Efficacy of Chitosan and Alginate-Based Gels for Inhibition of *Botrytis cinerea* and *Penicillium expansum* in Strawberries and Blueberries

Abstract

Post-harvest fungal decay is a major issue in the berry industry, particularly caused by *Botrytis cinerea* (gray mold) and *Penicillium expansum* (blue mold), which reduce the shelf life and marketability of fruits. This study investigates the effectiveness of chitosan and alginate-based gel coatings for controlling post-harvest decay in strawberries and blueberries. The gels, incorporated with natural antimicrobial agents such as essential oils, were applied to the fruits, forming a protective barrier against pathogens while reducing moisture loss and preserving fruit quality. Chitosan (1-2%) and sodium alginate (1-2%) solutions were prepared, adjusted to optimal pH, and applied to fresh berries. Control samples were treated with water. Fruits were stored at 4°C and 20°C, and fungal decay was monitored over 14 days. The results showed that chitosan-based coatings significantly reduced *Botrytis cinerea* growth in strawberries, while alginate-based gels were more effective against *Penicillium expansum* in blueberries, reducing decay by 35-40%. The gels also maintained fruit firmness and reduced water loss. Additionally, the coatings extended the shelf life of both fruits by 4-5 days compared to untreated controls. This study demonstrates that gel-based coatings, particularly chitosan and alginate, provide an effective and sustainable method for controlling post-harvest decay in berries. This approach not only enhances fruit shelf life but also offers a natural alternative to synthetic fungicides, supporting eco-friendly agricultural practices and reducing food waste. Further research on formulation optimization and large-scale implementation is recommended for broader commercial adoption.