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Polymer blends based on poly(lactic acid) (PLA) and poly(caprolactone) (PCL) for engineering applications

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INTRODUCTION & AIM

Automotive interior panels are typically manufactured using materials derived from fossil sources [1], which poses a significant environmental challenge at the end of a vehicle's service life. Once discarded, these components can persist in the environment for years without degrading, contributing to the accumulation of non-biodegradable waste [2]. Moreover, during their use, interior panels are prone to structural and aesthetic damage that affects both the comfort and visual appeal of the vehicle cabin. In light of this, it is essential to develop solutions that reduce waste generation while preserving the visual and functional integrity of these interior components.

METHOD

1. PLA was modified by grafting maleic anhydride (MA) in a single-screw extruder at 160 °C and a speed of 25 rpm to obtain filaments.
2. Cut into pellets using a laboratory-designed cutter.
3. After weighing, the materials are introduced into an automatic polymer mixer. Finally, they are processed in a single-screw extruder at 160 °C and a speed of 25 rpm to obtain filaments.

Figure 1. Raman spectrum of the mixtures.

RESULTS & DISCUSSION

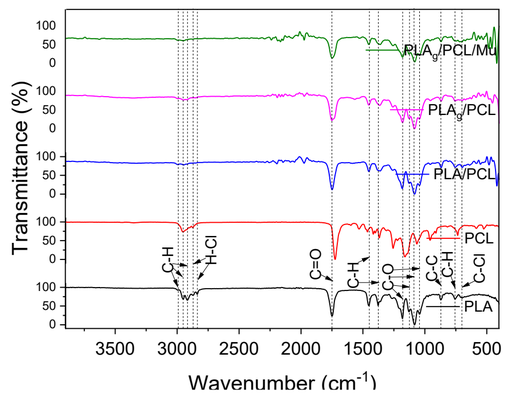

Figure 2. FT-IR spectrum of principal samples.

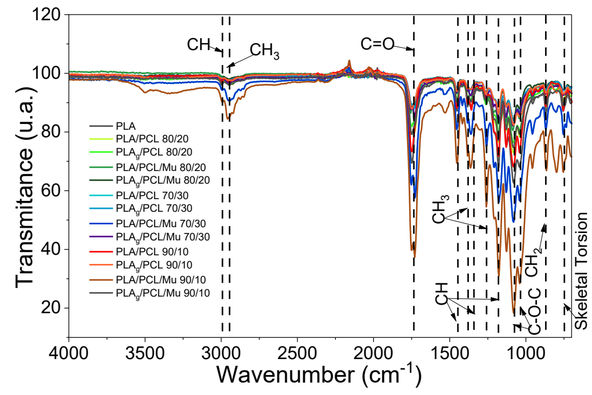

Figure 3. FT-IR spectrum of all samples.

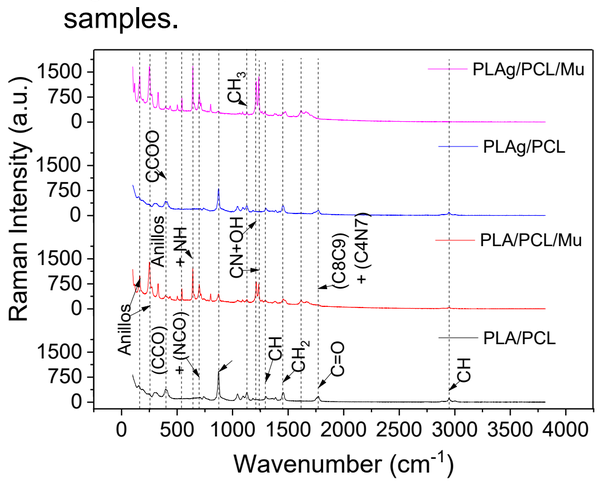

Figure 4. Raman spectrum of the mixtures.

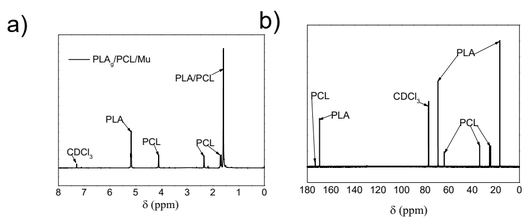

Figure 5. NMR sample PLAg/PCL/Mu.

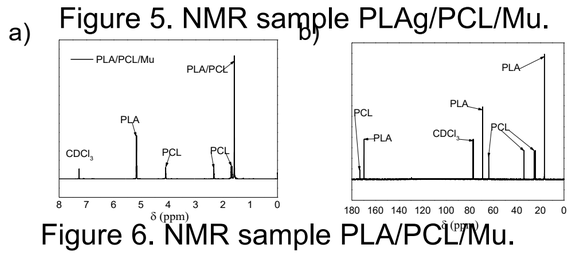

Figure 6. NMR sample PLA/PCL/Mu.

CONCLUSION

Spectroscopic analysis enabled the evaluation of murexide presence within the polymeric matrix. Although Raman spectroscopy did not reveal significant changes attributable to murexide, the FT-IR spectra showed more defined bands, particularly in the skeletal torsion region, which facilitated the identification of characteristic intensities. On the other hand, NMR analysis did not display new signals associated with murexide, likely due to its low concentration; however, the signals corresponding to the raw materials, PLA and PCL, were clearly identified. These results suggest that FT-IR is more sensitive for detecting murexide in this system, while NMR and Raman present limitations under the evaluated conditions.

FUTURE WORK / REFERENCES

[1] W. S. Jin *et al.*, "Design of Self-Healing EPDM/Ionomer Thermoplastic Vulcanizates by Ionic Cross-Links for Automotive Application," *Polymers*, vol. 14, no. 6. doi: 10.3390/polym14061156
[2] M. Wróbel, S. Szymańska, T. Kowalkowski, and K. Hrynkiewicz, "Selection of microorganisms capable of polyethylene (PE) and polypropylene (PP) degradation," *Microbiological Research,* vol. 267, p. 127251, 2023/02/01/ 2023.