

Volatile Compounds and Off-odors Analysis of PLA from Recycling Cycle for Biodegradable Packaging Applications: An Essential Factor for Ensuring Food Safety and Quality

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Introduction

Biodegradable and renewable plastics represent a new alternative that can reduce the environmental impact of using plastics from non-renewable sources (Ahmed et al. 2018). In addition, new European Commission guidelines intend to ban the production of single-use plastic packaging from non-renewable resources in favor of biodegradable bioplastics and, minimize the environmental impact of improper disposal of this type of packaging (Frans, Jyrki 2019; Commission, Sheet 2018). Therefore, an alternative that complies with the new guidelines is the recycling of bioplastics, which reduces the environmental impact, increases the added value of the material, and reintroduces it into the circular economy.

Aims and method

The objective of this study was to identify the odors compounds that can interfere with the aromatic profile of the PLA pellets that were submitted to the recycling cycle. Furthermore, Figure 1 illustrates the methodology of PLA biopolymer recycling steps followed by HS-PME-GC-MS and HS-SPME-GC-O-MS analysis.

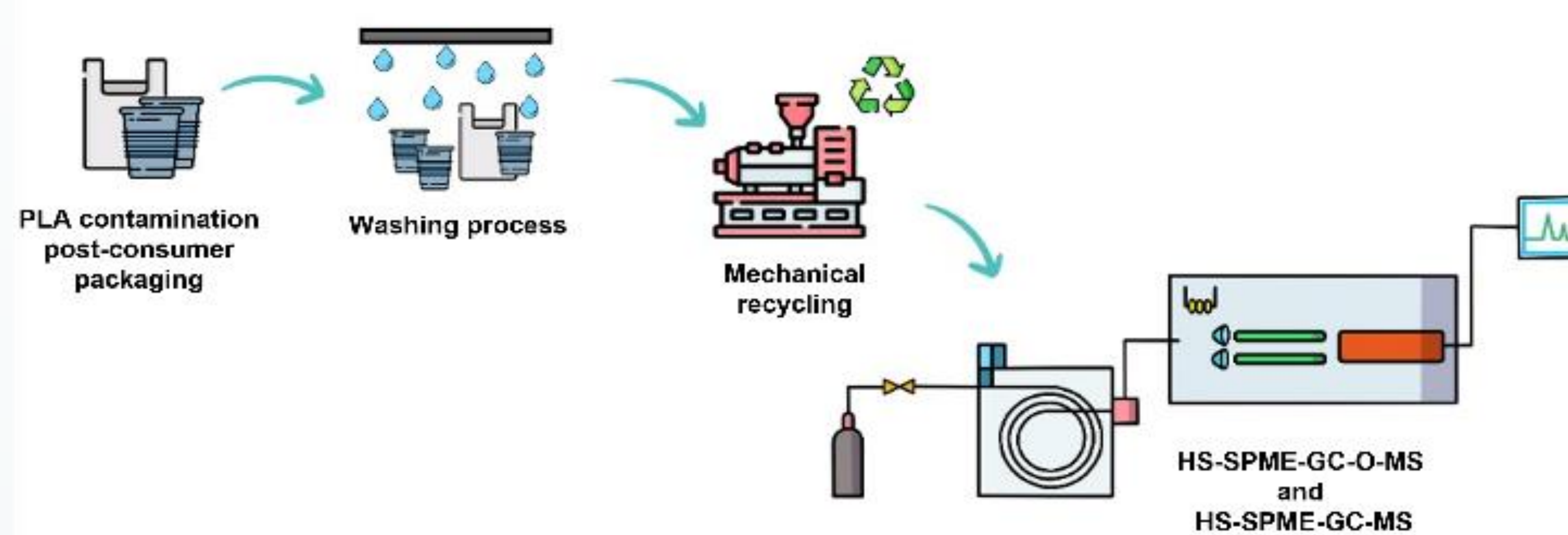


Figure 1: PLA recycling steps methodology

Results and Discussion

In this study, 34 different volatile and semi-volatile compounds including IAS and NIAS, have been identified in the PLA pellets submitted to post-consumer contamination procedure, washing and mechanical recycling. Furthermore, Figure 2 shows the relationship between the formation of different NIAS compounds with the steps of the PLA recycling process.

The radar graph shown in Figure 3 elucidates the impact of the aroma compounds classified and separate into 7 odor groups.



Figure 2: Schematic of the relationship between recycling process steps and the NIAS formation

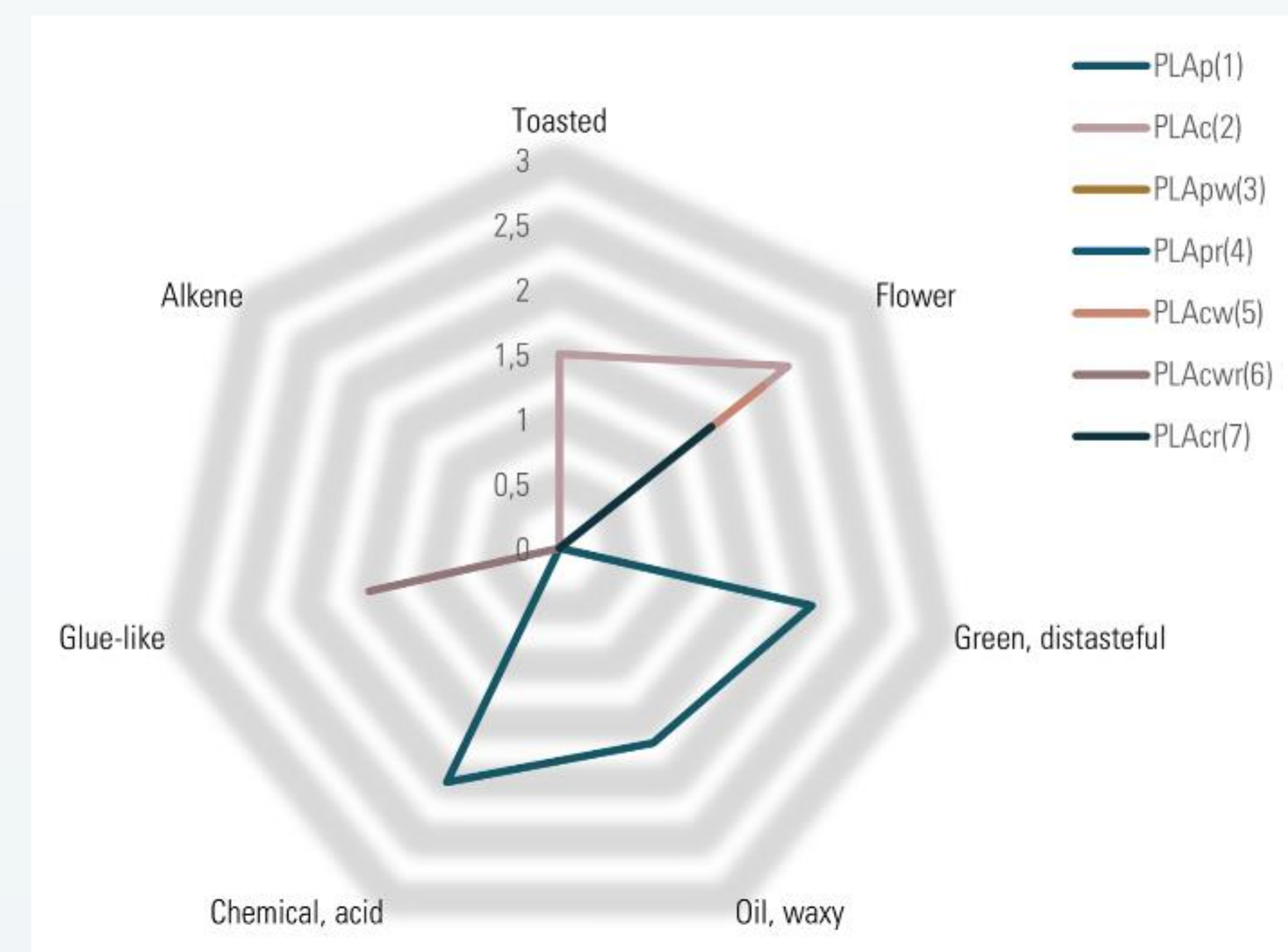


Figure 3: Results of the odor profile of the different PLA biopolymer samples represented by the radar graph comparing the odor intensity described by the panellists and catalogue in different odoriferous groups.

Conclusion

- Most of the substances detected in the analysis were the result of the biopolymer chain breaking down, such as linear or branched alkanes and alkenes.
- The primary NIAS found in all samples and IAS have been formed during the mechanical recycling process.
- The presence of off-odors can indicate the formation of harmful compounds, which can affect the sensory properties of the food, and even compromise it.
- Therefore, it is crucial to take appropriate measures to prevent the formation of NIAS or remove them from the recycled PLA material.

Bibliography

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Acknowledgment

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nivel Superior- Brasil (CAPES) – Finance Code 001, Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq – Brasil (200096/2022-2), and São Paulo Research Foundation (FAPESP) for Grant 2021/08224-1. The authors acknowledge the Project Government of Aragon and the European Social Fund for financial supporting (T-53-20R) to the GUIA Group.