

Influence of bio-based cling films on semi hard cheese quality: Evolution of appearance, odour and consumer liking over storage time

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Introduction

Food packaging materials made up of non-degradable plastics are a major source of solid waste, causing significant environmental pollution (1). Therefore, there is a growing interest in packaging made from renewable natural resources, and bio-based polymers may be a viable substitute for synthetic plastics due to their ability to biodegrade and the availability of reproducible materials (2).

Material

- Semi-hard Bra PDO cheese
- 5 types of cling films:
 - 2 bio-plastic materials obtained from renewable sources (**R-BP1 and R-BP2**)
 - bio-plastic film obtained from non-renewable source (**NR-BP**)
 - **PVC**
 - **PE**

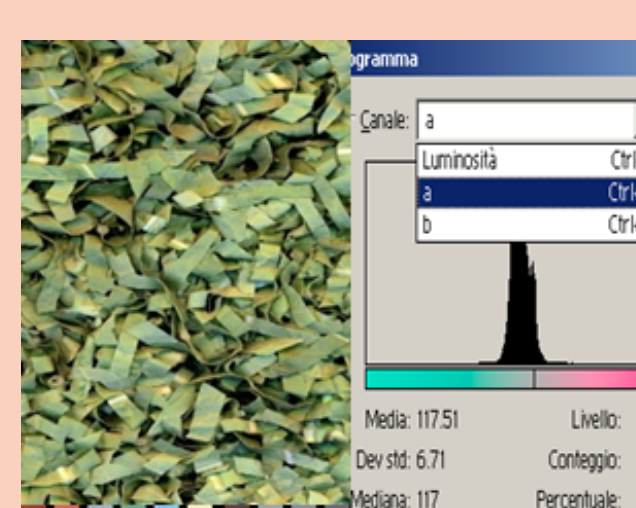
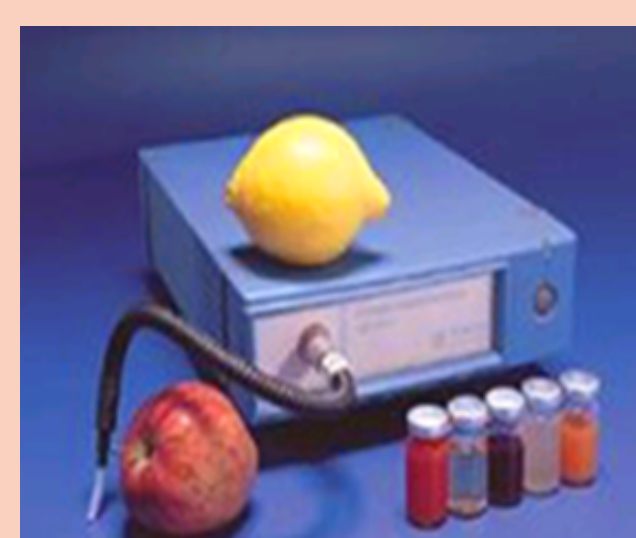
Methods

Colour variation → Image Analysis

- 3 replicates for each cling film
- Storage time T0, T4, T7, T9, T10, T11, T14
- Evaluation of colour parameters through ImageJ version 1.51 software and EasyRGB

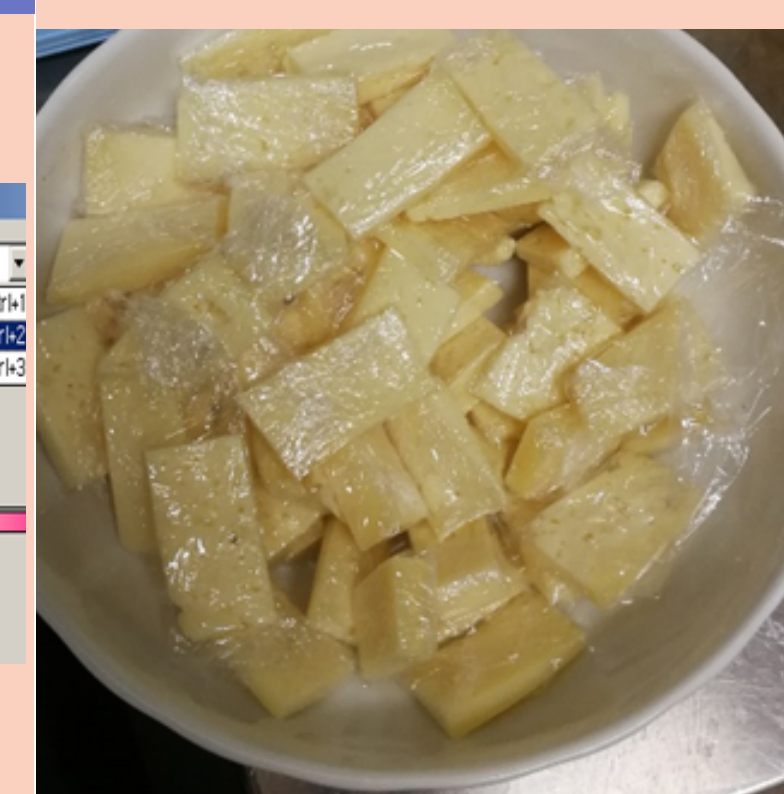
Odour variation → Electronic nose

- 4 replicates for each cling film
- Storage time T0, T4, T7, T9, T10, T11, T14
- emissions of volatile compounds were assessed by the portable PEN 3 e-nose



Sensory Evaluation

- 56 subjects (F = 36, M = 20)
- Storage time T7 and T10
- Liking test to rate how much they disliked/liked the appearance and the odor on a 9-point hedonic scale (1 = extremely dislike, 9 = extremely like).



Main results

APPEARANCE EVALUATION

- The biplot obtained from the PCA showed a **similarity** in performance and in the variation of the colour parameters **between the NR-BP and PVC** packaged cheese samples which were different from R-BP1, R-BP2 and PE.
- For **Delta E** parameter, the highest mean value was observed for the cheese wrapped in **NR-BP film** that was significantly **different** ($p = 0.002$) **from** the cheese wrapped into **R-BP1, PVC and PE** cling films.

ODOUR EVALUATION

- The biplot of the PCA applied to the e-nose data showed that the **aromatic profiles of the cheese** slices **packed in the different cling films** appear to have a **similar evolution over time**
- **At day 14 of storage**, the cheeses wrapped with **R-BP2** showed a **comparable** development of the aromatic profile **to** the cheeses wrapped with **PVC and PE**

SENSORY EVALUATION

- In terms of **appearance**, subjects **preferred** cheese wrapped into **R-BP1 and R-BP2** cling films that resulted significantly different with the cheese wrapped into NR-BP film. No difference with cheese wrapped into PVC and PE
- In terms of **odour**, subjects showed an **higher liking for R-BP1 cling film** packaged cheese, while the lowest mean score was achieved by cheese packaged in NR-BP film

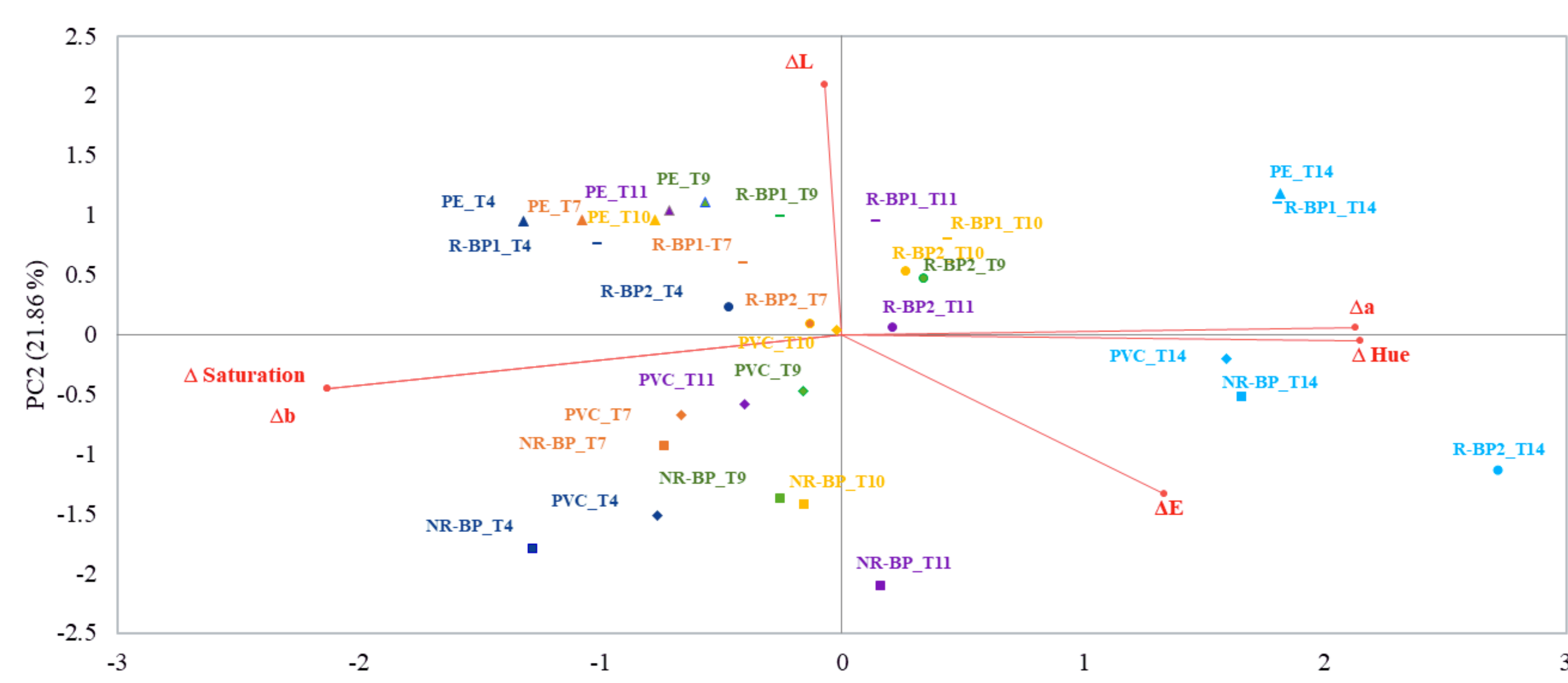


FIG. 1 BIPLLOT FROM THE PRINCIPAL COMPONENT ANALYSIS APPLIED TO INTERACTION OF THE CLING FILM AND THE STORAGE TIME IN RELATION TO COLOUR PARAMETERS (DELTA E, DELTA L, DELTA A, DELTA B, DELTA HUE AND DELTA SATURATION)

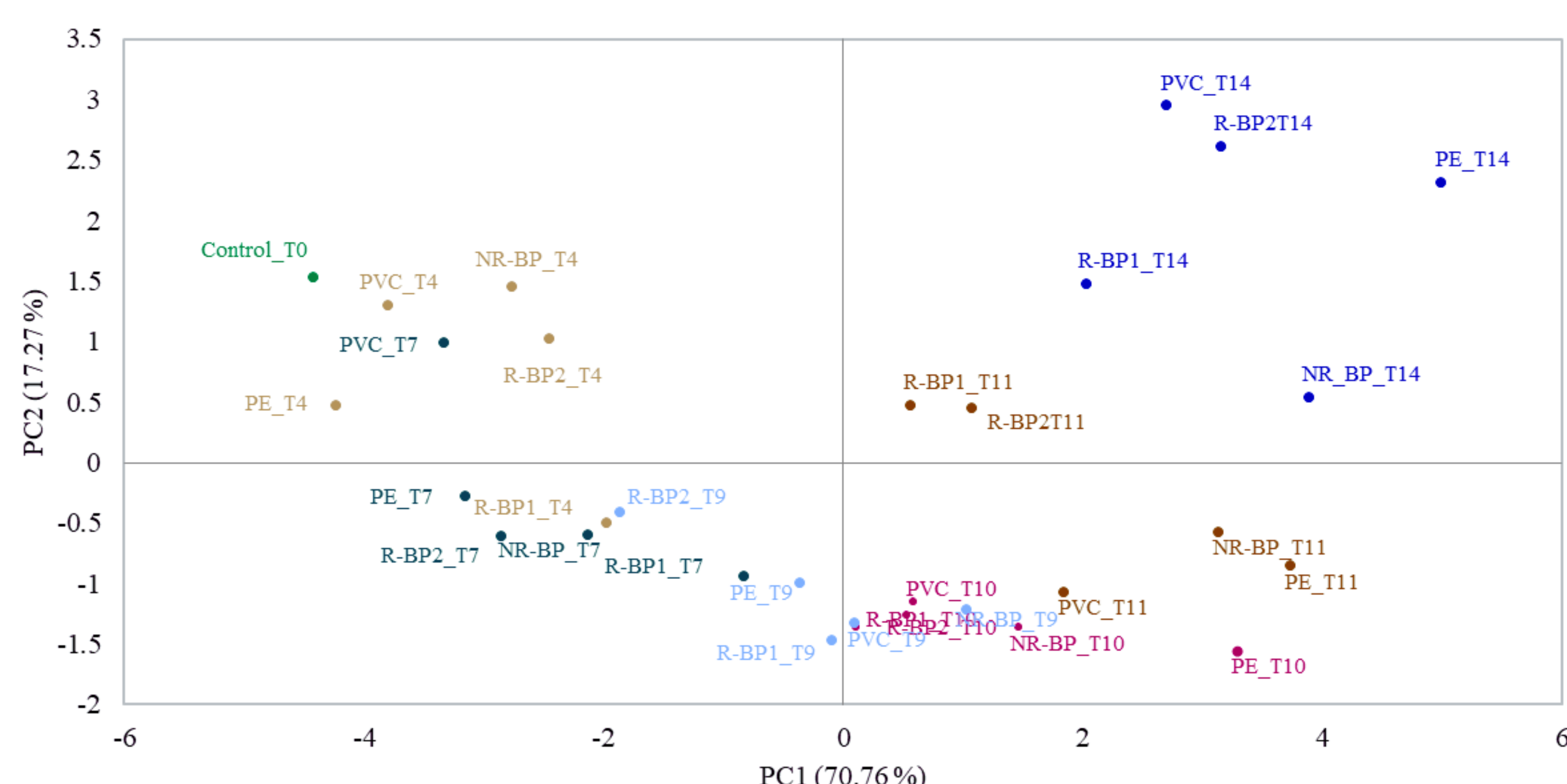


FIG. 2 BIPLLOT FROM THE PRINCIPAL COMPONENT ANALYSIS APPLIED TO ENOSE RESPONSES

Conclusion

This study shows how biodegradable cling films made from renewable resources can potentially be an alternative solution to conventional plastics used in the food industry and contribute multiple advantages for a sustainable development

References

1. Huang, T., Qian, Y., Wei, J., & Zhou, C. (2019). Polymeric Antimicrobial food packaging and its applications. In Polymers (Vol. 11, Issue 3). MDPI AG.
2. Wang, H., & Wang, L. (2017). Developing a bio-based packaging film from soya by-products incorporated with valonea tannin. Journal of Cleaner Production, 143, 624–633.

Variables	Appearance	Odour
Cling film		
NR-BP	5.1 ^b	4.6 ^c
R-BP1	5.7 ^a	5.3 ^a
R-BP2	5.6 ^a	5.1 ^{ab}
PVC	5.4 ^{ab}	4.6 ^{bc}
PE	5.6 ^{ab}	4.7 ^{bc}
p-value	0.005	0.0003
Storage Time		
T7	5.6 ^a	4.9 ^a
T10	5.3 ^b	4.8 ^a
p-value	0.026	0.776

FIG. 3 LIKING MEAN VALUES FOR CHEESE APPEARANCE AND ODOUR (N=56).

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PRIME

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