Nanopesticides to reduce the environmental impacts of agrochemicals

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The intense use of pesticides has progressively contributed to the contamination of the environmental matrices, and in particular of soils and groundwater. Nanopesticides have been proposed in recent years to overcome diverse technical and environmental problems of traditional agrochemicals. They consist of nanoparticles (nanocarriers) containing an active ingredient, sometimes protected by a coating, and dispersed in a colloidal suspension. Here a novel nanoformulation is presented, developed using eco-compatible, low-cost materials, including mineral particles as carriers and food-grade biopolymers as coatings. An illustrative application is discussed, namely a clay-based nano-formulation for the controlled delivery and reduced leaching of dicamba, a highly soluble and moderately volatile herbicide, widely used to control broadleaf weeds. The efficacy of the nano-formulation was tested in the laboratory against a commercial dicamba-based product. The reduced leaching and mobility in the subsoil was studied in column transport tests in un saturated and saturated conditions, mimicking respectively the pesticide transport in top soils and in aquifer systems. Transport tests were performed at different scales, from small columns (1.6 cm diameter, 10-20 cm length) up to a laboratory lysimeter (30 cm diameter, 70 cm length). A significantly reduced leaching of the nanoformulation compared to the commercial formulation was observed in all experiments. Greenhouse tests, conducted in collaboration with DISAFA – University of Torino, indicated that the clay-based nanoformulation does not hinder the dicamba efficacy towards target weeds, even though differences were observed depending on the treated species. Despite the small (lab and greenhouse) scale of the tests, these preliminary results suggest a good efficacy of the proposed nanoformulation in controlling the environmental spreading of dicamba, without hindering efficacy toward target species.

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