

# Solventless Preparation of Thoria and Its Inclusion into SiO<sub>2</sub> and TiO<sub>2</sub>: A Luminescence and Photocatalysis Study

Diaz, C.

Valenzuela, M.L.

Laguna-Bercero, M.A.

Carrillo, D.

Segovia, M.

Mendoza, K.

Cartes, P.

## Abstract

Thoria was prepared using a solid-state method from the macromolecular precursor Chitosan·Th(NO<sub>3</sub>)<sub>4</sub> (chitosan) and PS-co-4-PVP·Th(NO<sub>3</sub>)<sub>4</sub> (PVP). The morphology and the average size of ThO<sub>2</sub> depend of the chitosan and PS-co-4-PVP polymer forming the precursor. Their photoluminescent properties were investigated, finding a dependence of their intensity emission maxima, with the nature of the precursor polymer. The photocatalytic activity of ThO<sub>2</sub> toward the degradation of methylene blue was measured for the first time, finding a degradation of about 66% in 300 min. The inclusion of ThO<sub>2</sub> into SiO<sub>2</sub> and TiO<sub>2</sub> was achieved by the solid-state pyrolysis of the macromolecular composites Chitosan·Th(NO<sub>3</sub>)<sub>4</sub>//MO<sub>2</sub> and PS-co-4-PVP·Th(NO<sub>3</sub>)<sub>4</sub>//MO<sub>2</sub>, MO<sub>2</sub> = SiO<sub>2</sub> or TiO<sub>2</sub>. The ThO<sub>2</sub> exhibits a homogeneous dispersion inside the silica, showing sizes of about 40 and 50 nm for the chitosan and PVP polymer precursors, respectively. The luminescent properties of the ThO<sub>2</sub>/SiO<sub>2</sub> and ThO<sub>2</sub>/TiO<sub>2</sub> composites were also studied, finding a decrease in intensity when introducing the SiO<sub>2</sub> or TiO<sub>2</sub> matrices. The photocatalytic behavior to methylene blue degradation of ThO<sub>2</sub> and their composites ThO<sub>2</sub>/SiO<sub>2</sub> and ThO<sub>2</sub>/TiO<sub>2</sub> was investigated for the first time, with them in the following order: ThO<sub>2</sub> > ThO<sub>2</sub>/TiO<sub>2</sub> > ThO<sub>2</sub>/SiO<sub>2</sub>.