Nanotechnologies for environmental remediation: applications, limits and side effects

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Thematic Area: Advanced conversion techniques of biomass/bioWaste to Renewable Energy

Abstract

The use of engineered nanomaterials (ENMs) for environmental remediation, known as nanoremediation is considered one of the largest engineering innovations since the Industrial Revolution (Wang et al., 2013). In particular, the feverish development of engineered nanoscale materials (NMs) represents a technological revolution for the development of innovative material and new productive sectors (Lofrano et al., 2016). A promising technological breakthrough is expected from the nanotechnology field, which holds a great potential for advancing water and wastewater treatment and contaminated sites remediation with improved efficiency and lower energy consumption. Environmental nanoremediation of various contaminants has been recently reported for the treatment of surface water, groundwater, wastewater, and for soil and sediment cleanup from toxic metal ions, organic and inorganic solutes, and emerging contaminants, such as pharmaceutical and personal care products. Although the growing interest in nanotechnological solutions for pollution remediation, with significant economic investment worldwide, environmental and human risk assessment associated with the use of ENMs is still a matter of debate and nanoremediation is seen yet as an emerging technology (Corsi et al., 2018). Unfortunately, in spite of the great excitement about the potential benefits offered by the introduction of environmental nanoremediation several safety-related questions, e.g. the induction of toxic effects due to uncontrolled release of NMs into the environment, remain unsolved and we must be careful about the potential risk of econanotoxicity.

To favour environmental safety and industrial competitiveness the following aspects have to be addressed: (i) ecosafety has to be a priority feature of ENMs intended for nanoremediation; ii) predictive safety assessment of ENMs for environmental remediation is mandatory; (iii) greener, sustainable and innovative nano-structured materials should be further supported; (iii) those ENMs that meet the highest standards of environmental safety will support industrial competitiveness, innovation and sustainability.

Keywords: engineered nanomaterials, environmental remediation, nanoremediationm sustainability.

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