Acta Scientific AGRICULTURE (ISSN: 2581-365X)

Volume 9 Issue 6 June 2025

Research Article

# Control of "*Citrus sinensis*" Postharvest Losses by the Use of Natural Polymer Glazer

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**Received:** February 14, 2025

**Published:** May 20, 2025



## Abstract

The use of mucilage as a natural polymer, extracted from waste flowers of roadside plants, can aid in preserving the quality of harvested vegetables and reducing losses during post-harvest transport. A natural coating was developed using mucilage powder combined with protein and lipid complexes. Mucilage from *Spathodeacampanulata* enhances the water content, relative water content, succulence, and osmotic potential of Citrus sinensis (orange), which helps maintain the turgidity of the fruit. When this coating is applied to Citrus sinensis, it significantly increases the postharvest shelf-life of the vegetables. The presence of strong starch bonds in the range of 1200 to 700 cm-1 indicates freshness, while turgidity reflects the quality of the vegetables and fruits. Applying various concentrations of the natural coating to Citrus sinensis notably enhances their turgidity and water content, helping to preserve their freshness and extend their shelf life. This approach also mitigates further deterioration during storage after harvest, proving beneficial for maintaining the quality of Citrus sinensis during marketing. Overall, the application of *Spathodeacampanulata* mucilage coating shows promise for improving the post-harvest management of Citrus sinensis in the future.

**Keywords:** Post-Harvest Physiology; Osmotic Potential; Relative Water Content; Succulence; LCMS

## Introduction

Applying edible coatings to various fleshy fruits helps extend their shelf life and protects them from environmental factors. Such coatings enhance food quality and prolong the freshness of produce [1]. Using natural polymers as coatings for fruits and vegetables strengthens their structural integrity while preventing moisture loss and oxidative reactions. When mucilage comes into contact with a surface, it forms a soothing layer over the exposed area. This emollient effect of mucilage also protects the digestive tract lining, suggesting its potential as a remedy for ulcers, lesions, and inflammation in the gastrointestinal tract, while inhibiting acid secretion. *Spathodeacampanulata* P. Beauv., commonly known as the fountain tree or pichkari in Marathi, belongs to the Bignoniaceae family. This semi-deciduous tree has a dense, bushy crown and produces ornamental flowers that can be seen from afar. It is widely grown in gardens and along roadways. In contrast, synthetic polymers such as cellulosic, acrylics, and vinyl are used for film coatings in various pharmaceutical formulations. However, these synthetic materials can lead to ecological and health issues. Therefore, plant-based natural polymers, with their polysaccharides, are a more environmentally friendly, biodegradable, and biocompatible alternative.

## Material and Methods

The coating of fruits was carried out following the method outlined by [8]. Absorbance measurements were taken on the 1st, 4th, 8th, and 12th days, which were then used to calculate water content, relative water content, succulence, and osmotic potential. These calculations followed the methods established by [2] for water content, [3] for succulence, [4] for relative water content (RWC), and [5] for osmotic potential.

## Results and Discussion

The impact of the natural mucilage coating on the post-harvest storage of *Citrussinensis* (orange) is illustrated in figures 1 and 2, as well as tables 1 and 2, and plate 1. The data clearly shows that the mucilage coating significantly enhances water content, relative water content, succulence, and osmotic potential. It is also observed that fresh *Citrus sinensis*fruits coated with mucilage and stored in cool conditions or at room temperature retain better turgidity and water balance compared to those without the coating. While quality cannot be improved post-harvest, it can be maintained, emphasizing the importance of harvesting fruits, vegetables, and flowers at their optimal stage and size for peak quality. Edible coating technology is considered a promising solution for this purpose. Renewable resources such as lipids, polysaccharides, and proteins used in edible coatings can act as barriers to water vapor, gases, and other solutes, as well as serve antimicrobial and antioxidant functions, ultimately enhancing the quality and extending the shelf life of fresh and minimally processed produce [6].

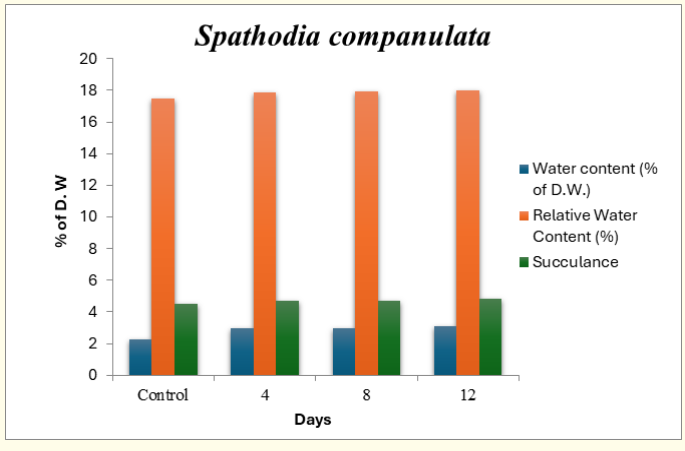


**Figure 1:** Effect of *Spathodiacampanulata* Mucilage extract on Post harvest shelf life of *Citrus sinensis*(Orange) stored in Cold condition.

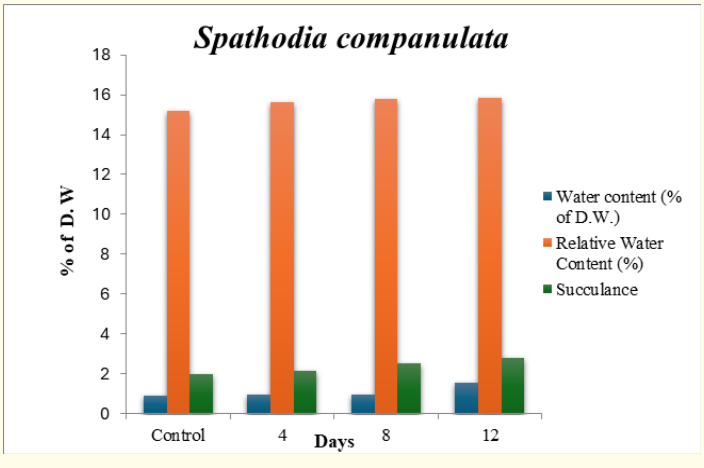


**Figure 2:** Effect of *Spathodiacampanulata* Mucilage extract on Post harvest shelf life of *Citrus sinensis*(Orange) stored in Cold condition.

| Treatment EC(mS $cm^{-1}$) | *Spathodiacampanulata* | | | |
|---|---|---|---|---|
| | **Control** | **4** | **8** | **12** |
| Water content (% of D.W.) | 2.278 | 2.94 | 2.98 | 3.08 |
| Relative Water Content (%) | 17.45 | 17.89 | 17.92 | 17.98 |
| Succulance | 4.52 | 4.68 | 4.72 | 4.81 |
| Osmotic potential | -2.12 | -2.19 | -2.21 | -2.18 |

**Table 1:** Effect of *Spathodiacampanulata* Mucilage extrct on *Citrus sinensis*(Orange) at cold condition.

| Treatment EC(mS $cm^{-1}$) | *Spathodiacampanulata* | | | |
|---|---|---|---|---|
| | **Control** | **4** | **8** | **12** |
| Water content (% of D.W.) | 0.924 | 0.946 | 0.953 | 1.562 |
| Relative Water Content (%) | 15.19 | 15.62 | 15.79 | 15.86 |
| Succulance | 1.98 | 2.16 | 2.52 | 2.79 |
| Osmotic potential | -1.99 | -2.03 | -2.10 | -2.12 |

**Table 2:** Effect of *Spathodiacampanulata*Muilage extract on *Citrus sinensis*(Orange)at room temperature.

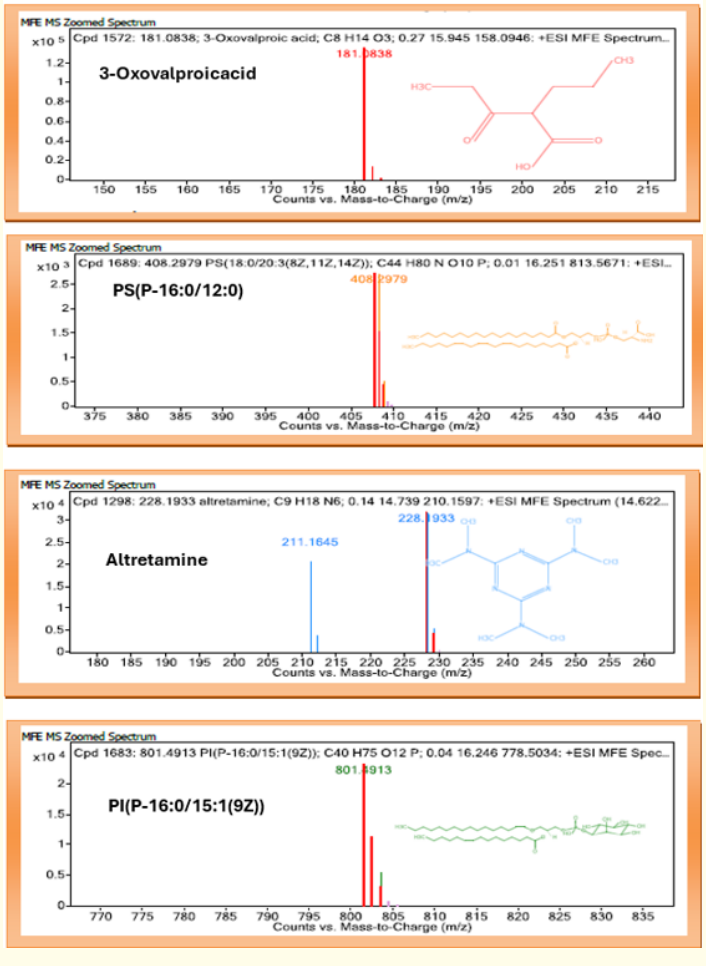


**Plate 1:** LCMS fragments and structure of the compounds detected in mucilage of flowers of *Spathodeacampanulata*.

Succulence is commonly regarded as an anatomical trait associated with plants that have developed significant water storage tissues [3] in one or more plant organs. The water content in food is crucial, affecting physical properties, technological processes, microbiological stability, and shelf life, along with legal and economic implications [7] Water is the predominant component in most fruits and vegetables, and relative water content (RWC) is considered an effective indicator of plant water status regarding the physiological effects of cellular water deficits. Thus, RWC is a relevant measure of plant hydration influenced by leaf water potential and osmotic adjustments. The mucilage extract from *Spathodeacampanulata* flowers after analysis by LC-MS contains significant compounds such as PI (P-16:0/15:1(9Z), PI (18:1(9Z)/15:0), Dihydromacarpine, JSTX-3, Fendiline, 2-Hydroxypromazine, Glucocerebrosides, 3-Oxovalproic acid, Dikegulac, 2-Hydroxymestranol, Ile Asp, and Altretamine. Analysis complements LC-MS by providing data on small polar compounds like organic acids, sugars, amino acids, and sugar alcohols [4] LC-MS is a technique used for the separation, identification, and quantification of phytochemicals from plant extracts. Natural products tend to exhibit higher bioactivity due to the sequential binding of various proteins during their biosynthesis.

The natural coating was formulated using mucilage powder combined with protein and lipid complexes. This coating, derived from *Spathodeacampanulata*mucilage, enhances water content, relative water content, succulence, and osmotic potential in Citrus, helping to preserve their turgidity. Turgidity is a key indicator of freshness in fruits and vegetables. The application of various concentrations of this natural coating significantly improves the turgidity and water content of Citrus, aiding in the preservation of their freshness and shelf life. Therefore, using mucilage as a natural polymer extracted from the waste flowers, fruits, and leaves of roadside plants can help maintain the quality of harvested fruits, reduce post-harvest losses, and delay deterioration during storage and transport.

## Conclusion

Mucilage possesses excellent swelling properties and viscosity that make it suitable for formulating gels, jellies, creams, and other semi-solid drug dosage forms. Additionally, dried mucilage has favorable flow characteristics that are ideal for direct compression formulations. LC-MS is a technique used for the separation, identification, and quantification of phytochemicals from plant extracts. Natural polymers are cost-effective, biodegradable, and readily available, which can mitigate the biocompatibility issues and bioaccumulation associated with synthetic chemicals. These polymers also prolong drug release, making them advantageous for drug delivery systems. Therefore, this research highlights the potential sources of plant-based natural polymers that can be easily utilized in the pharmaceutical, cosmetic, textile, and agricultural industries.

## Acknowledgement

The authors are thankful to the Head, Department of Botany, Department of Microbiology and Food Technology, Shivaji University Kolhapur, and Vivekanand College Kolhapur (Empowered Autonomous) for providing laboratory and library facilities.

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