High surface area nanoporous carbons as photocatalytic reactors. An experimental evidence of confining pore effect.

Juan Matos[1]*, Vanessa Fierro[2], Ricmary Montaña[1], Alicia Martínez de Yuso[2], Weigang Zhao[2,3], Alain Celzard[2]

[1] Biomaterials Department, UDT, University of Concepcion, Chile.
[2] Institut Jean Lamour, UMR Université de Lorraine, Epinal, France.
[3] College of Material Engineering, Fujian Agriculture & Forestry University, China.

*Emails: jmatoslale@gmail.com; j.matos@udt.cl

High surface area (ca. 1700-3400 $m^2.g^{-1}$) activated carbons (ACs) were prepared from Chinese anthracite by chemical activation with KOH using KOH/Anthracite weight ratios ($W_{KOH}/W_{Anthracite}$) ranging from 1.6 to 5. The photocatalytic degradation of methylene blue (MB) at high concentration conditions up to 25 ppm under UV-vis irradiation was performed on AC and on TiO_2-AC mixtures prepared by slurry methodology. The highest values of both BET surface area and of micropore volume to total pore volume ratio were found with a $W_{KOH}/W_{Anthracite}$ ratio of 4. It was found that ACs developed photocatalytic activity and an important synergistic effect with TiO_2. TiO_2-AC mixtures showed enhancements in the photocatalytic activity up to 6 times higher than commercial TiO_2. The photocatalytic activity of ACs and binary materials was discussed with respect to textural properties and surface functional groups of carbons. The ratio of micropore volume to total pore volume and the surface pH of the ACs play important roles upon the photocatalytic activity of TiO_2-AC, and the combination of adsorption followed by photodegradation clearly contributed to the treatment of highly concentrated methylene blue. It was concluded that nanoporous ACs have a beneficial influence upon the photocatalytic activity of TiO_2 also indicating that the control of confining pore effect [1] is a driven force for the enhancement in the free-semiconductor photochemical reactivity of carbon-based materials.

Reference(s)

J. Matos, V. Fierro, R. Montaña, E. Rivero, A. Martínez de Yuso, W. Zhao, A. Celzard. *Appl. Catal. A: Gen.* **2016**, 517, 1-11.