Ecofriendly Nanocarriers

Giuseppe CICCARELLA & Francesca BALDASSARRE - *University of Salento*

Controlling pests is an unquestionably crucial task when goals for an important future concerning ecosystems are to be achieved. Inefficient pest control using conventional techniques leads to a large amount of waste and serious environmental pollution. More than 90% of conventional biocides are lost owing to degradation, photolysis, evaporation, and surface runoff after their application. To overcome these issues, researchers have pledged to develop effective, safe, and green pesticide formulations. The application of innovative technological tools has raised the hope of delivering new-generation agrochemicals that are risk-free to the environment and effective at low doses. New-generation biocides could be composed, for example, of structured or nanostructured materials, which act on specific target, and they are released in slow/controlled manner. Various inorganic and organic materials have been exploited to synthesise smart ecofriendly nanocarriers thanks to their biocompatibility, biodegradability, wide biological activities, and ecological safety. The encapsulation of biocides into polymers, lipids, or other systems such as tocosomes and niosomes is generating considerable interest because they appear promising in this sector. The use of lignin-based polymers in nanotechnology has attracted the interest of the research community. Lignin and cellulose can be used as a low-cost eco-friendly reinforcement to prepare high-performance nanocomposites. Niosomes formulations resulted in ecofriendly materials useful for eradicating mosquito vectors. A series of eco-friendly interpenetrating polymer network hydrogels integrated with natural soil colloid were useful for obtaining novel swellable controlled release systems. These carriers can stabilize sensitive components, control the release of core material, physically separate reactive or incompatible ingredients and thus increase biocide shelf life, and, at the end, use them for further application in the agriculture sector. Thus, different micro and nanoencapsulation approaches have been investigated as eco-friendly and economical processes to obtain new tools to control phytopathogens as recently investigated for *Xylella fastidiosa*.