

Rosemary Chitosan Antifungal Packaging Film for Food Preservation

Akshaya Pradhul

Sahrdaya College of Engineering and Technology, Kodakara, Thrissur, Kerala, India

Annabel Vilson

Sahrdaya College of Engineering and Technology, Kodakara, Thrissur, Kerala, India

Anjali Krishna. K

Sahrdaya College of Engineering and Technology, Kodakara, Thrissur, Kerala, India

Nitha Parvin C

Sahrdaya College of Engineering and Technology, Kodakara, Thrissur, Kerala, India

Abstract

The rapid spoilage of bakery products due to fungal contamination poses a significant challenge in food preservation and contributes substantially to food waste. This project focuses on developing a natural, eco-friendly, and cost-effective solution through a rosemary–chitosan nano-encapsulated wrap designed to extend the shelf life of baked goods and reduce post-production food loss. Rosemary extract, known for its potent antifungal and antioxidant properties, is combined with chitosan, a biodegradable polymer with natural antimicrobial activity. The formulation was nano-encapsulated using the ionic gelation method with sodium alginate as a crosslinking agent to enhance stability and enable controlled release of bioactive compounds.

The prepared nanoparticles were coated onto food-grade paper to produce an active antimicrobial wrapping film. Experimental evaluations will assess antifungal efficiency against common spoilage fungi in bakery products. In addition, *in silico* molecular docking using AutoDock Vina and PyRx software will analyze the interactions of rosemary bioactive compounds and chitosan oligomers with key fungal target proteins such as Rhizopus pepsin, glucoamylase, lipase, and chitin deacetylase.

This combined experimental and computational approach aims to validate the antifungal potential of the developed wrap while demonstrating its potential as a sustainable packaging strategy for extending shelf life and reducing food waste in bakery products. The study highlights a low-cost, scalable methodology suitable for small laboratories and emphasizes the practical use of natural bioactive compounds for sustainable food preservation.