RESEARCH PROJECT

Seashell wastes valorization by mechanical and physical treatments.

Seashells consist mainly of calcium carbonate (CaCO3, > 95 wt.%) and are one of the most abundant by-products of the food industry, with generally little or no commercial value. The valorization of these residues could represent an interesting platform in circular economy system for the development of high added value compounds with sanitary, financial and environmental advantages. For instance, the valorization of seashells will help to decrease the disposal costs of the fishery industry by-products, as well as to mitigate the pollution problems related to the illegal dumping of unmarketable seashells in open seas.

In this respect, the objective of the present project is to produce $CaCO_3$-based materials from the circular economy of seashells to obtain sustainable fertilizers for applications in agriculture. In particular, carriers will be obtained from biomasses residues that will be functionalized with several elements and applied directly to the soil in experimental plots under controlled conditions (pots in greenhouse). The trials will evaluate the effect of treatments on soil elements bioavailability and microelements contents in leaves and tuber. Moreover, the innovative fertilisation will be tested under Candidatus Liberibacter solanacearum (CaLsol) infection evaluating the titre of pathogen in potato tissues by molecular analysis using Digitaal Droplet PCR (dd-PCR) approach. Tuber produced under the described experimental conditions will be also assessed for resistance to postharvest pathogens.

To achieve this goal, within the project will be developed green and easily scalable methods to obtain $CaCO_3$ powders from different seashells (e.g. oyster and clams) and for the tailoring of the physical-chemical properties of the materials in view of each application. Different synthesis and characterization techniques including, but not limited to, wet precipitation and sonochemical synthesis, will be employed. Moreover, different methods of incorporation of macro and micronutrients in $CaCO_3$ powders, such as impregnation in water and ball milling in wet and solid state, will be tested and compared. The obtained functionalized powders will be characterized in term of composition, morphology and structure, by various characterization techniques.