Cyclodextrin-based nanomaterials for sensing and removal of pollutants in precision agriculture

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One of the increasingly valuable natural resources is clean water. Intensive farming plays the dual role of an avid consumer and a potential polluter. Agrochemicals are considered as emerging pollutants from accumulation, thus limiting the reuse in irrigation of wastewater from low-impact agricultural processes. In this regard, cyclodextrin-based nanomaterials were produced to exploit their complexing ability towards a specific set of pesticides and used in different strategies for sensing and removal of agrochemicals with the aim of realize fast, facile and reliable on-field multimodal sensoristic platform for water. A magnetic hybrid system was produced by supramolecular self-assembly between sulfobutylether-β-cyclodextrin (Captisol®) and magnetic iron oxide-based nanoparticles (MNPs). The MNPs@Captisol assembly was characterized by FT-IR, XPS, μXRF, TEM, TGA, magnetization, DLS an adapted turbidimetric analysis and demonstrated its promising use as magnetic water remediation agent against the toxic herbicide paraquat. Very promising but still preliminary results were obtained from an electrochemical detection strategy of paraquat using cyclodextrin-modified screen-printed electrodes. Similarly, a polymeric blend based on β-cyclodextrin was used to increase the electrochemical response of MWCNTs-modified screen-printed electrodes for the herbicide diuron. Finally, an optical sensor for MOSH and MOAH (saturated/aromatic mineral oil hydrocarbons) based on a luminescent cyclodextrin is currently under development. Acknowledgements: This work is supported by the PNRR-MUR through the NextGenerationEU program with the project SAMOTHRACE “SiciliAn MicrOnanoTecH Research And innovation CEnter”.