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

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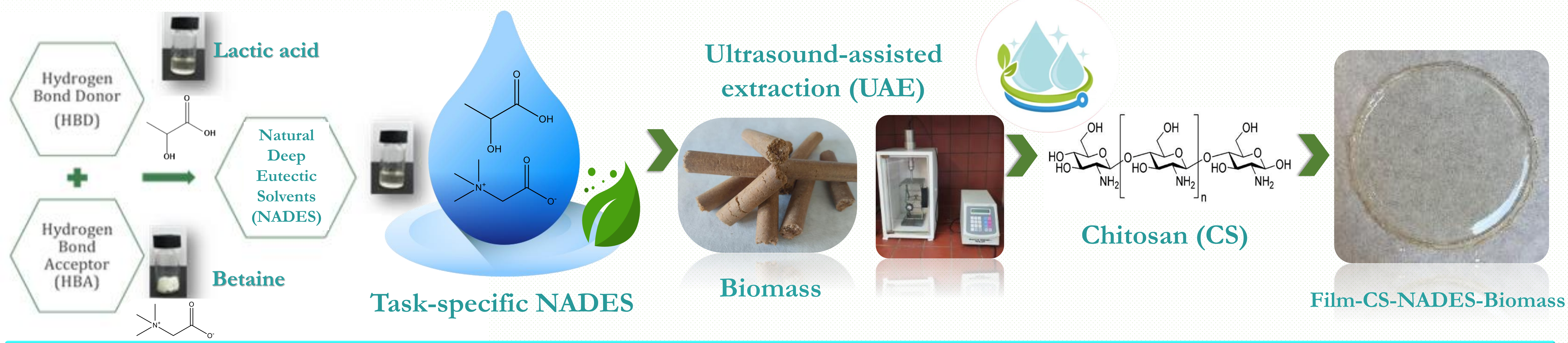
## Introduction

**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. **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. 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.

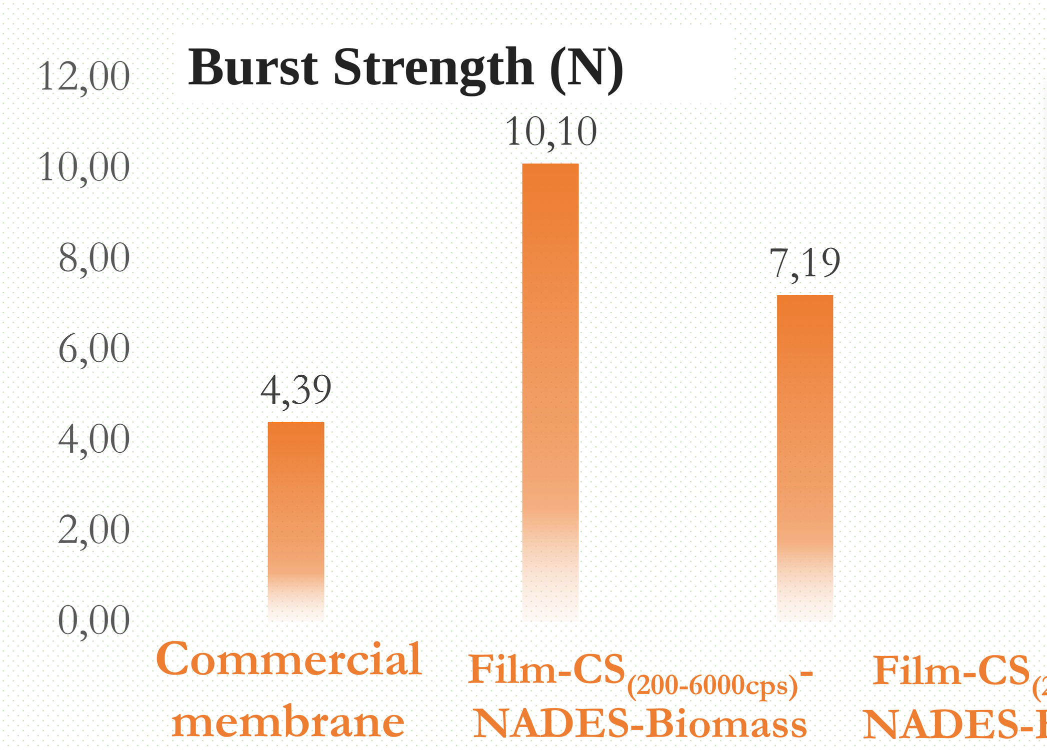
## Material & Methods

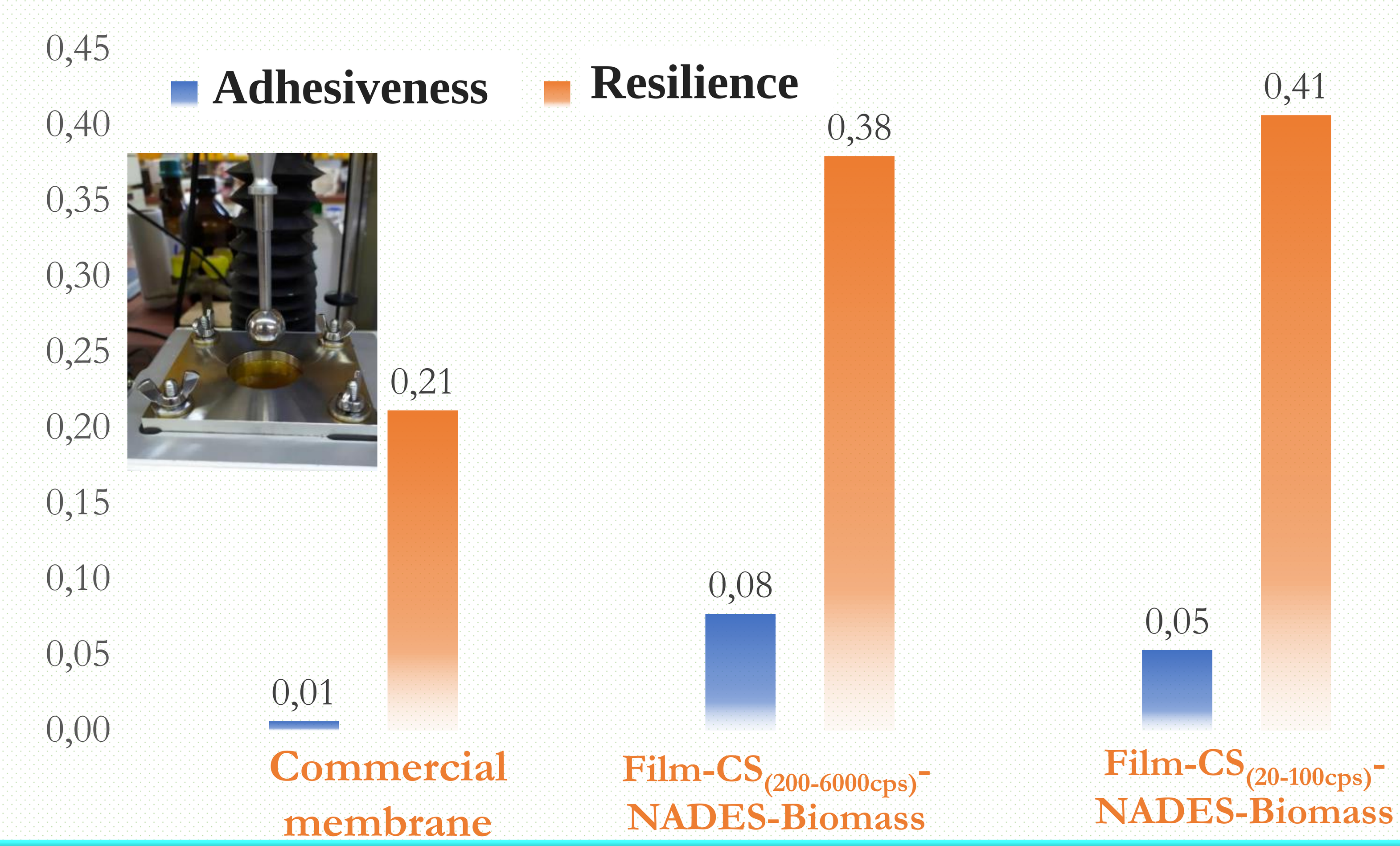



## Results & Discussion

### Mechanical properties of chitosan films

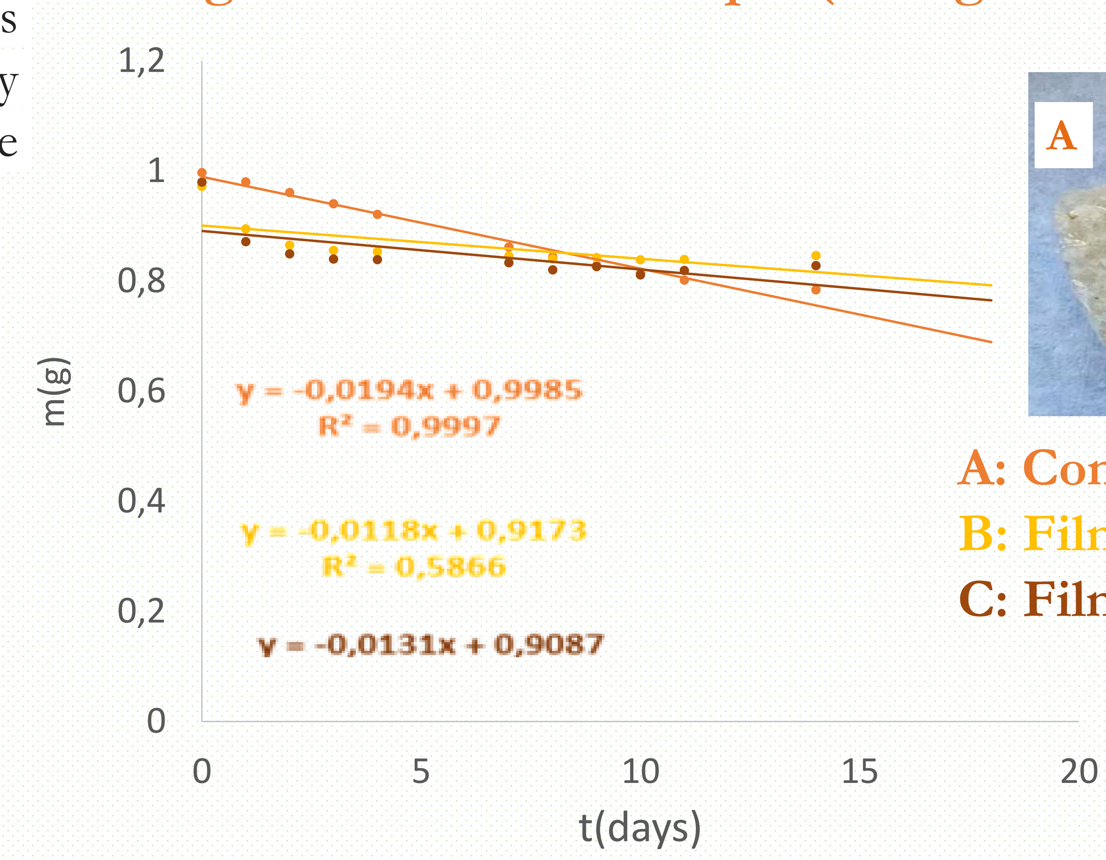
The mechanical properties of the films were studied using texture analyzer.. Burst Strength, adhesiveness and resilience of the films were determined as some of the most important mechanical properties for maintaining the integrity of food during processing, transportation, and storage. Preliminary results are summarized in the following diagrams.




### Chitosan-films as active packaging materials

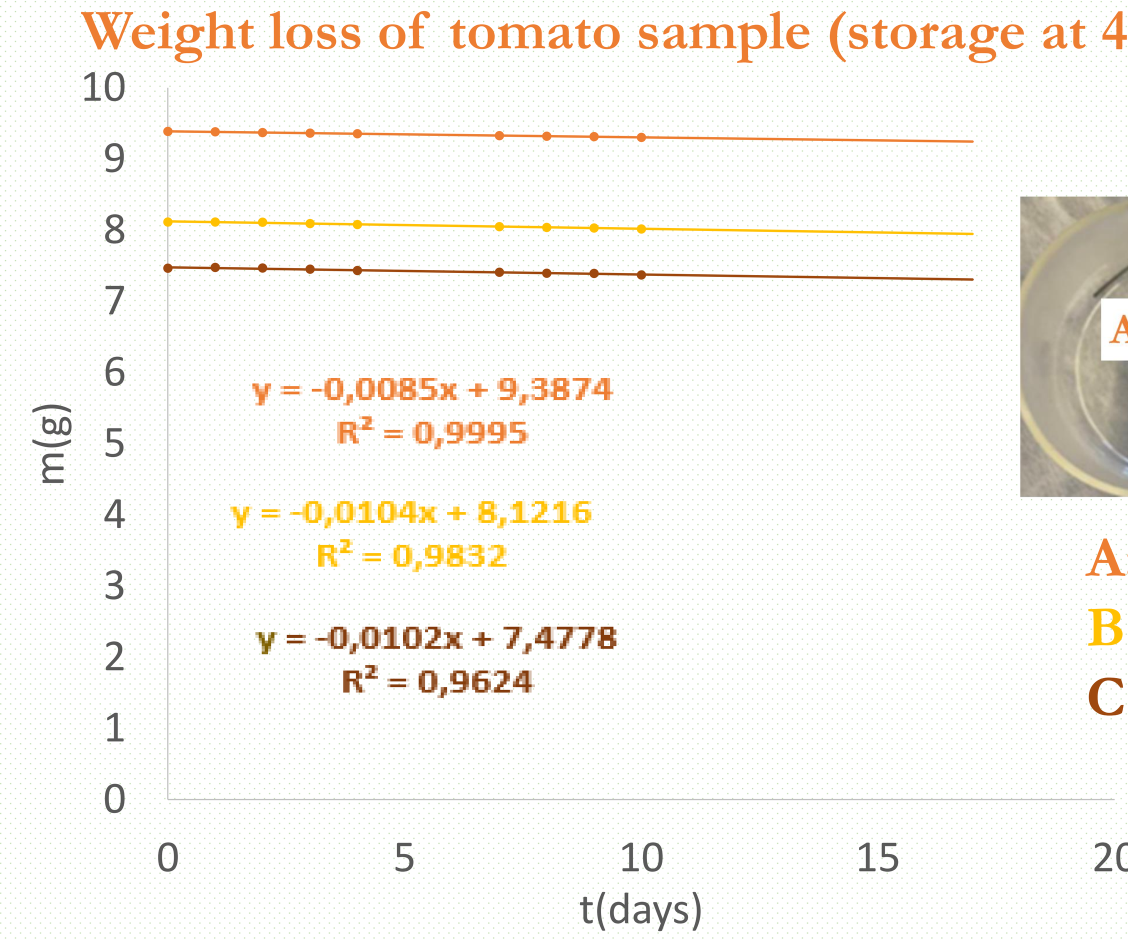
Weight loss of bread sample (storage at 4 °C)

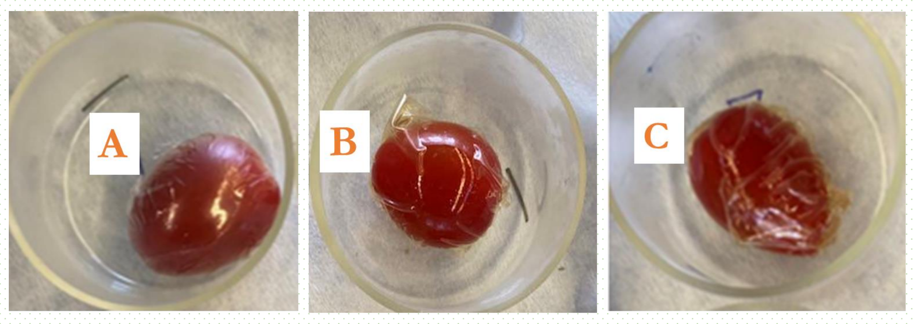




A: Commercial membrane
B: Film-CS(20-100cps)-NADES-Biomass
C: Film-CS(200-600cps)-NADES-Biomass

Weight loss of tomato sample (storage at 4 °C)




A: Commercial membrane
B: Film-CS(20-100cps)-Biomass
C: Film-CS(200-600cps)-Biomass

## Conclusions

- **Chitosan-NADES-Biomass based films** demonstrate **enhanced mechanical strength**, attributed to the synergistic interaction between chitosan, NADES, and biomass components.
- **Chitosan-NADES-Biomass films** exhibited **lower moisture loss** in bread samples compared to **commercial membrane.**
- The current results revealed the possibility of such films as a possible alternative to conventional **plastic-based materials as food coating** and **active packaging materials**.