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PRELIMINARY INVESTIGATIONS REGARDING THE RELEASE OF ANTIMICROBIAL PEPTIDES FROM CHITOSAN-BASED FILMS

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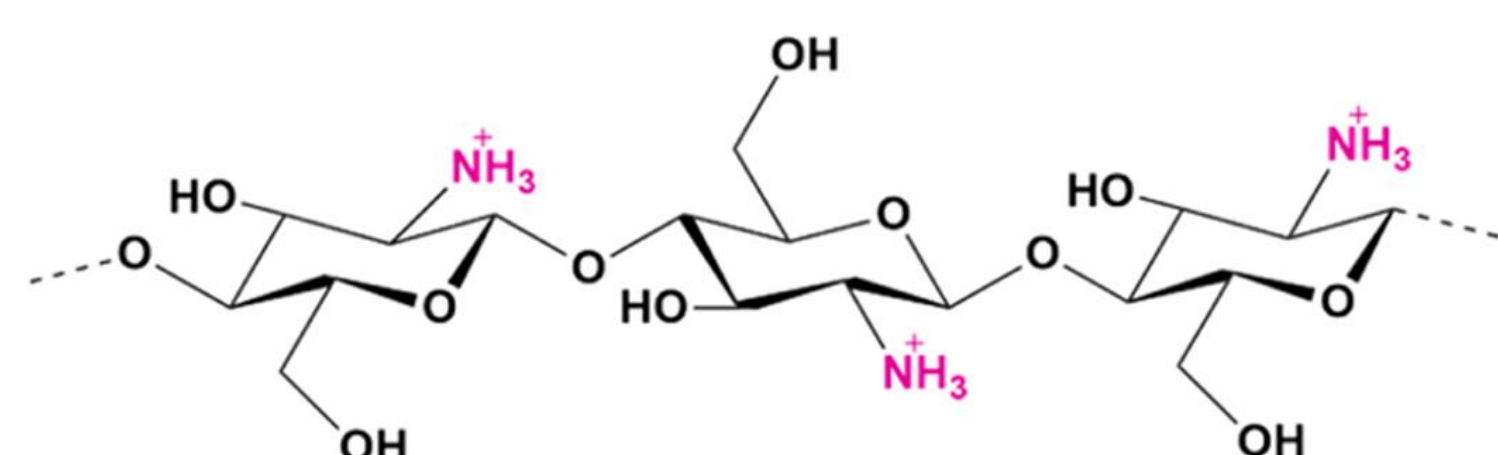
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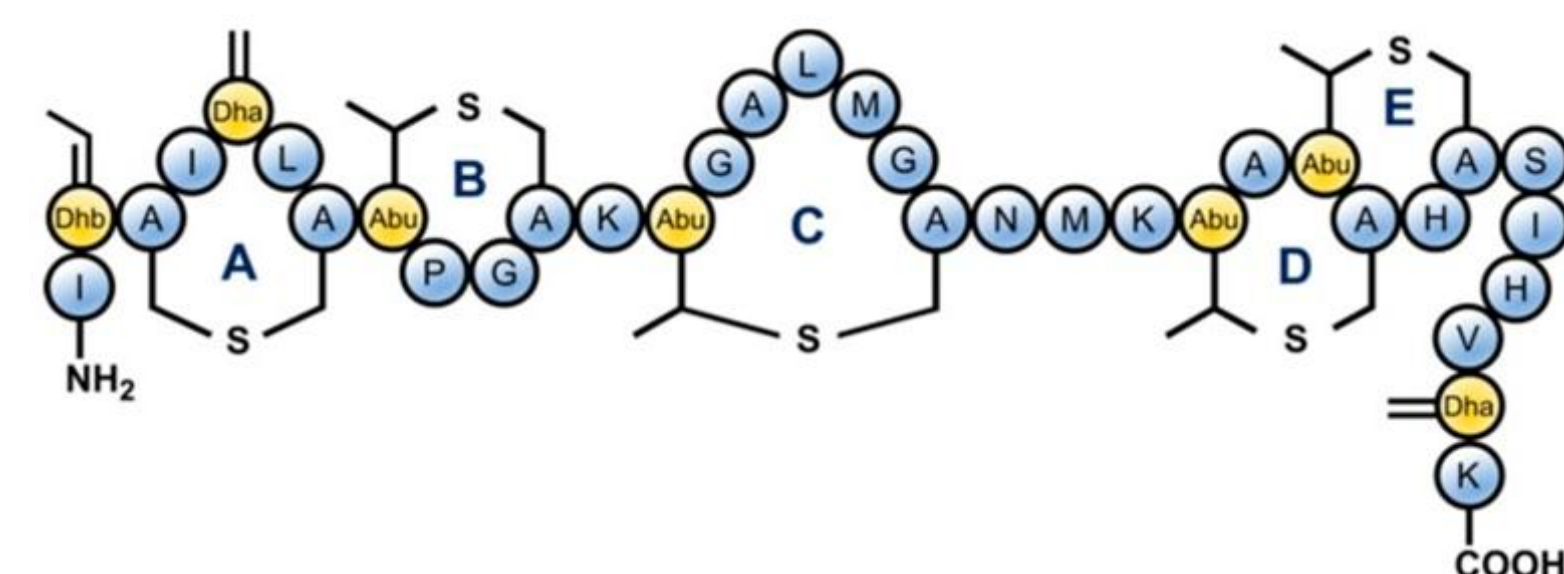
Abstract: The study aimed to investigate the controlled release of nisin, an antimicrobial peptide, from chitosan-based films for potential use in wound dressings. Nisin is valued for its antimicrobial properties and wound-healing potential. On the other hand, chitosan represents a suitable matrix for the delivery of antibiotics. The study found that nisin was gradually released from the films, with the highest release rate in the initial four hours, especially in acidic conditions. Film degradation occurred only in the presence of lysozyme. Overall, chitosan-based films show promise for delivering nisin in biomedical applications, particularly in antibacterial wound dressings.

• Introduction

Chitosan, the deacetylated form of chitin, is a cationic polymer found in crustaceans and mushrooms. It is renowned for its antimicrobial and wound-healing properties, low toxicity, and film-forming capacities. Recently, chitosan has gained recognition for its use in wound dressing materials.



On the other hand, nisin, a polycyclic cationic peptide, is widely known for its role in the food industry as a food preservative (E234). It holds a GRAS status, signifying it is Generally Recognized as Safe, and exhibits strong biocompatibility. As a result, nisin is finding new applications in the biomedical field as a substitute for conventional antibiotics. These two substances are frequently combined to address bacterial resistance in the context of skin lesions and other medical treatments.



• Materials and methods

Three types of chitosan-based films with varying nisin concentrations (0 mg, 5 mg, and 10 mg) were created and two separate experiments were conducted.

1. Release of Nisin:

The first experiment focused on observing the release of nisin from these films. Different pH solutions (5.8 pH, 7 pH, 8.9 pH) were prepared. One film from each set was immersed in a specific pH solution. Spectrophotometric measurements were taken at regular time intervals over 72 hours to monitor the release of nisin in various acidic conditions.

2. In Vitro Degradation:

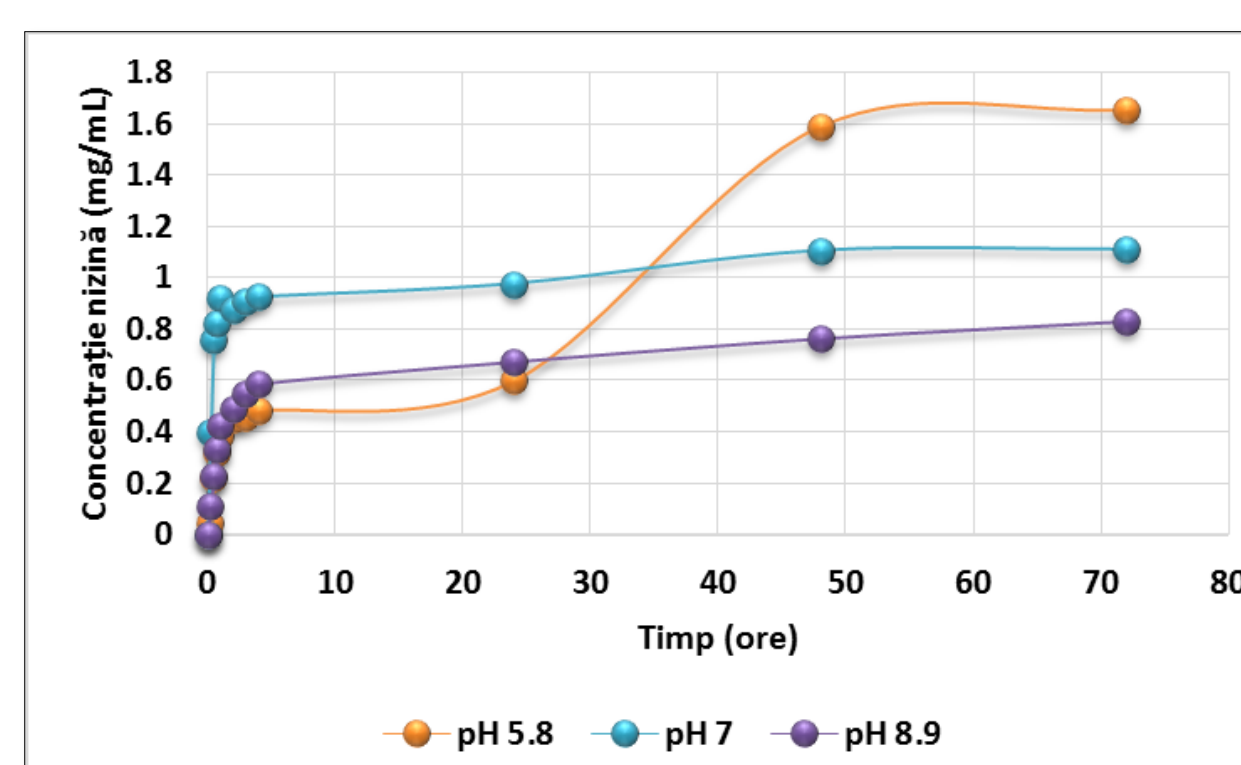
The second experiment involved monitoring the *in vitro* degradation of the chitosan-based films. Degradation was assessed in different media, including PBS (Phosphate Buffer Saline), PBS-lysozyme, and SBF (Simulated Body Fluid)

Acknowledgement:

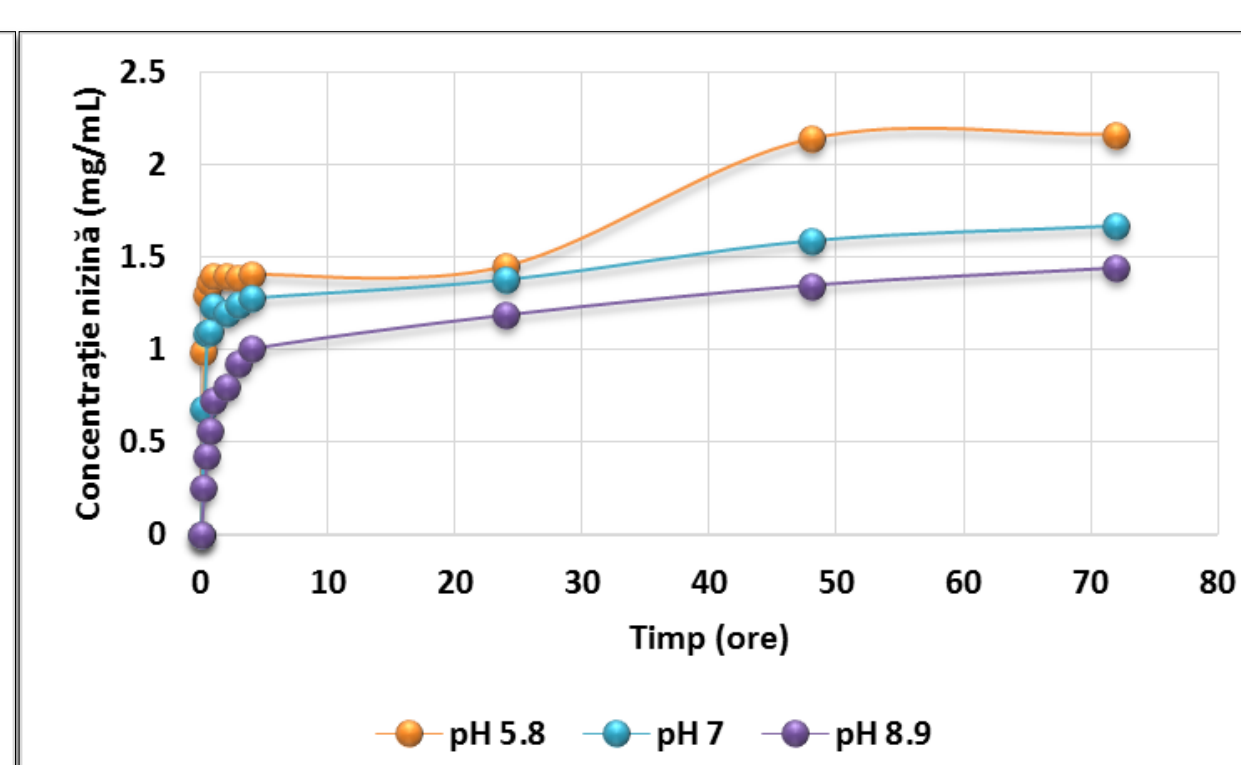
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• Results and discussions

The release of nisin was characterized by an initial spike, followed by a sustained liberation. Notably, the release of nisin was more effective in acidic solutions, resulting in the highest concentration being discharged from the chitosan-based films.

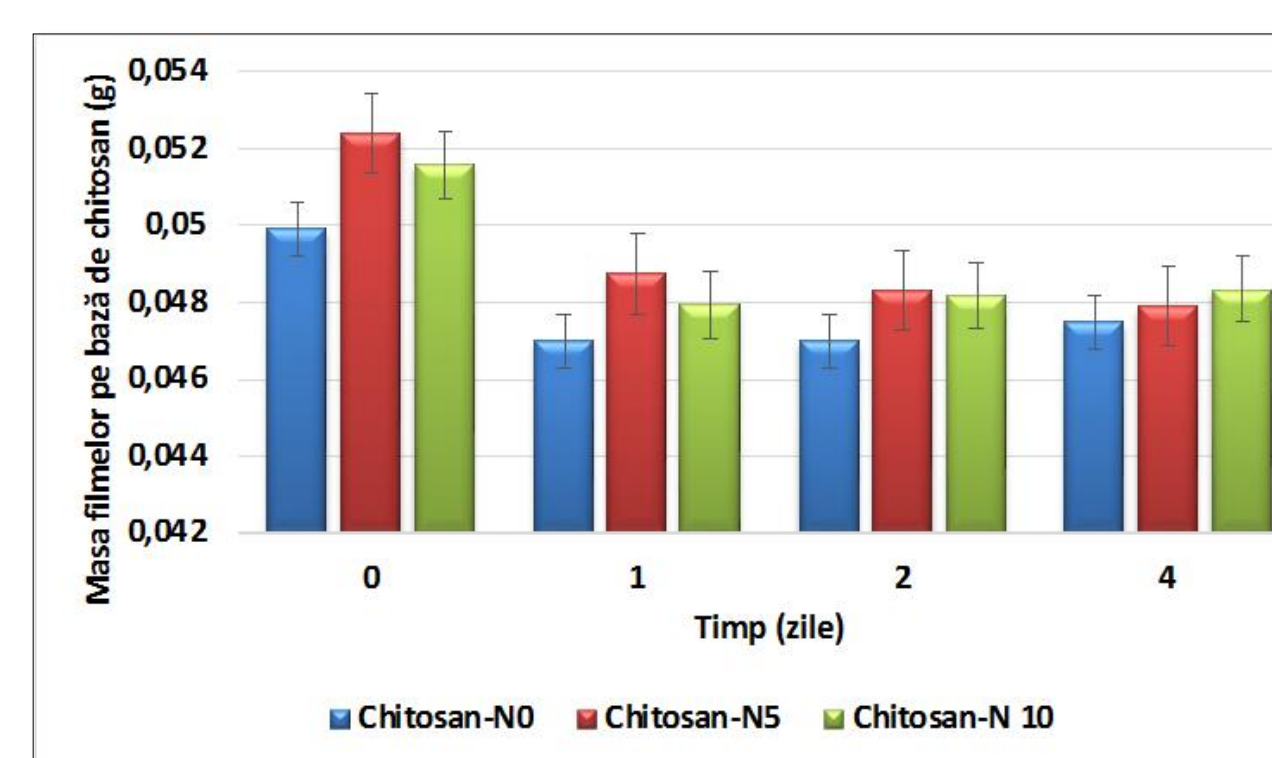


The release of nisin at different pH levels from Chitosan-N5 films (5 mg/mL nisin)

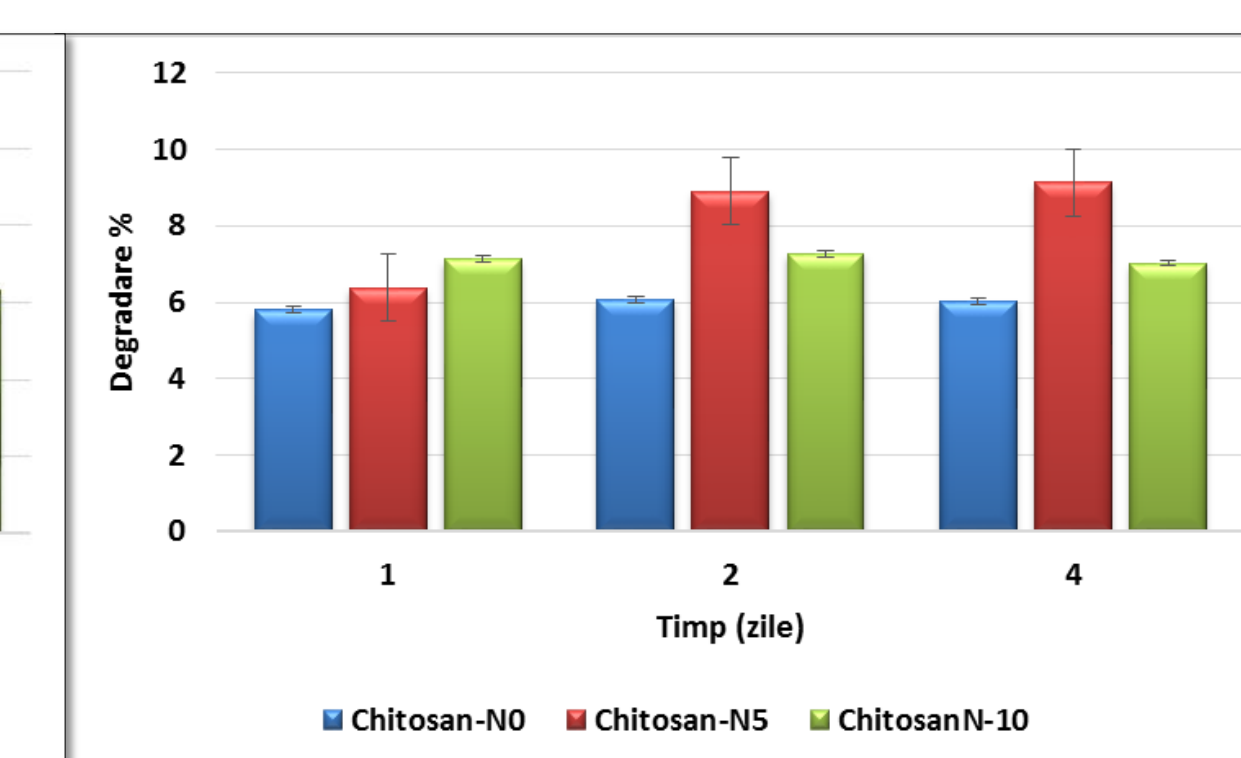


The release of nisin at different pH levels from Chitosan-N10 films (10 mg/mL nisin)

In contrast, the *in vitro* degradation was found to be closely linked to the presence of lysozyme, which facilitated the breakdown of the films. Interestingly, in PBS and SBF, degradation results were either zero or negative, whereas, with lysozyme, a 7% degradation rate was observed after four days of monitoring.



The degradation rate of chitosan-based films in lysozyme



• Conclusions

Chitosan serves as an ideal matrix for delivering various substances due to its accessibility and excellent biocompatibility. Antimicrobial peptides, in turn, represent a significant advancement in combatting the ongoing bacterial resistance crisis against conventional antibiotics. Additionally, the sustained release of nisin in an acidic pH environment is advantageous, particularly in the context of skin lesions, where the skin's pH is acidic. Prolonged antibiotic delivery can effectively combat infections under these conditions.