Synthesis of Porous Titania Powders by Self-assembly for Water Purification

Young-Sang Cho[1]

[1]*Department of Chemical Engineering and Biotechnology, Korea Polytechnic University, Siheung-si, Korea*

*E-mail: yscho78@kpu.ac.kr

Porous particles have attracted much attention since those materials can be applied to various areas including catalytic supports, separation medium, or adsorbents. In this presentation, macroporous ceramic particles will be discussed emphasizing the synthesis method by droplet-assisted self-assembly and their applications for photocatalysts.

The ceramic precursor such as titanium diisopropoxide bisacetylacetonate (TDIP) was added to the polystyrene latex dispersed in polar organic medium. The mixed dispersion was adopted as dispersed phase for the production of emulsion droplets in continuous oil phase by emulsification. The droplets were evaporated to organize the polystyrene suspension and precursor to prepare organic-inorganic aggregates. After calcination at 500 °C, macroporous ceramic powder with well-defined pores could be produced and applied as photocatlyst for water purification.

Figure 1a and 1b contain the schematic figure for the formation of the porous ceramic particles and SEM image of the porous particles made of titania, respectively. The emulsion droplets produced using homogenizer were evaporated by heating to form composite particles of polystyrene nanospheres and titania precursor, which were originally contained in the droplets. After heat treatment, macroporous titnaia particles with spherical morphologies were fabricated as contained in the electron microscope image of Fig. 1b and 1c.

In this study, rhodamine B molecules dissolved in aqueous medium were decomposed using the porous titania particles as photocatalyst. The dimensionless concentration of the model contaminant is plotted as a function of UV irradiation time, as displayed in the graph of Fig. 2. Assuming first order reaction, the rate constant of the porous titnaia particles was calculated as 0.038 min-1, which was larger than that of commercial titania nanoparticles, suggesting that the porous particles can be used as efficient photocatalyst without nano-toxicity [2].

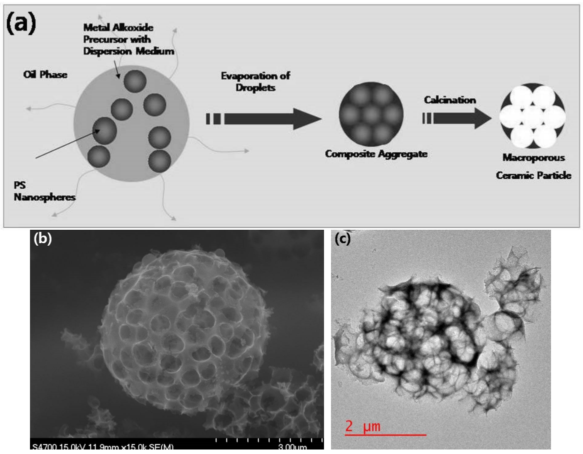

Fig.1 (a) Schematic figure of the fabrication of porous ceramic particles. (b) SEM and (c) image of macroporous titania particles.

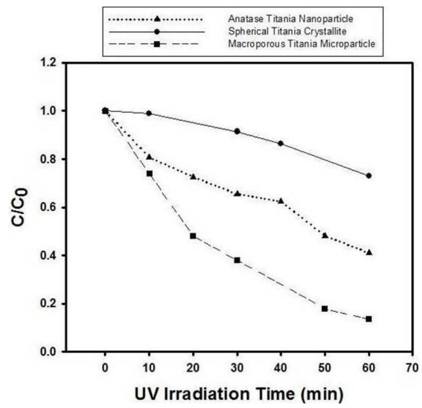

Fig.2 The change of rhodamine B concentration as a function of UV irradiation time.

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