Nano-bio systems for water remediation

M. Blosi[1], I. Zanoni[1,2], S. Ortelli[1], A. Brigliadori[3], S. Albonetti[3], and A.L. Costa[1]

[1:] Institute of Science and Technology for Ceramics, National Research Council, Via Granarolo 64, Faenza (Italy)

[2]: Clinical Unit of Occupational Medicine, Department of Medical and Surgical Sciences, University of Trieste, Via della Pietà 2/2, 34129 Trieste, Italy

[3]: Dipartimento di Chimica Industriale "Toso Montanari", University of Bologna, viale del Risorgimento 4, 40136 Bologna, Italy

We present the development of a novel nano-bio catalyst usable in downstream treatment of industrial wastewater remediation. We combined the potentialities of *Chlorella vulgaris* microalgae with the photocatalytic properties of TiO_2 NPs, in order to investigate unexplored synergistic effects which will enable the innovation of the algal remediation technology toward a more promising cost-effective balance consistent with its industrial implementation. We started from non-living *C. vulgaris*, which keeps the absorption properties of the living microalgae, but greatly enhancing its processability. *C. vulgaris* biomass was coupled with TiO_2 NPs with an optimized colloidal process and with different TiO_2/*C. vulgaris* weight ratios. The hybrid nanosols were then dried by means of a spray freeze drying (SFD) technique, able to produce highly reactive granules [1]. A widespread physicochemical characterization of the nano-bio catalysts (DLS, ELS, BET, FESEM, FTIR, ICP-OES, UV-VIS) supported the preparation process and the performances evaluation in terms of Cu^{2+}absorption and photocatalytic activity. The results exhibited greatly enhanced heavy metal absorption, pointing out a positive synergistic interaction between *C.Vulgaris* and TiO_2. The preliminary results pave the way for the integration of such nano-bio catalysts into water remediation systems. Tests are ongoing on living microalgae doped with TiO_2, where the metabolic activity could emphasize new application perspectives.

[1] Innovative synthesis of nanostructured composite materials by a spray-freeze drying process: Efficient catalysts and photocatalysts preparation, Catalysis today 2018 https://doi.org/10.1016/j.cattod.2018.11.022