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Abstract

Highly photo active pure anatase form of TiO_2 nanoparticles with average particle size 4 nm have been successfully synthesized by ultrasonic acoustic method (UAM). The effects of process variables i.e. precursors concentration and sonication time were investigated based on central composite design and response surface methodology. The characteristics of the resulting nanoparticles (RNP) were analyzed by scanning electron microscopy, dynamic light scattering, transmission electron microscopy, X-ray diffractometry and Raman spectroscopy. Photocatalytic experiments were performed with methylene blue dye which is considered as model organic pollutant in textile industry. A comparative analysis between the RNP and commercially available Degussa P25 for photocatalytic performance against dye removal efficiency was performed. The rapid removal of methylene blue in case of RNP indicates their higher photocatalytic activity than P25. Maximum dye removal efficiency 98.45 % was achieved with optimal conditions i.e. TTIP conc. 10 mL, EG conc. 4 mL and sonication time 1 h. Interestingly, no significant difference was found in the photocatalytic performance of RNP after calcination. Moreover, self-cleaning efficiency of RNP deposited on cotton was evaluated in RGB color space. The obtained results indicate the significant impact of ultrasonic irradiations on the photocatalytic performance of pure anatase form than any other hybrid type of TiO_2 nanoparticles.

Keywords: Anatase; Ultrasonic irradiations; RNP; Ethylene glycol; Dyes removal; RSM