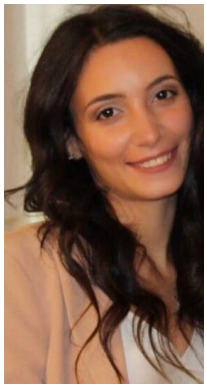
ECO-SUSTAINABLE DESIGN OF HYBRID REDOX-ACTIVE MATERIALS TO REMOVE MICROPLASTICS FROM WATER AND SIMULTANEOUSLY TO PRODUCE HYDROGEN



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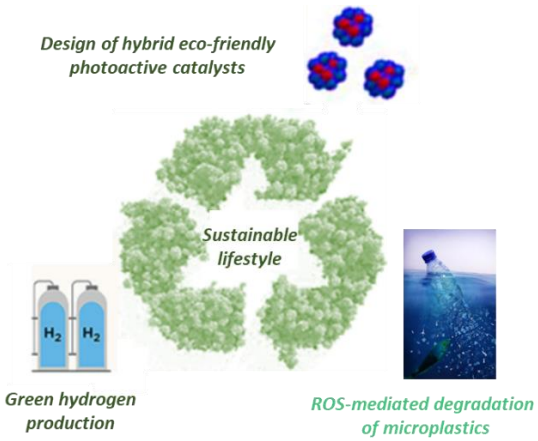
Plastics are synthetic organic polymers with a wide variety of applications due to their durability, versatility, hydrophobicity, and relatively low cost. However, despite their benefits to the daily life, plastics are associated with high levels of waste and release into the environment, in fact most of them are very difficult to degrade.

Plastic waste has become a highly abundant and growing problem across global environments, as a result of increasing plastic manufacture, disposal and anthropogenic activities. In particular, plastic particles less than 5 mm in size, the well-known microplastics (MPs), have now caught both scientific and public awareness. Due to their small size, microplastics can be discharged into the environment from wastewater effluents, causing damages to aquatic ecosystems. Therefore, great interest of the scientific and technological community is directed toward defining of viable solutions to address this threat.

The aim of this PhD research activity is the realization of new environmentally friendly hybrid redox-active materials, obtained by combining an inorganic component with bioavailable and/or from biomass wastes organic molecules.

These materials will be tested for the degradation of plastics and microplastics and the simultaneous production of hydrogen through Advanced Oxidation Processes (AOPs), taking advantage of their ability of ROS (reactive oxygen species) production.

In this context, the green photocatalytic removal of microplastics from water, activated by visible and/or solar light, represents a possible operational strategy since photoactive materials can be used for hydrogen production through photoreforming processes by exploiting, as sacrificial agents, organic substances present in industrial wastes or waste products, including the microplastics. The joint use of eco/bio-inspired photocatalytic systems and microplastics as sacrificial agents represents a viable alternative for green hydrogen production, as well as environmental protection.



This work is in collaboration with ICPB-CNR in Pozzuoli and in synergy with the company Re.Ma.Plast Srl involved in the project. The company Re.Ma.Plast Srl is active in the bioplastics sector and is strongly motivated by the definition of alternative strategies for recycling and degradation of processing waste products through environmentally sustainable approaches. The synergy with the company will enable the definition of operational degradation strategies in pilot plants, in response to the demand for environmental sustainability.

Paola Amato, PhD student XXXVII cycle, July 2022