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USE OF NANO-STRUCTURAL MATERIALS FOR POLLUTANTS REMOVAL IN WATER TREATMENT

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Intensive cultivation and industrial activities inevitably leads to water and soil pollution. Intensive agricultural production requires the use of specific fertilizers with superior and technical characteristics to conventional ones. Among them, the most efficient and functional fertilizers are slow-release ones. A significant issue of the Italian territory is the leaching of nutrients brought into the soil, such as nitrates and other anions. This phenomenon does not allow nutrients to be assimilated by plants, but end up directly in groundwater or in natural waters. Concerning the industrial activities, groundwater pollution can be accidental or malicious. Main pollutants that could be found into groundwaters are organic compounds (such as pesticides) or heavy metals. To try to solve these big issues, the study was focused on innovative nano-structured materials (such as nanosponges) for the removal of different types of pollutants. Nanosponges result from maltodextrin based biopolymers. Maltodextrins are a family of oligosaccharides achieved from starch coming from different biomass (such as potatoes, corn, peas). The use of specific cross-linking agents allows to get a hyper-cross-linked biopolymer having an eco-compatible and biocompatible polymeric structure. Moreover, it is possible to have a high retention and release of relevant compounds, according to appropriate synthetic modifications. The syntheses have been optimized towards a greener process, using water as a reaction medium and without any use of organic solvents.

Laboratory tests were performed to assess the capacity and potential retention of heavy metals, organic compounds and anions (such as NO_3^-). In the specific case of nitrates removal, nanosponges were evaluated as slow-release fertilizer. Several absorption tests were conducted (both in batch and in column), changing concentration, absolute quantity and volume. The results achieved were from 50% up to 80-90% retention of anions (including nitrates) and heavy metals (including Cr (VI)). Concluding, nanosponges are innovative, biodegradable and eco-compatible sugar-based materials that have shown noticeable potential for future application in water treatment.