Final Year Design Project Showcase
Batch-2022
Year 2026

	Department: Chemistry Programme: BS Chemistry
1	**Project Title** Development of Eco-Friendly Edible Coatings from Sugar Industry By-Products for Quality Preservation of Fruits/Vegetables
2	**Project Idea** Perishable foods like fruits and vegetables have a highly limited post-harvest shelf life heavily influenced by environmental conditions such as temperature and moisture. Pakistan's extensive sugar industry (comprising around 99 mills) generates a vast surplus of agricultural by-products, including filter mud, bagasse, and molasses. A key valuable component extractable from these by-products is sugarcane wax (SCW). This project evaluates the novel application of sustainable, bio-based sugarcane wax as a core component in protective edible coatings to regulate gas exchange, reduce transpiration, delay metabolic ripening, and expand the market life of highly perishable commodities like persimmons.
3	**Process** Sugarcane wax (SCW) pellets were used as the lipid component for the preparation of the edible coating. Initially, aloe vera gel was homogenized with the required additives to obtain a uniform coating matrix. The SCW was then incorporated into the formulation under continuous stirring and homogenization to produce a stable and homogeneous coating emulsion. Fresh tomatoes were washed, air-dried, and coated by the dipping method, in which each fruit was completely immersed in the coating solution for a predetermined time. The coated tomatoes were removed, allowed to drain, and dried at room temperature to form a thin, uniform edible coating on the fruit surface before storage experiments. The overall preparation and application procedure is illustrated in **Figure 1**.
4	**Outcome** The highly stable, cost-effective and non-toxic biopolymer edible coating successfully minimized the physiological weightloss and securely preserve the structural and chemical attributes of Persimmons under both temperature conitions.
5	**Evidence (Theoretical Basis)** The SCW-based edible coating formulations demonstrated suitable physicochemical and microbiological properties, including good emulsion stability, appropriate solid content, slightly acidic pH, and low bacterial and fungal counts, supporting their suitability for use as edible coatings on tomatoes **(Table 1)**. **Table 1. Physicochemical and microbiological characteristics of SCW-based edible coating formulations**

	Coating formulation code	Emulsion stability (%)	Percent solid content (%)	pH	TBC (CFU/mL)	TFC (CFU/mL)
	G1	93.53 ± 1.83	1.96 ± 0.51	4.45 ± 0.21	2.6×10^2	1.1×10^2
	G2	96.71 ± 0.11	2.90 ± 0.23	4.47 ± 0.10	2.5×10^2	1.0×10^2
	G3	94.43 ± 0.64	3.92 ± 0.41	4.61 ± 0.10	3.4×10^2	1.4×10^2
	G4	91.88 ± 0.66	4.02 ± 0.11	4.53 ± 0.10	3.0×10^2	2.7×10^2

6 **Competitive Advantage or Unique Selling Proposition**

Process Improvement :

Traditional industrial wax coatings often incorporate non-consumable, toxic, or highly expensive synthetics that demand complex processing steps. In contrast, this process successfully upcycles a massive, low-cost industrial by-product of regional sugar mills (sugarcane wax) into a value-added, entirely edible biopolymer barrier. The extraction and formulation utilize accessible chemicals, making it exceptionally cost-efficient, safe for direct consumer intake, and easily scalable for commercial agricultural supply chains.

a **Attainment of any SDG:**

Post-harvest spoilage and transport mass losses drastically threaten regional food supplies and damage local farming economies. This eco-friendly coating addresses these critical systemic vulnerabilities by directly extending shelf life, mitigating food waste, and preserving the nutritional profile of fresh perishables without using commercial chemical synthetics.

7 **Target Market**

Commercial agriculture sectors, local fruit and vegetable wholesalers, supermarket distribution networks, food packaging industries, exporters dealing in cold-chain logistics, and regional sugarcane processing biorefineries seeking high-value commercial pathways for manufacturing by-products.

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11	**Video (If any)**	NA	

Pictures (to be pasted below)

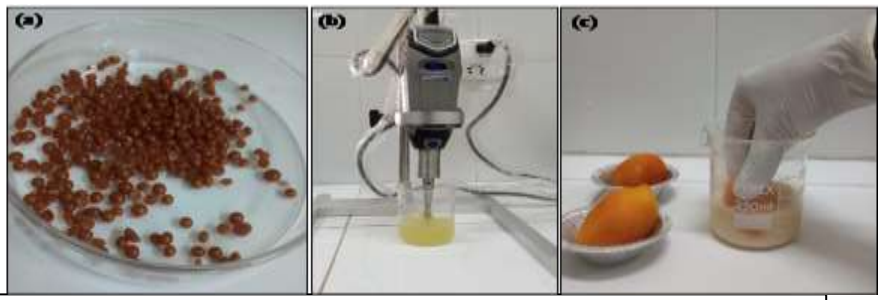

Figure 1. Preparation and application of the SCW-based edible coating on samples. (a) SCW pellets; (b) homogenization of aloe vera gel with additives to prepare the coating solution; (c) application of the coating on tomatoes by the dipping method