Harnessing Green-Synthesized TiO_2 Nanoparticles for Superior photocatalytic Degradation of Pollutants in Aquatic Environments

Agnese De Luca[1*], Angelantonio De Benedetto[1], Valeria De Matteis[1,2*], Mariafrancesca Cascione[1,2], Rosaria Rinaldi[1,2]

[1] Department of Mathematics and Physics "E. De Giorgi", University of Salento, Via Monteroni, 73100 Lecce, Italy

[2] Institute for Microelectronics and Microsystems (IMM), National Research Council (CNR), Via Monteroni, 73100 Lecce, Italy

Corresponding authors: agnese.deluca@unisalento.it; valeria.dematteis@unisalento.it

In the last years the aquatic environment has been increasingly contaminated by organic chemicals. Beside conventional methods used for the removal of toxic pollutants, other technologies are needed to treat wastewaters, such as advanced oxidation processes (AOPs) that are usually used in combination with biological treatments. Among different materials, Titanium dioxide (TiO_2) is the most studied photocatalyst due to its unique physical-chemistry properties including high photoactivity. To this end, the photocatalytic activity of TiO_2 NPs was evaluated by investigating the degradation of methylene blue (MB) under UV light. In detail, the TiO_2 NPs used in this work were synthesized by means of two different synthesis methods: a green route, exploiting the *Aloe vera* leaves extract properties, and a conventional approach, using in both cases Titanium(IV) isopropoxide (TTIP) as TiO_2 precursor. Both synthesized NPs were characterized by means of XRD, TEM and ζ-potential analysis. The both types of TiO_2 NPs showed a degradation efficiency value of (50 ± 3)% and of (16 ± 3)% after 180 min, respectively for green and conventional TiO_2 NPs. This result was confirmed by the reaction rate constant: it was found to be about 5 times higher for TiO_2 NPs synthesized by green approach than that of NPs obtained by conventional route.