Chitosan nanoparticles doped with dsRNA as a tool for sustainable viticulture: preliminary results

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Agriculture is recently undergoing a period of transition towards sustainability, with the aim of providing sufficient food for the growing population by reducing the environmental impact. In this context, nanotechnologies are arousing interest in research thanks to the versatility and peculiar properties of some nanomaterials, which appear promising to make some agronomic practices, such as nutrition and crop protection, more eco-sustainable. Chitosan (CH) is an interesting organic polymer to be used to obtain nanoparticles (NPs), thanks to its biocompatibility and to the possibility of sourcing it through the circular economy. CH is known for its ability to induce several biological responses in plants concerning their growth and their defense against diseases, and it shows also good performances as a shuttle for a variety of molecules. This opens the possibility both to profit from the CH carrier function and its protective action against external agents, and to obtain a synergistic effect between it and the transported molecule. In our case, the goal is the functionalization of CH-NPs with specific dsRNA sequences of grapevine pathogens to exploit the RNA-interference (RNAi) mechanism, which has been suggested as an innovative strategy to limit pathogen infections.

Preliminary results will be here presented, concerning the development of a protocol for the synthesis of CH-NPs, their characterization and the first information regarding their interaction with dsRNA sequences. Two variants of NPs have been produced (from chitosan as it is, or treated with hydrogen peroxide), which were doped with dsRNA sequences of Esca disease pathogens. The difference in synthesis procedures determined opposite interactions with nucleotides, resulting in a lower dimensional size and greater retention of the doping agent by the NPs obtained with untreated chitosan.