

16-17 November, 2023

ASSESSMENT OF THE EFFECTS OF CHITOSAN-BASED BIODEGRADABLE FILMS ON THE ACTIVITY OF SOME SOIL ENZYMES AND ON THE SOIL MICROBIAL COMMUNITY

Mariana-Adina MATICA¹, Diana-Larisa ROMAN^{2,3}

¹Department of Chemistry-Biology, Institute for Advanced Environmental Research, West University of Timisoara, 4C Oituz, 300086, Timisoara, Timiș, Romania

²Faculty of Chemistry, Biology, Geography, West University of Timisoara, 16 Pestalozzi, 300115 Timisoara, Timiș, Romania

³Advanced Environmental Research Laboratories, West University of Timisoara, 4A Oituz, 300086, Timisoara, Timiș, Romania

Corresponding author email: mariana.matica@e-uvt.ro

Abstract: The objective of this study was to investigate the effect of biodegradable chitosan-nisin films on soil health by monitoring the effect on the activity of some enzymes found in soil (dehydrogenase, phosphatase and urease) and by assessing the effect on soil bacterial community over a period of 34 days.

• Introduction

Chitosan-based polymeric materials are widely used in various applications; therefore, it is inevitable that they will become waste products. Assessing the biodegradability of such materials gives a better understanding on how we can develop a sustainable waste management.

• Materials and methods

A medium molecular weight chitosan was used to prepare chitosan-based films containing different concentration of nisin (5 mg/mL and

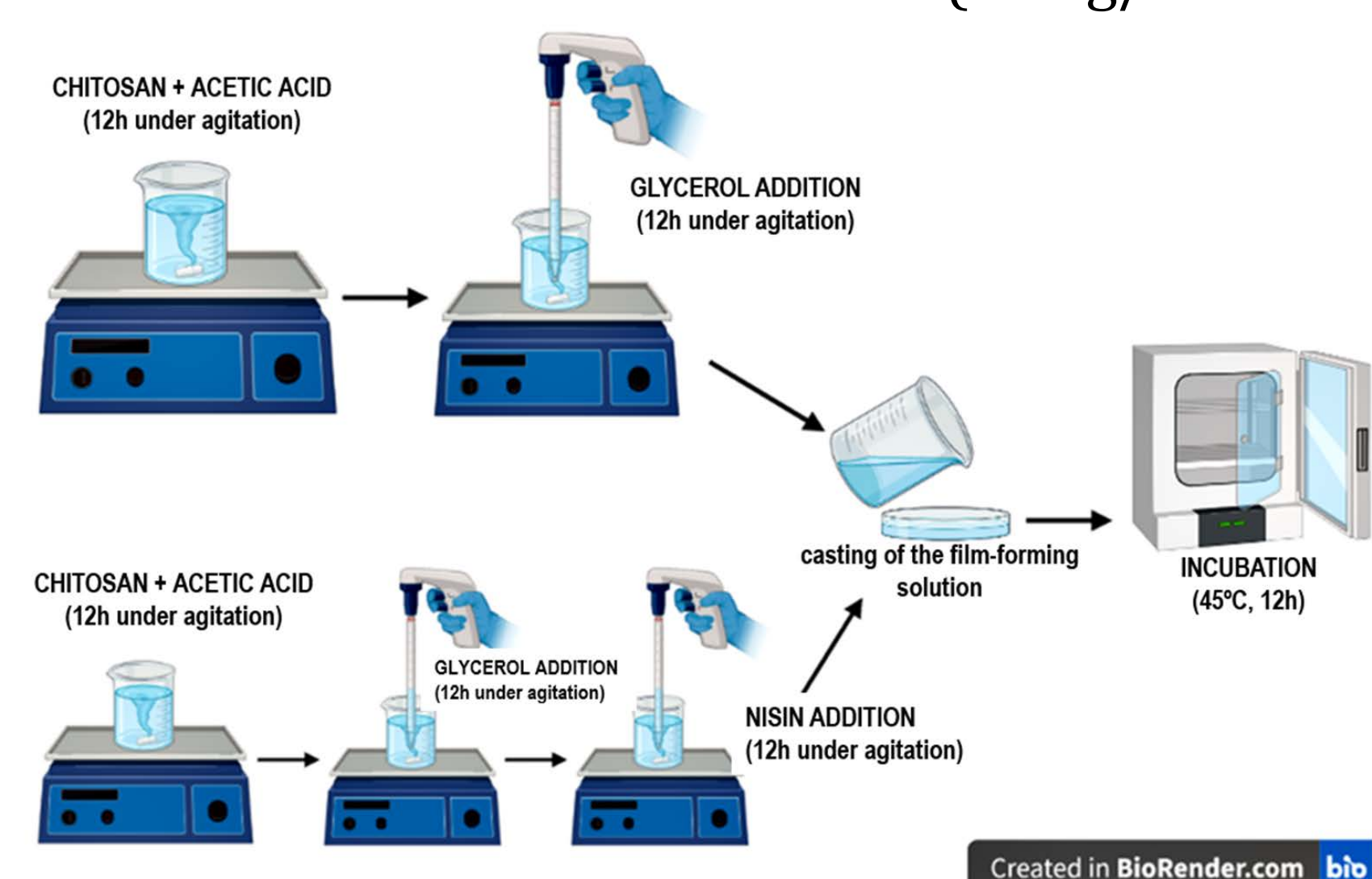


Figure 1. Schematic representation of the solvent casting method



Figure 2. Digital images of chitosan-based films

The biodegradability studies were performed by placing chitosan-based films in soil and by monitoring their decompositions over a period of 34 days.

Acknowledgement: This work was supported by the ERA-Net COFASP Project "Biotechnological tools implementation for new wound-healing applications of byproducts from the crustacean seafood processing industry-Chitowound (project no. PN3-P3-284/4/2017 program H2020, financed by the Romanian National Authority for Scientific Research UEFISCDI).

• Conclusions

Given the results we obtained, chitosan-nisin films may be used in several applications, such as biodegradable packaging or wound dressings, and due to their good biodegradability, they represent a safe alternative for the environment as well.

• Results and discussions

The result of our study showed that chitosan-based films, do not affect the soil bacterial community, as chitosan and chitin by-products are known to represent carbon sources for microorganisms. Chitosan-nisin films did not affect the enzymatic activity, monitored at different intervals, over a period of 34 days.

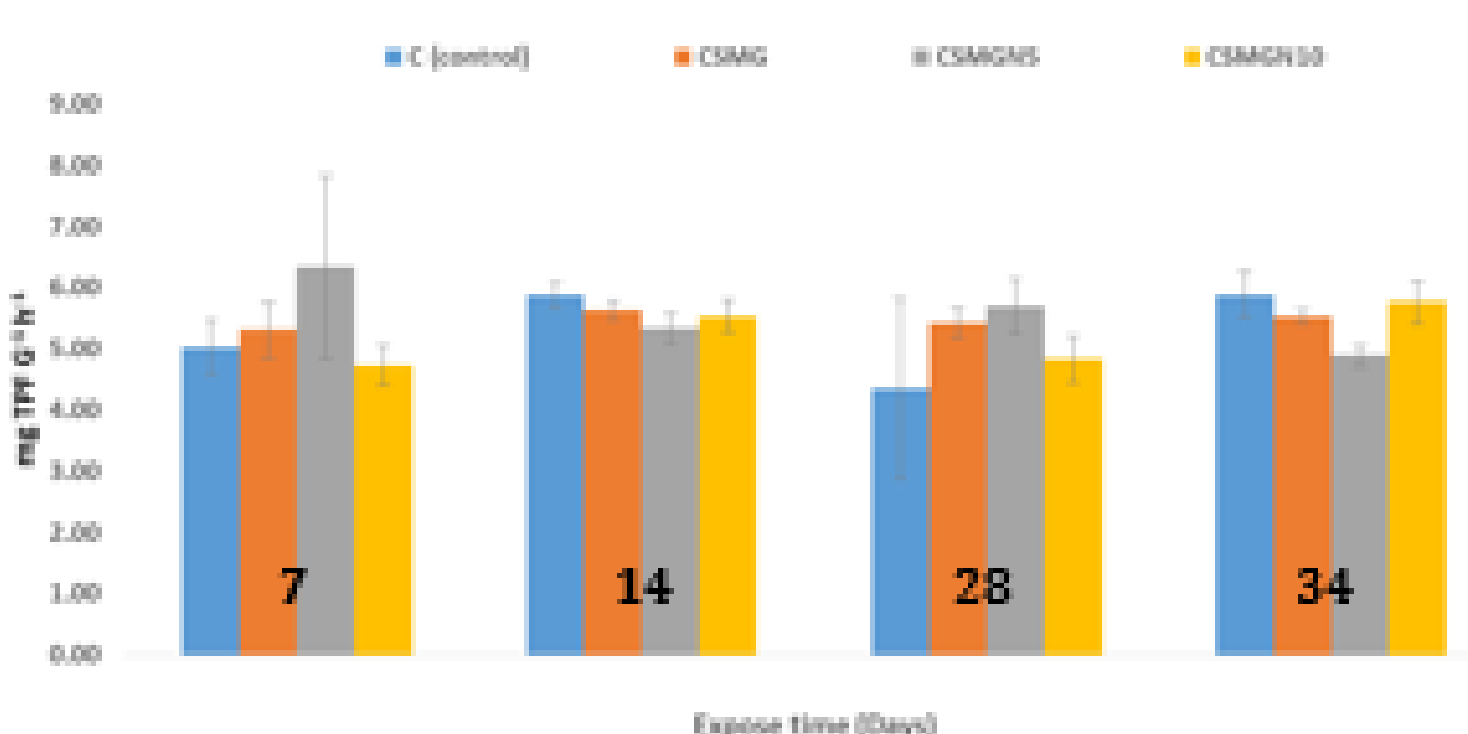


Figure 4. Dehydrogenase activity in soil

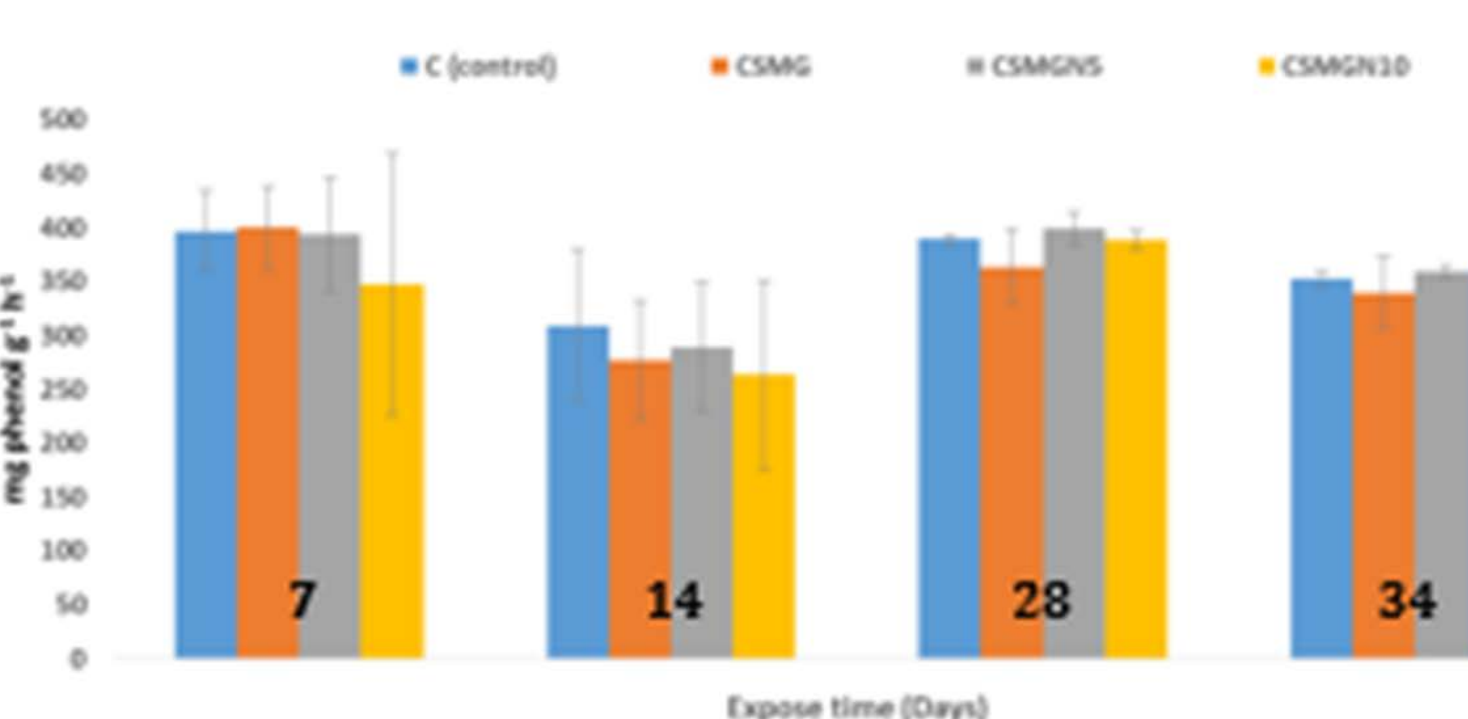


Figure 5. Urease activity in soil

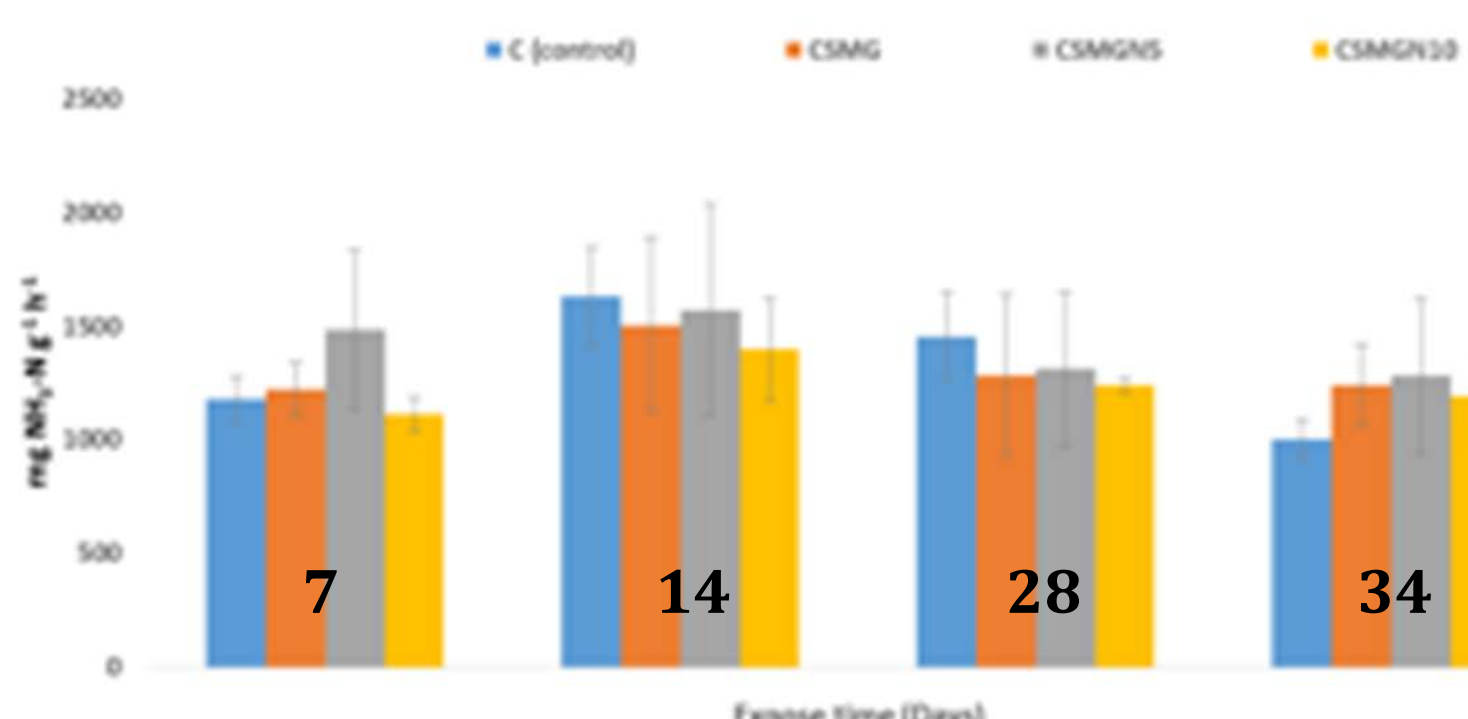


Figure 5. Phosphatase activity in soil

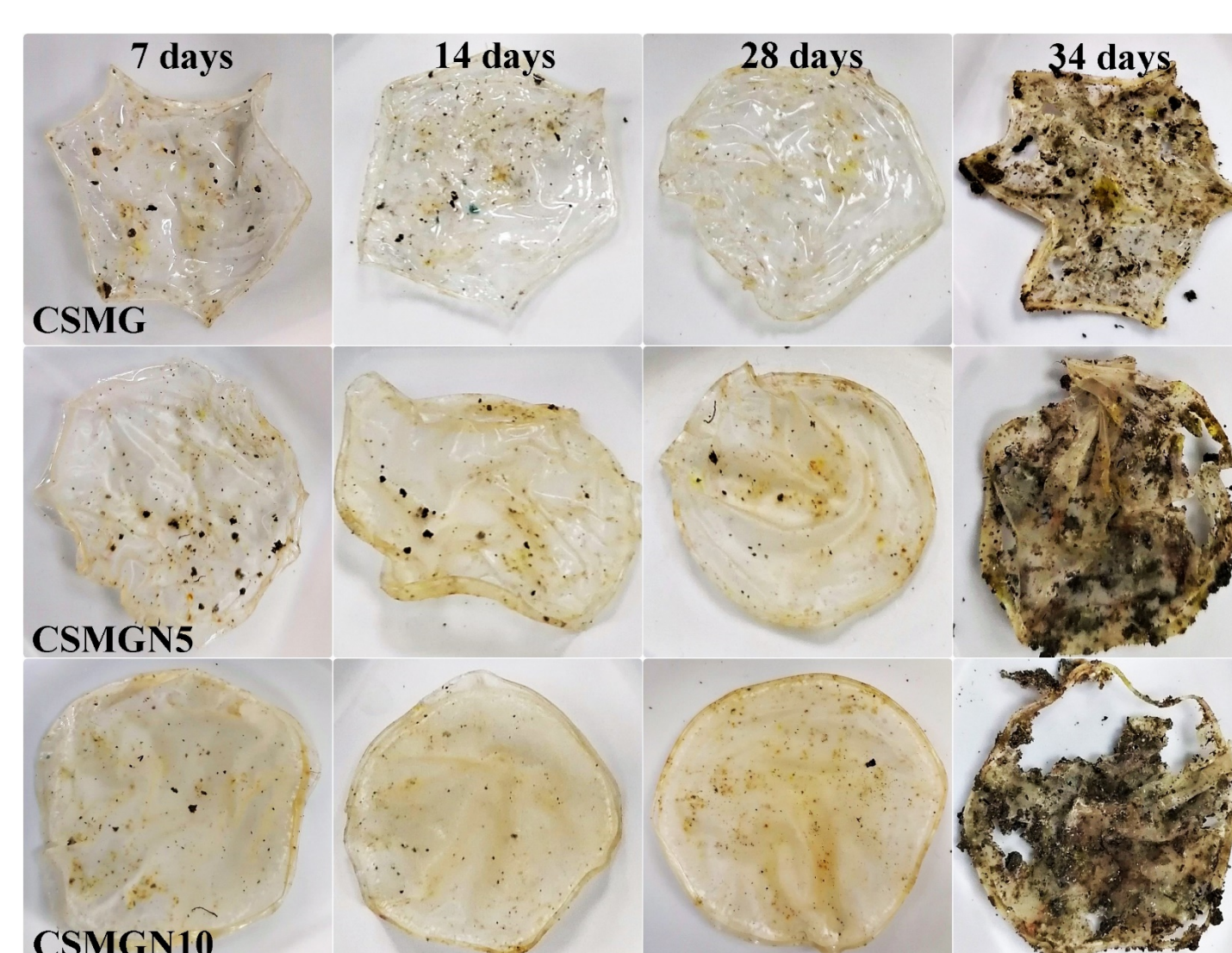


Figure 6. Biodegradability of chitosan-based films

The enzymatic activity in soils was not affected by the degradation of chitosan films. Soil biodegradability test showed that chitosan-based films have a high rate of degradation, and this is a great advantage when considering environmental issues.

The availability of chitosan as a waste byproduct generated by the seafood processing industry is a topic that lines up with the interest of current scientific research, which is to enhance exploitable resources in the context of the circular and sustainable economy.

Microbial count was higher compared to the first day of monitoring, due to the degradation of chitosan-films and the use of chitosan-byproducts as carbon source.

