



Consumer Perception of SCP-Based Edible Films from Cheese Whey Valorization: Insights for Sustainable Packaging in a Circular Bioeconomy

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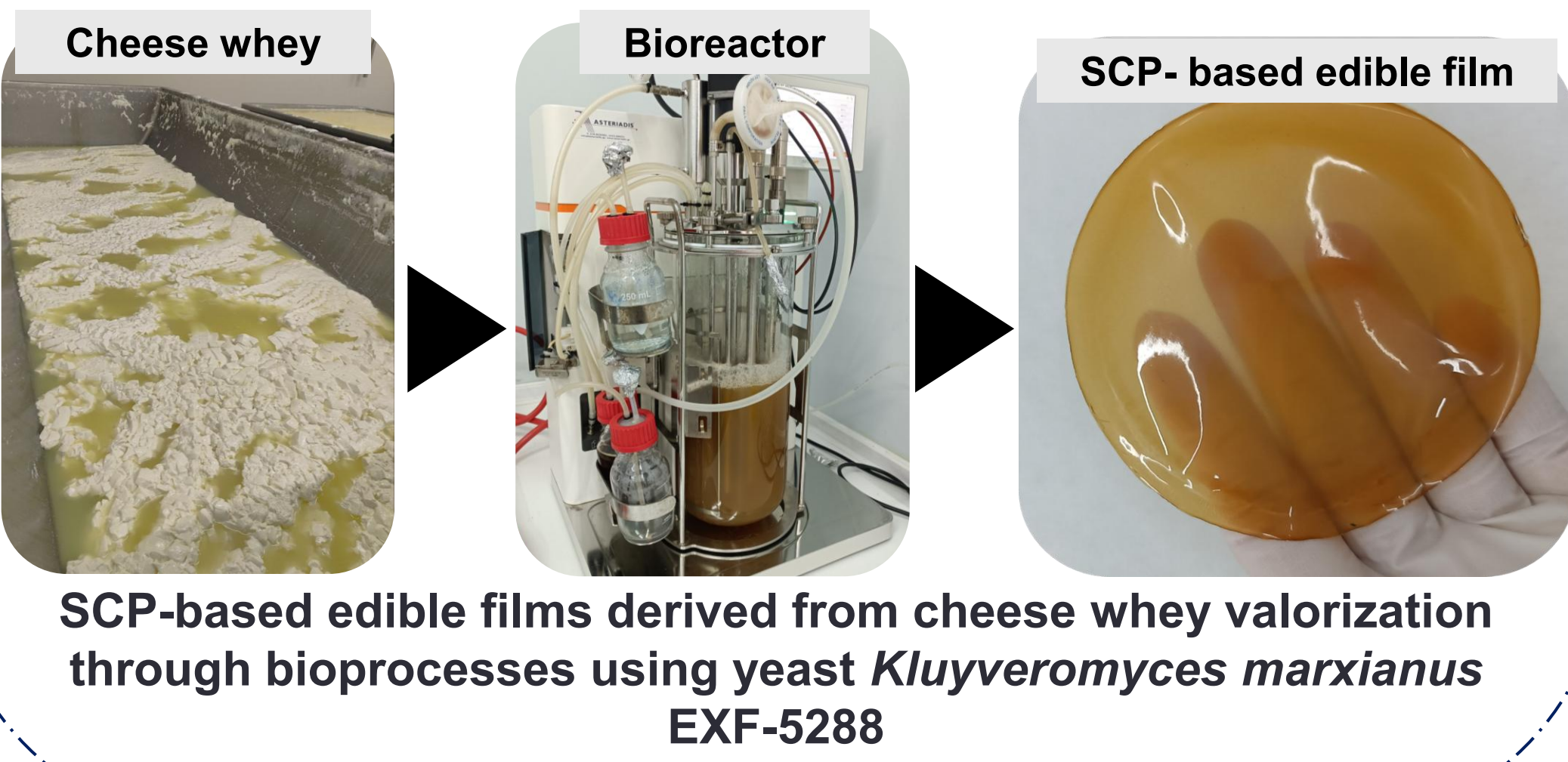
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Agri-food Waste Management for Sustainable bio-economy through Higher Education curricula and upskilling



INTRODUCTION

Edible films are gaining interest as sustainable alternatives to synthetic packaging due to their biodegradability and potential integration into circular food systems. This study explores consumer perception of edible films produced from Single Cell Protein (SCP), derived through biotechnological valorization of cheese whey — a high-volume agri-food by-product. SCP-based edible films offer a promising solution for reducing plastic waste while addressing consumer concerns about sustainability.

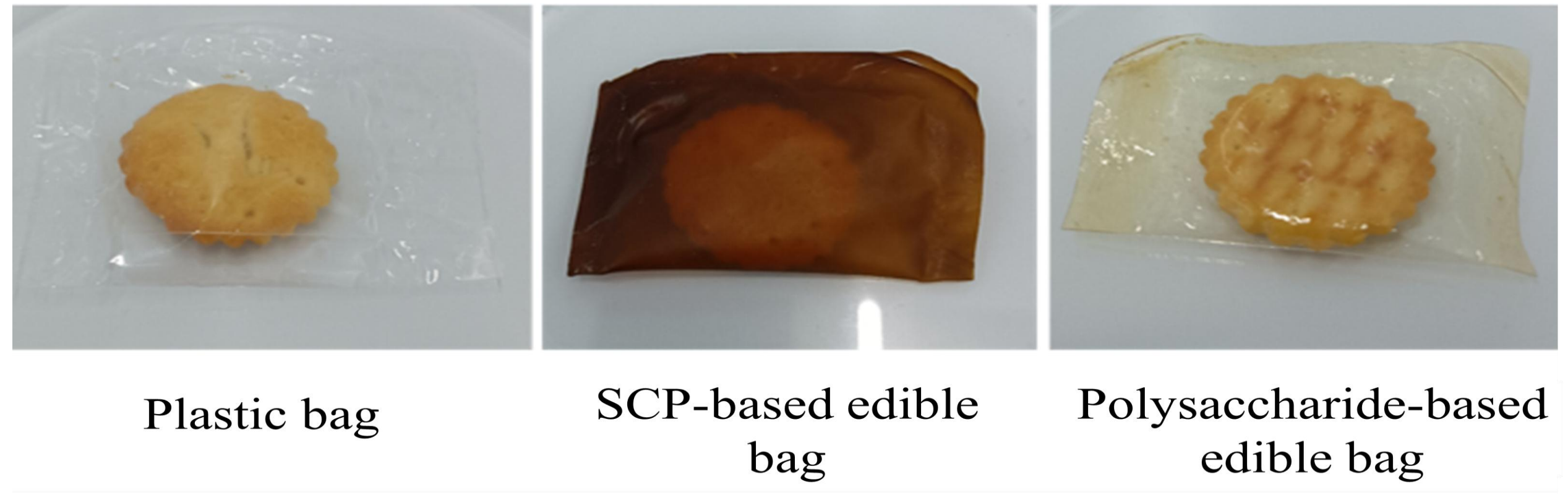


MATERIALS & METHODS

CONSUMER STUDY

- Focus Groups¹** N=6: Sensory traits, labeling, potential food applications.
- Online Surveys** N=178: Emotional responses using CATA list of 33 emotions.
- Eye-tracking** N=100: Visual attention towards yogurt samples covered with SCP - based films.
- Sensory Evaluation²** N=80: Texture, odor, overall acceptability

1. Comparison of SCP-based edible films (N=3) with polysaccharide-based films (N=3)
2. Comparison of plastic vs. edible bags (polysaccharide-based and SCP-based).



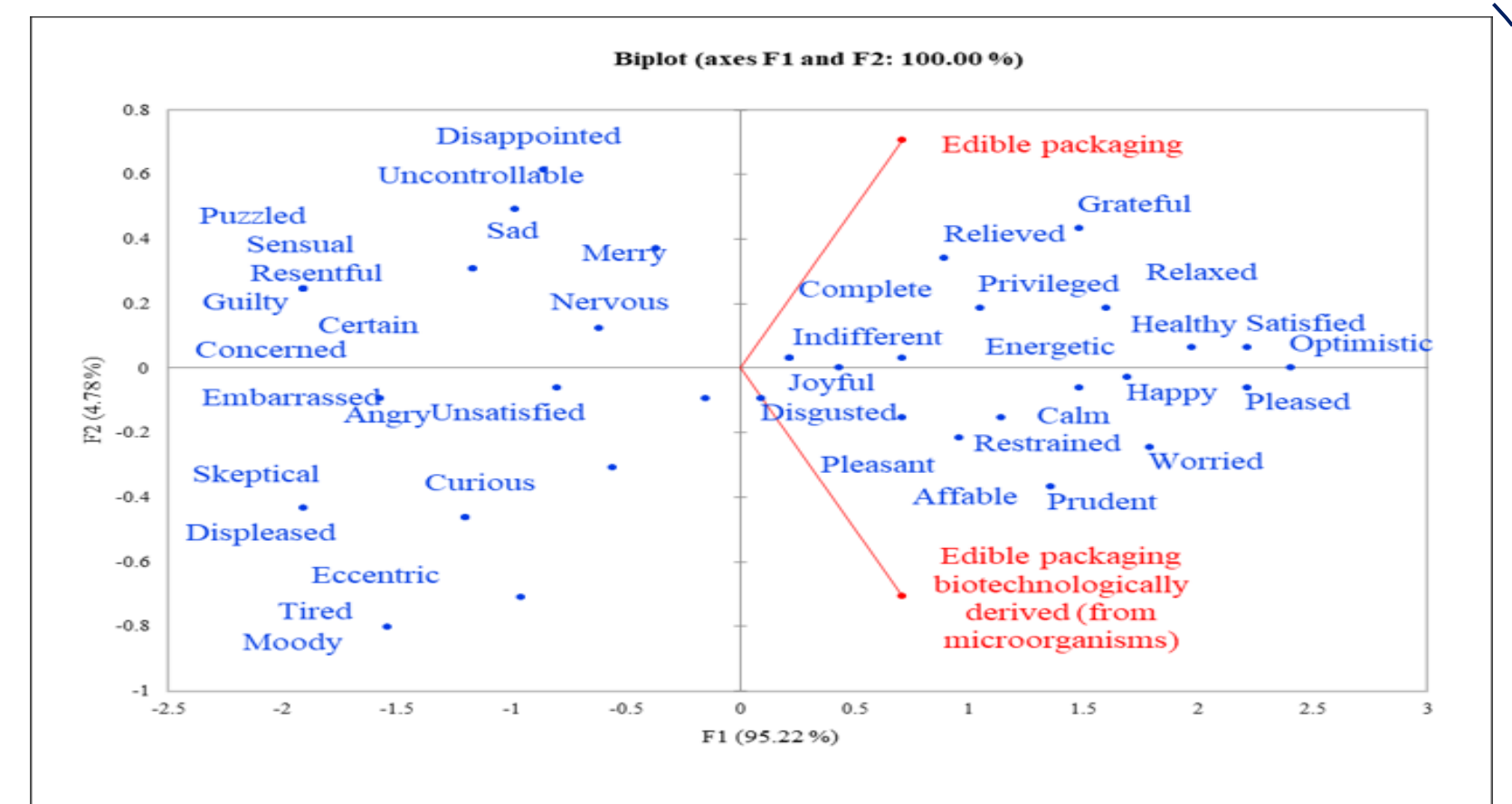
RESULTS & DISCUSSION

- Consumers expressed positive attitudes toward edible packaging regardless of microbial origin.
- Eco-friendly claims significantly increased perceived acceptability.
- The brown color of SCP-based films elicited negative emotional responses such as disgust.

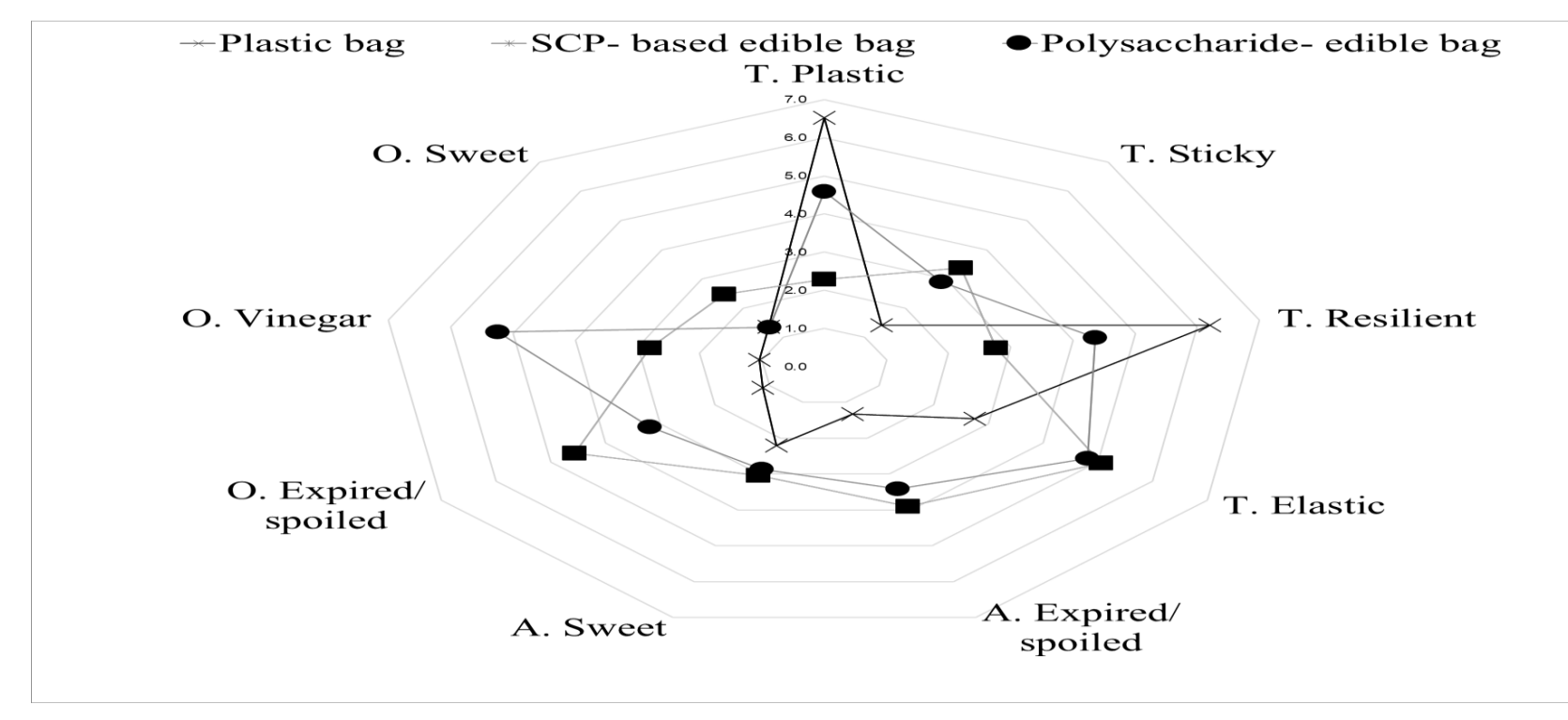
- Texture was well accepted, but odor scores were lower, often linked to spoilage or vinegar-like odor.
- Participants preferred edible films as internal packaging within conventional containers, indicating opportunities for hybrid sustainable packaging solutions.



Graph 1. Visual stimuli are presented in response to heatmap of participants gazing behavior for control (left) and SCP-based edible film (right) as layers in yogurt pot.



Graph 2. Biplot from Principal Component Analysis (PCA) of emotions correlated to edible packaging and edible packaging biotechnologically derived (from microorganisms) of online survey.



Graph 3. Mean values of attributes intensity scores for plastic, polysaccharide-based and SCP-based edible bags. T= taste; O= odor; A= appearance.

Sample	Appearance	Odor	Texture	Overall acceptability
Plastic bags	5.0 ^a	4.8 ^a	4.7 ^a	4.9 ^a
Polysaccharide-based edible bags	4.3 ^b	3.3 ^b	4.7 ^a	4.1 ^b
SCP-based edible bags	4.1 ^b	3.2 ^b	5.0 ^a	4.2 ^b
Pr > F	< 0.0001	< 0.0001	0.244	< 0.0001

Table 1. Liking scores regarding appearance, odor, texture and overall acceptability for plastic, polysaccharide-based and SCP-based edible bags. Means in column followed by same letter (a,b) are not statically different (P> 0.05).

CONCLUSIONS

1. SCP-based edible films show promise as sustainable packaging materials derived from food industry by-products.
2. Their successful adoption depends on optimizing sensory and visual attributes and providing clear, environmentally friendly labeling strategies.
3. Integration of food science, sensory evaluation, and data-driven analysis into higher education curricula supports innovation in sustainable packaging.

Disclaimer

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