T810: Other topics in nanotechnology and nanoscience

Liposomal encapsulation of anti-freeze proteins with potential agricultural use

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Nanotechnology has received great attention due to diverse applications in agriculture, the food industry, biotechnology, and medicine. In the agricultural sector, nanotechnology has generated significant interest in the formulation of nanopesticides and nanofertilizers [1]. However, there are applications aimed at protecting agricultural crops from adverse environmental conditions that have been little studied and could minimize crop losses due to low temperatures. In this context, antifreeze proteins (AFPs) have shown a high capacity for inhibiting ice recrystallization (IRI) [2]. An innovative and potential alternative application of these proteins is by using liposomes as nanocarriers, which could retain the active compound, protect the molecule, improve its solubility, and allow the release of the encapsulated molecule. Liposomes are vesicles synthesized by hydrating dried phospholipids. These nanoparticles can be prepared in different structures, compositions, sizes, and flexibility using various types of lipid molecules [3]. Due to their amphiphilic nature, biocompatibility, biodegradability, and easy surface modification, liposomes have been extensively used as carriers for hydrophilic and lipophilic molecules [4].

In this regard, the use of these nanostructures in conjunction with the AFPs would have significant applications in the agricultural sector as stabilizers of cellular structure or the macromolecules during freezing. This study aims to evaluate the nanoencapsulation of antifreeze proteins in liposomes for future agricultural applications. For this purpose, liposomes will be synthesized, and antifreeze proteins will be encapsulated using a kit (L4395 Sigma-Aldrich). Subsequently, the particle size distribution and polydispersity index will be determined, morphology will be examined using optical microscopy, and finally, will be assessed the encapsulation efficiency. The goal is to obtain antifreeze proteins encapsulated in liposomes with a homogeneous size distribution and a higher mass of encapsulated proteins compared to the mass of proteins without encapsulation.

Acknowledgments

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References

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