GBMeeting
ENCONTRO DAS PÓS-GRADUAÇÕES EM GENÉTICA, BIOLOGIA MOLECULAR E MORFOFUNCIONAL
29, 30 e 31 de janeiro de 2024

SYNTHESIS AND CHARACTERIZATION OF LAYERED DOUBLE HYDROXIDE (LDH) NANOCARRIERS FOR PEST CONTROL IN AGRICULTURE.

André Lopes Ferreira*, Henrique Marques Barbosa de Souza, Marcelo Bispo de Jesus

Department of Biochemistry and Tecidual Biology, Universidade Estadual de Campinas (UNICAMP), P.O. Box 6154, 13083-970, Campinas, SP, Brazil.

*e-mail: a216293@dacc.unicamp.br

In recent years, with the growing population and increased food consumption, the use of agrochemicals has become indispensable for pest control. Pests are responsible for losses of approximately 20% to 40% of agricultural production. To mitigate these losses, producers have turned to synthetic chemicals, yet their indiscriminate and irresponsible use can harm human health, cause water and soil pollution, and have a broad-spectrum impact on non-target species. Hence, the development of new methodologies for efficient pest control that address these issues becomes crucial. An alternative approach is the use of RNA interference (RNAi) gene silencing technology, representing a sustainable alternative for controlling agricultural pests and diseases with high target specificity and versatile mechanisms of action. A major challenge for RNAi technology in agriculture is the development of formulations that provide stability to the molecules, enhance their efficiency, and enable their delivery to the cells of the target organism. Therefore, our project aims to develop double-stranded RNA (dsRNA) nano-carriers using Layered Double Hydroxide (LDH) nanoparticles, a class of inorganic nanomaterials with attractive features for gene delivery due to their excellent anion exchange capacity, high stability, low cytotoxicity, and high biocompatibility. We will develop different LDH compositions by varying the metallic ions used in synthesis to achieve diverse physicochemical properties for platform development. We started by synthetizing different LDHs by fixing the M^{3+} ion (in this case aluminium) and varying the M^{2+} ion (Mg, Ni, Co, Cu, and Mn). Next, suspensions underwent physicochemical characterization by Dynamic Light Scattering (DLS) to assess their dispersion, size, and Zeta potential of each nanomaterial. The size was between 184 and 518 nm, showing that all formulations are at the nanoscale. The Polydispersity Index (PDI) ranged between 0.19 and 0.39, providing satisfactory information about the homogeneity of size distribution in the dispersions. The Zeta potential was positive for all dispersions with values ranging from 33.4 to 49.4, indicating that they are capable of electrostatic interaction with negatively charged dsRNA molecules. In conclusion, the synthesis process can be standardized and executed successfully. Through the variation of metal ions, we were able to optimize physicochemical properties, resulting in satisfactory outcomes. This includes achieving a positive charge ranging from 33.4 to 49.4 and maintaining stability for more than 8 weeks in nanoparticles. The upcoming phases will center around selecting nanocarriers based on criteria such as efficient complexation, effective delivery, low toxicity, and in vivo performance. The project's success represents a significant advancement in RNAi technology, promoting the sustainable management of insect pests in agriculture. The upcoming phases focus on selecting nano-carriers based on criteria such as efficient complexation, effective delivery, low toxicity, and in vivo performance. The success of the project represents a significant advancement in RNAi technology, promoting sustainable management of insect pests in agriculture.

Apoio: CNPQ (Grant number: 141241/2023-3),