Meso/macroporous dual TiO_2 materials, prepared using highly concentrated emulsions as templates, and study of its photocatalytic activity

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Materials with multimodal pore size distribution have gained great interest, because they combine the benefits of high surface area of micro and/or mesoporosity, with the accessible diffusion pathways of macroporous networks. One of the methods to prepare inorganic oxide materials with dual pore size distribution uses a two-step procedure [1]. A molded polystyrene foam, obtained from a water-in-oil highly concentrated emulsion, serves as a macroporous scaffold for a mesostructure forming sol-gel/amphiphilic block copolymer composite. Highly concentrated emulsions are characterized by possessing a volume fraction of the disperse phase that exceeds 0.74, which corresponds to the critical value for the most compact packing of monodisperse spherical droplets [2,4]. Meso/macroporous dual materials have interesting applications as catalysts. In this context, titania is a semiconductor photocatalyst capable of oxidizing adsorbed organic pollutants under near ultraviolet (UV) light [5]. As it is well known, the catalytic properties of TiO_2 are strongly influenced by the crystalline structure, the morphology, and the particle size. The main aim of this research has been to study the preparation and characterization of meso/macroporous materials based on TiO_2, and to evaluate the photocatalytic activity of such dual porous materials. Accordingly, meso/macroporous TiO_2, consisting of cellular interconnected macropores (0,5-5 μm in diameter), and mesopores incorporated in the macroporous walls, has been obtained by using the two-step procedure. The materials were characterized by means of Scanning electronic microscopy (SEM), Transmission Electronic Microscopy (TEM), X-ray diffraction (XRD), nitrogen sorption, FTIR and Thermogravimetric Analysis. The XRD patterns indicated the formation of anatase and rutile at around 350ºC and at 600 ºC respectively. The colour-fading of methylene blue under UV light, as a model molecule, was performed in order to evaluate the photocatalytic activity.

Acknowledgements

Financial support from the Spanish Ministry of Economy and Competitivity (CTQ2008-06892-C03-01 and BES-2009-027271 grant).

References

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