



A process for the development of Bio-polymer based edible coating materials from agricultural and food processing by-products

TECHNOLOGY AVAILABLE FOR TRANSFER

UNMET NEED AND OPPORTUNITY

India ranks second globally in fruit and vegetable production but faces the highest spoilage rates, around 25-30%. Factors like lacking post-harvest management, traditional on-farm storage, and infestations contribute to these losses which aggravated by limited cold chain facilities for storage and transportation. The escalating demand for edible coatings stems from their ability to form a uniform, invisible layer on fruits and vegetables, extending shelf life by regulating metabolic activities like moisture loss, respiration rate, and ethylene production while maintaining fruit firmness and aroma. Edible coatings are preferred over plastic ones for their cost-effectiveness, simplicity, and ability to prevent harmful microorganism growth during transportation and marketing. Currently, there is no sustainable method available to enhance fruit and vegetable shelf life, highlighting the urgent need for scalable, sustainable, and cost-effective solutions to reduce respiration rate, water loss, and protect against physical damage and microbial spoilage.

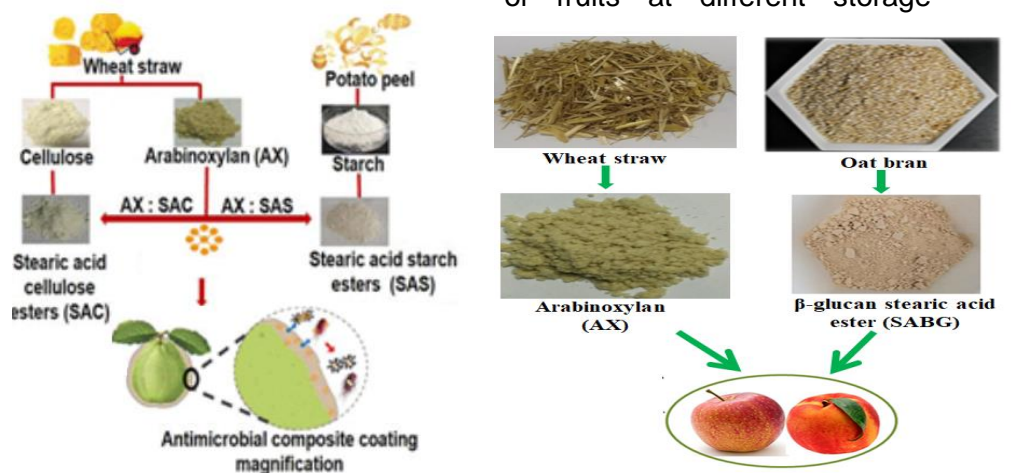
The present groundbreaking technology offers coating formulation based on polysaccharides from agricultural and food processing by-products such as "arabinoxylan-β-glucan stearic acid ester (AX-SABG)" and "arabinoxylan-cellulose fatty acid esters (AX-SAC) and arabinoxylan-starch fatty acid esters (AX-SAS) to extend the post-harvest quality of different varieties of fruits and vegetables such as for apples by 30-45 days under ambient storage. Further, the coating formulations also extended the shelf-life of fruits (peaches, guavas and bananas) up to 6-9 days under ambient storage.

TECHNOLOGY

The present technology comprises:

- AX-SABG emulsion (60:40, w/w) in the concentration range 1-4% reduced the weight loss, ripening index, color characteristics, polyphenol oxidase activity and increased the fruit firmness of varieties conditions (22°C at 65% and 85% relative humidity, RH).

- AX-SAC and AX-SAS emulsion in the concentration range 1-4% reduced the respiration rate, ethylene production rate, weight loss, color degradation, fruit softening enzymatic activity (PPO and POD), total phenolics, and flavonoid content.



process, ripening index,



STAGE OF DEVELOPMENT

TRL-4.

UNIQUE SELLING PROPOSITIONS

- **Quality** – Biocompatible, biodegradable and non-toxic.
- **Enhanced efficacy- AX-SABG**
 - a) AX-SABG coating has significant effect in reducing the weight loss, ripening index, color characteristics and polyphenol oxidase activity on fruits (apples) at different storage conditions 22°C at 65% and 85% RH for 30-45 days as compared to commercially available shellac coatings.
 - b) AX-SABG coating also significantly maintained the quality of fruits (apples) at 40°C, 50% RH up to 10-15 days as compared to un-coated fruits by reducing weight loss and retaining fruit firmness.
 - c) More pronounced effect in preventing loss of aroma volatiles (**45.6–99.5 µg/kg**) compared to shellac coated fruits such as peaches (24.4–26.4 µg/kg).
 - d) Reduced fruit decay rate (**4%**) in AX-SABG coating compared to shellac coated and uncoated fruits (8%).
 - e) AX-SABG coating is also effective in maintaining significantly higher hue value in the range of **54.4-55.1** compared to uncoated fruits hue value 49.7.

AX-SAC and AX-SAS

- f) Antimicrobial composite coating AX-SAC and AX-SAS significantly reduced the respiration rate, ethylene production rate, weight loss, color degradation, fruit softening process, ripening index, enzymatic activity (PPO and POD), total phenolics, and flavonoid content at 24°C as compared to the uncoated fruits and carnauba wax during storage.
 - g) Reduced microbial spoilage and retained aroma volatiles during storage in comparison with both uncoated and carnauba-wax-coated guavas.
 - h) Increased the shelf-life and quality of fruits compared to uncoated and carnauba-wax coated fruits.
- **Shelf-Life-** By forming a protective barrier around fruits and vegetables, the coating formulations extended shelf life of various perishable fruit crops and vegetables such as for apples by 30-40 days under ambient storage. Further, the coating formulations also extended the shelf-life of fruits (peaches, guavas and bananas) up to 6-9 days under ambient storage.
 - **Market demand-** Biopolymer-based edible coatings has substantial market demand, offering a viable alternative to conventional animal-derived waxes such as shellac.
 - **Cost effective-** AX-SABG, AX-SAC and AX-SAS serves as a cost-effective resource and is expected to be of low cost. **AX-SABG (1%) coating is ~Rs.0.5 (~50 paisa) to coat 1 kg of apples and the cost is comparable to food grade commercial wax/resin coating.**
 - **Toxicity-** Acute and chronic toxicological studies have shown no tissue related toxicity and mortality in mice.
 - **Ease of use** – Easy to prepare, biocompatible, non-toxic and can be seamlessly integrated into existing farm practices, requiring minimal training or investment in equipment.

APPLICATION

The agricultural sector, preferably farmers, is the user of this technology. After harvest, this coating formulation forms a protective layer, shielding the external factors such as moisture loss, microbial contamination, and physical damage during storage and transportation. As a result, the shelf life of the produce is extended, reducing spoilage and minimizing postharvest losses. Additionally, by addressing the demand for natural and sustainable coating solutions, this innovation holds immense potential to revolutionize the fruit and vegetable industry in



India, fostering economic growth and environmental stewardship.

INTELLECTUAL PROPERTY

Indian patent filed

LICENSING OPPORTUNITY

BCIL is looking for suitable Licensee for transfer of this technology.

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