Silver clusters-TiO_2 hybrid nanomaterials as photocatalyst for degradation of emerging pollutants

María Moreno Pérez[1,2], Carlos Vázquez Vázquez[1], David Buceta[2], Iria R. Arias[2], José Manuel Ageitos[2], M. Arturo López Quintela[1], Michael Schwarze[3], Reinhard Schomäcker[3]

[1]University of Santiago de Compostela, Laboratory of Magnetism and Nanotechnology (NANOMAG), Institute of Materials (iMATUS), Santiago de Compostela, Spain
[2]NANOGAP S.A., Milladoiro, Ames, Spain
[3]Technische Universität Berlin, Institut für Chemie, Berlin, Germany

mariamoreno.perez@usc.es

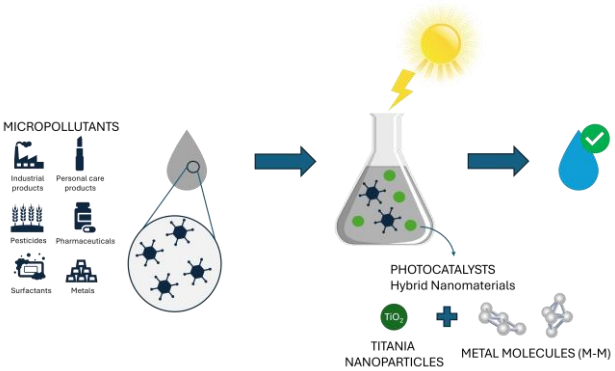

Figure 1. Scheme of photodegradation of micropollutants using clusters (metal molecules, M-M) as photocatalysts.

Nowadays, water and wastewater present certain natural and anthropogenic substances that influence the activity of living organisms, even in trace concentrations. These are so-called emerging contaminants or micropollutants[1]. Within these compounds are alkylphenols, bisphenol A (also endocrine disruptor) or pharmaceutical compounds such as antibiotics, contrast agents, estrogens, etc.

Photodegradation using classic semiconductors, such as titania, has the drawback that their absorption is limited to the UV range, with low efficiencies due to rapid electron-hole recombination. It has been shown that the deposition of sub-nanometric clusters (metal molecules) has proved capable of modifying classic semiconductors bandgap, resulting in enhanced light absorption and a reduction effect on the recombination rate of electron-hole pairs[2].

In the present work, a disruptive method is proposed that uses cluster-TiO_2 hybrid nanomaterials as photocatalysts to degrade these micropollutants that are difficult to eliminate by conventional treatments.

The photocatalytic properties of these new hybrid nanomaterials have been studied by degrading bisphenol A in water using a solar simulator. The results confirm the improvement in the photocatalytic efficiency achieved thanks to the deposition of clusters. Furthermore, different parameters relevant to photocatalysis were optimized, such as the deposition of clusters or the catalyst concentration, among others.

References

[1] A. Bergman, J. J. Heindel, T. Kasten, K. A. Kidd, S. Jobling, M. Neira, R. T. Zoeller, G. Becher, P. Bjerregaard, R. Bornman, et al., Environ. Health Perspect., 121 (2013) 104.

[2] M. Pilar de Lara-Castells, A. W. Hauser, J. M. Ramallo-López, D. Buceta, L. J. Giovanetti, M. A. López-Quintela, F. G. Requejo, J. Mater. Chem. A, 7 (2019) 7489.

Figures