Polymeric nanoparticles as carriers for bioactive componds: the case of crop protection from pathogens

Sara Falsini[1], Ilaria Clemente[2], Corrado Tani[1], Silvia Schiff[1], Alessio Papini[1], Cristina Gonnelli[1] and Sandra Ristori[2]

[1] Department of Biology, Via Micheli 1-3, 50121, University of Florence, Firenze, Italy;

[2] Department of Chemistry "Ugo Schiff"& CSGI, University of Florence, Sesto Fiorentino (FI) 50019, Italy;

Concerns about environmental problems have led to sustainable approaches in new technologies and, in particular, in nanoparticle design. Different sustainable practices have been adopted in laboratory protocols, including the use of renewable starting materials, of less toxic solvents and biodegradable compounds. These procedures become of fundamental importance when nanoparticles move from laboratory to large-scale manufacturing and, particularly, in agricultural processes. Although nanoparticles are still at an early step in agricultural development, it is evident that they are a promising strategy for enhancing the effectiveness of crop production compounds (i.e hormones, biocides, insecticides etc.), while at the same time reducing their environmental impact. In this context, among various nanocarriers, polymeric nanocapsules (NCs) have received attention for their ability to trap bioactive components inside or on the shell matrix. Moreover, ad hoc designed polymeric NCs can unite biocompatibility, biodegradability and controlled release. The preparation of NCs can be carried out within the frame of solvent/co-solvent engineering for polymer-based nanosystems, a versatile procedure which allows different protocols to be used, depending on the chemical properties of the inner core, the shell and the cargo molecules. Several polymers are currently used in plant science for delivery purposes, such as starch, alginate, chitin, albumin, and cellulose. Polymeric β-glucan, obtained by the treatment of crustaceous chitin, possesses itself an antifungal activity. Alginate, extracted from some brown algae (*Phaeophyceae*) can be manipulated to obtain NCs for insecticides delivery. Another promising material is lignin which can be devised for delivering bioactive compounds to plants, which, in addition, represents the main by-product in paper and cellulose manufacturing.