Biomass Valorisation for the Development of Chitosan Films Using Natural Deep Eutectic Solvents

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Chitosan, a copolymer of glucosamine and N-acetyl glucosamine, is derived from chitin which is found in cell walls of crustaceans, fungi, insects and in some algae, microorganisms, and some invertebrate animals and it is emerging as a very important raw material for the synthesis of a wide range of products used for food, medical, pharmaceutical, health care etc. (Detsi et al., 2020)

Chitosan-based films, possess desirable properties due to the natural origin and bioactivity of chitosan. However, depending on the used plasticizer, chitosan films can be brittle with poor mechanical properties (Vieira et al., 2011). The aim of this study is the development of chitosan-based films with advanced properties suitable for coating/packaging applications.

Deep Eutectic Solvents (DES) are comprised of at least one hydrogen bond acceptor and hydrogen bond donor components, which in specific molar ratios, possess a very low-temperature eutectic point. When naturally occurring compounds constitute DES, they are known as Natural Deep Eutectic Solvents (NADES). Biocompatible and task-specifically designed NADES have been recently used as plasticizers in order to improve the elasticity and reduce the fragility of chitosan films (Pontillo et al., 2021).

In the present study, a task-specific NADES was synthesized and used for the ultrasound-assisted treatment of biomass derived from a plant material source in order to obtain an extract rich in cellulose. The as-obtained extract was then used as a multifunctional agent-as a plasticizer and mechanical properties enhancer-in order to prepare chitosan films using the casting method.

The effect of the molecular weight of chitosan as well as the quantity of biomass used during the pretreatment process with the NADES on the mechanical properties of the chitosan films were investigated. The films were characterized using FT-IR spectroscopy, whereas their weight, thickness, elasticity, bristliness, and water vapor permeability were also evaluated.

References

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