Mechanical recycling of poly(lactic acid): *improvement of the properties of the recycled material*

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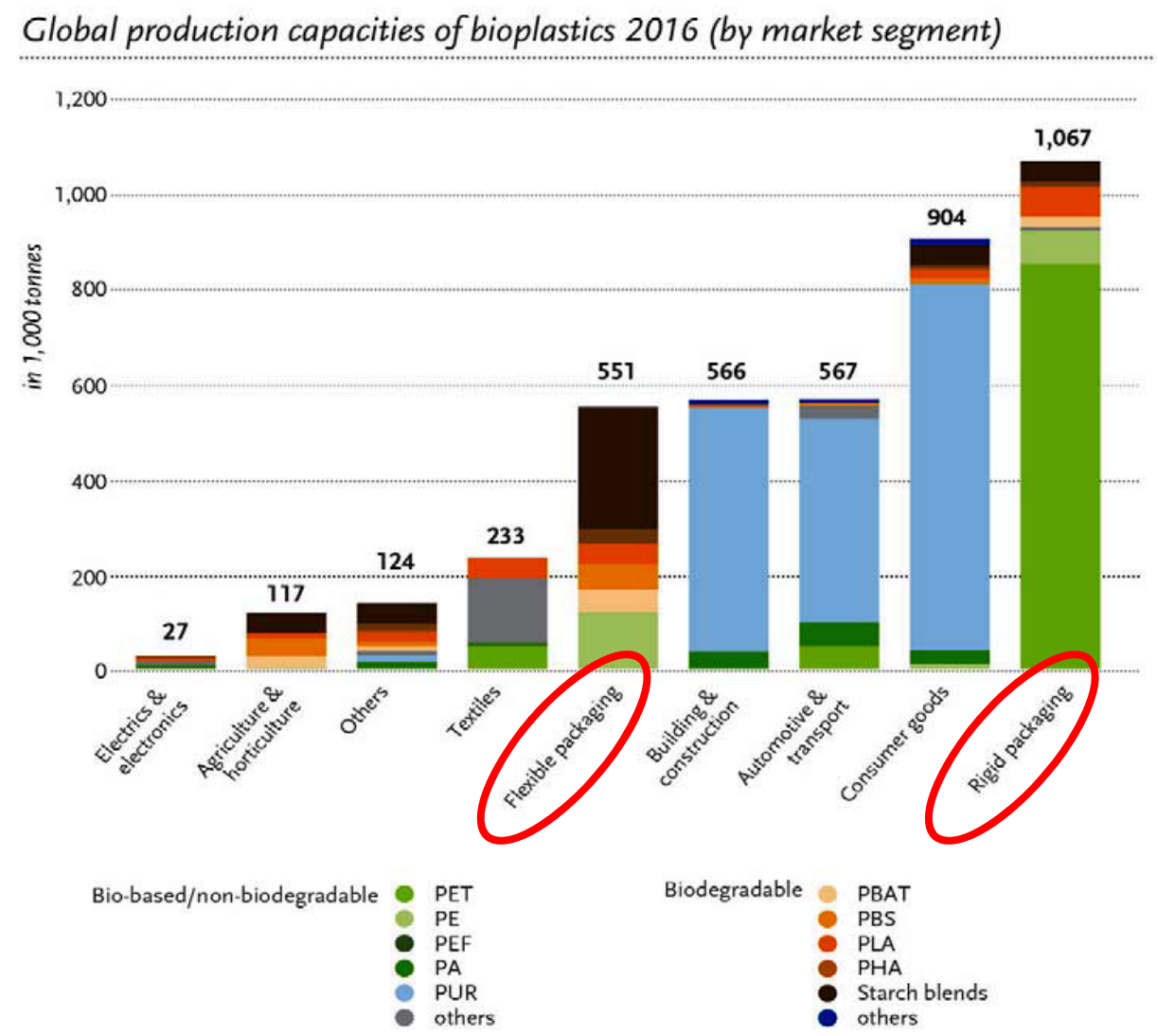
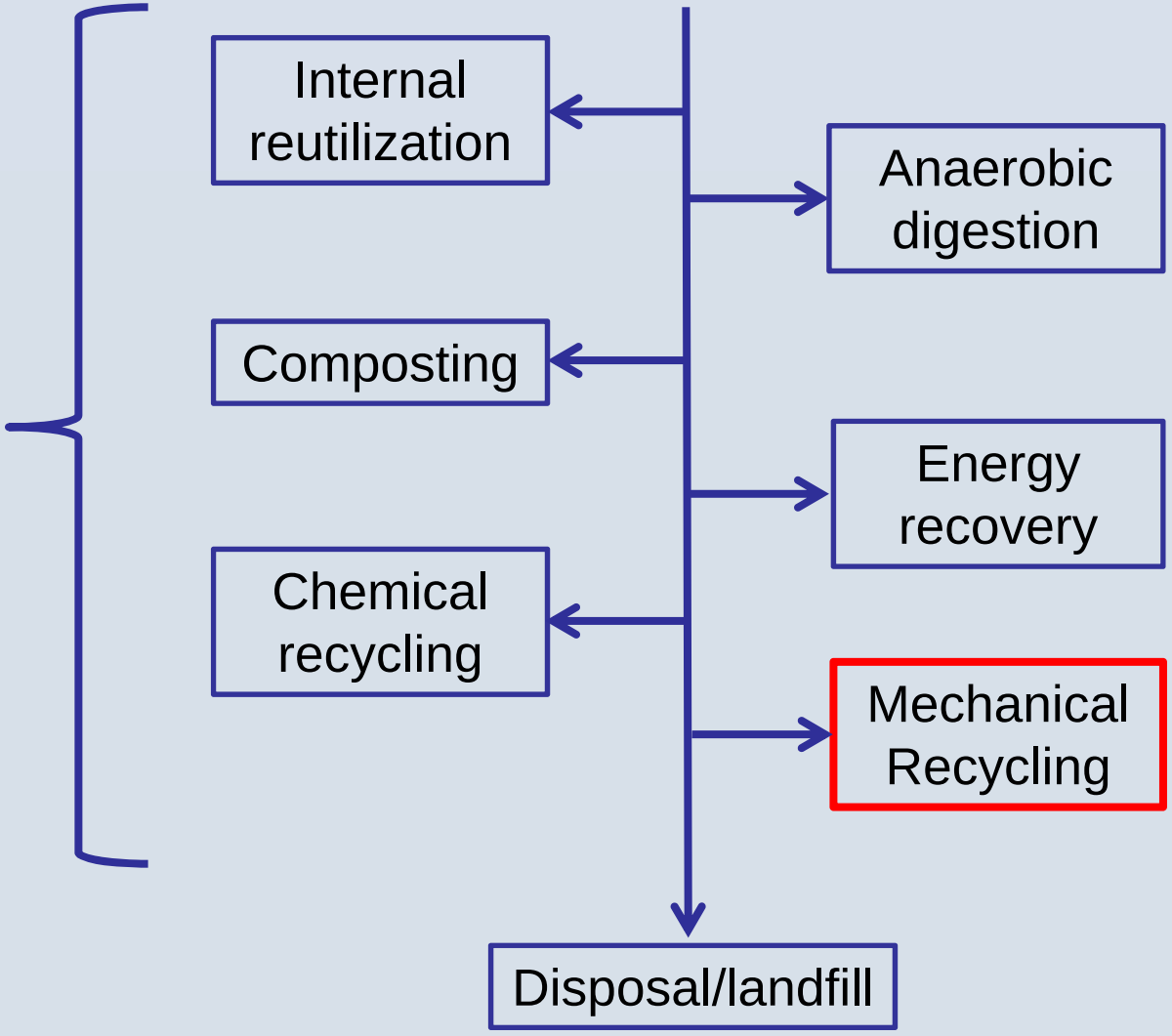
Poly(lactic acid) (PLA)

- Is an aliphatic polyester produced from renewable resources
- It has good processability, optical and mechanical properties
- Is a well established bioplastic in the market

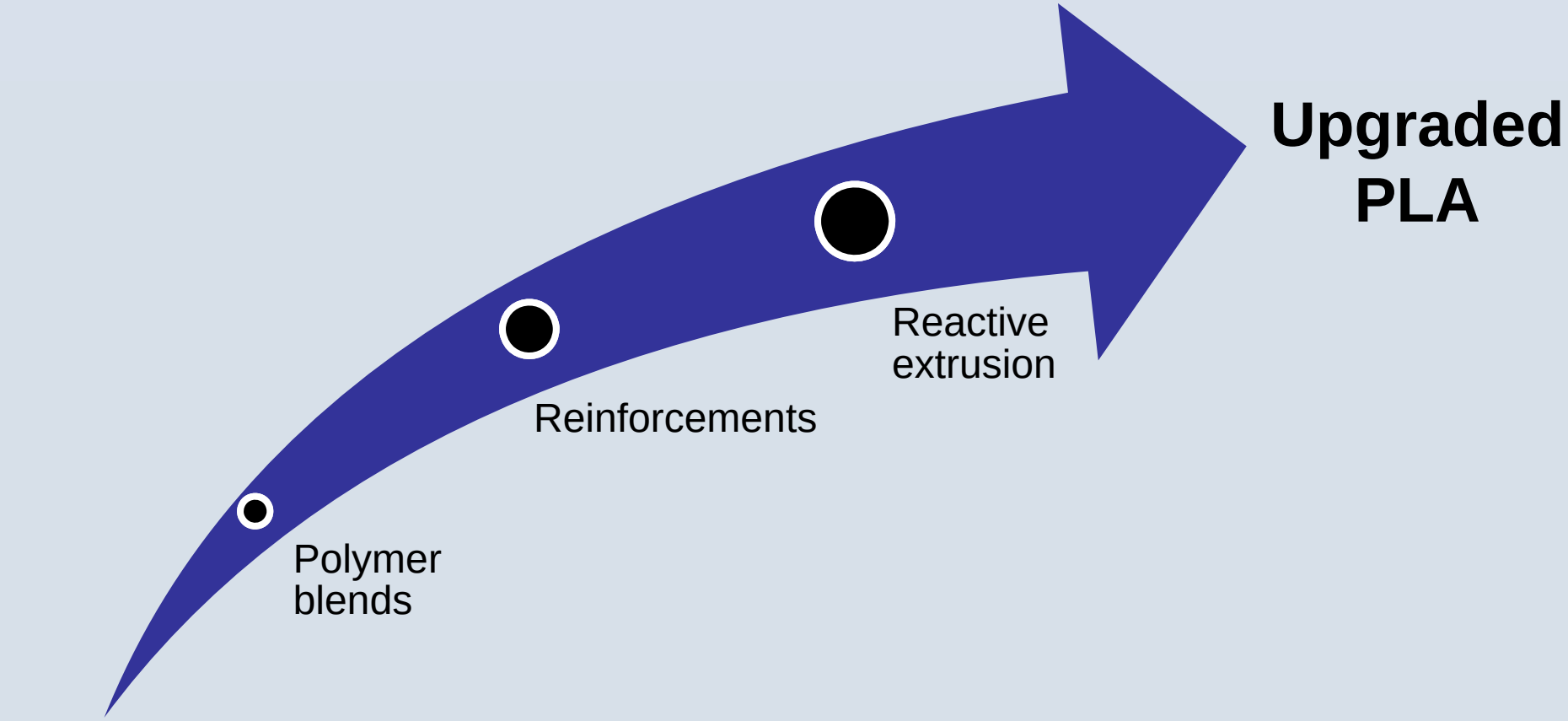


Valorization of PLA wastes

Waste reduction and valorization



Alternatives for upgrading recycled PLA



Objective

The main aim of this work was to study different alternatives for upgrading the properties of mechanically recycled PLA, thus increasing its recyclability

Methods

PLA: Ingeo™ 2003D

Processing
- Extrusion
- Compression molding

Service life
- Photochemical
- Thermal
- Hygrothermal ageing

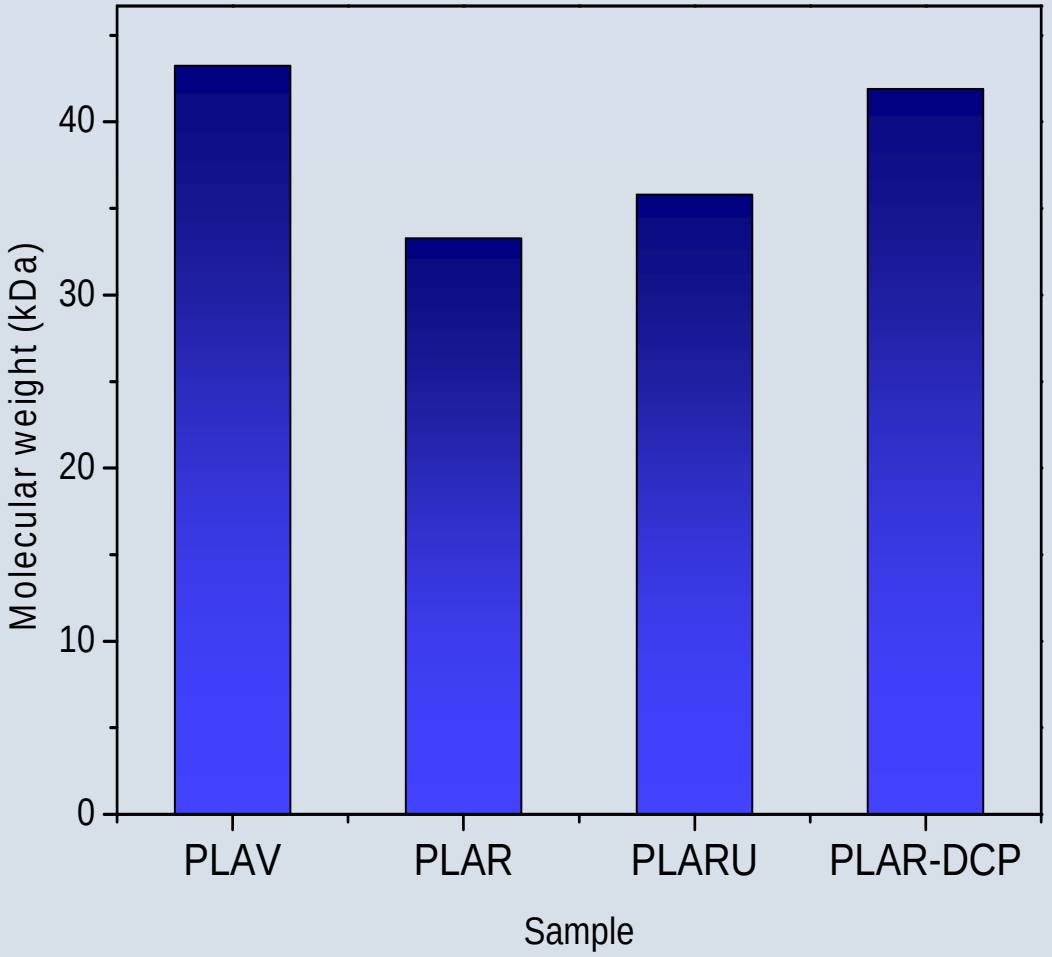
Washing
- At 85 ° C
- NaOH and surfactant

Reprocessing
- Blend with virgin PLA
- 0.3% peroxide

Sample	Description
PLAV	Processed PLA
PLAR	Recycled PLA
PLAR-U	50/50 PLAR-Unprocessed PLA
PLAR-DCP	PLAR with 0.3% dicumyl peroxide

Evaluation of the molecular weight

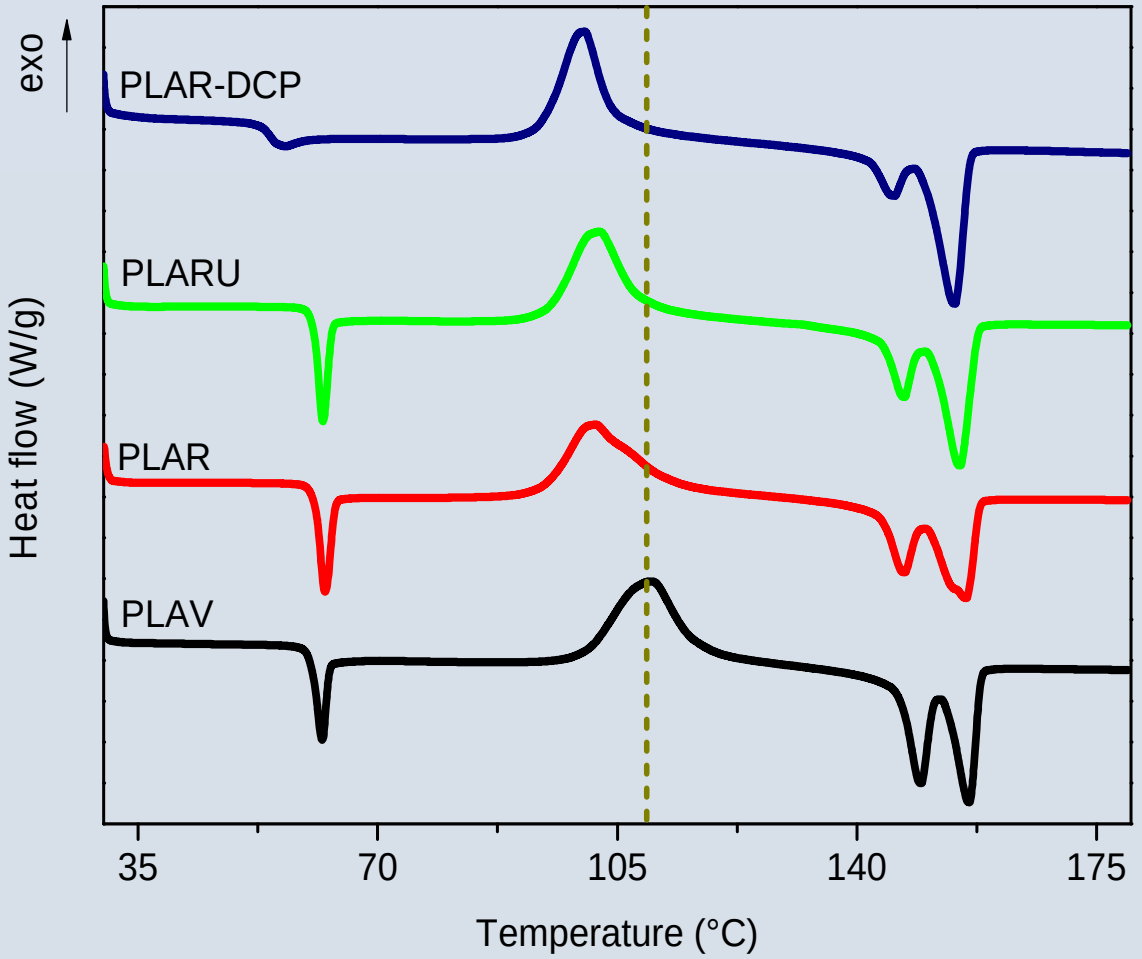
- Molecular weight (M_v) of the different samples was measured by intrinsic viscosity
- Recycling caused a decrease on M_v
- The addition of virgin PLA and DCP increased M_v



Viscosimetric molecular weight of the samples

Thermal properties

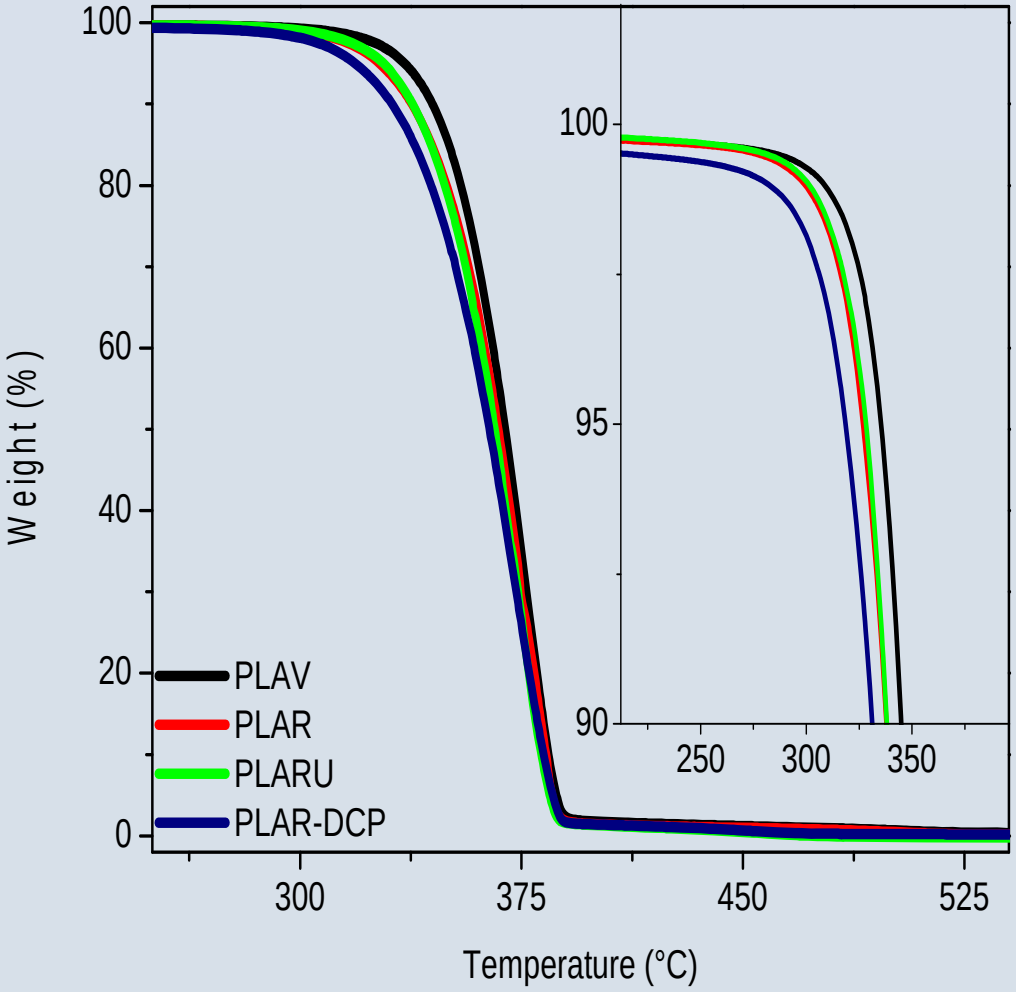
- Recycling caused a decrease on the cold crystallization temperature of PLA.
- The addition of DCP seems to promote crystallization in PLA.
- The overall crystallinity of all the samples is close to zero.



First heating scans of the different samples

Thermal properties

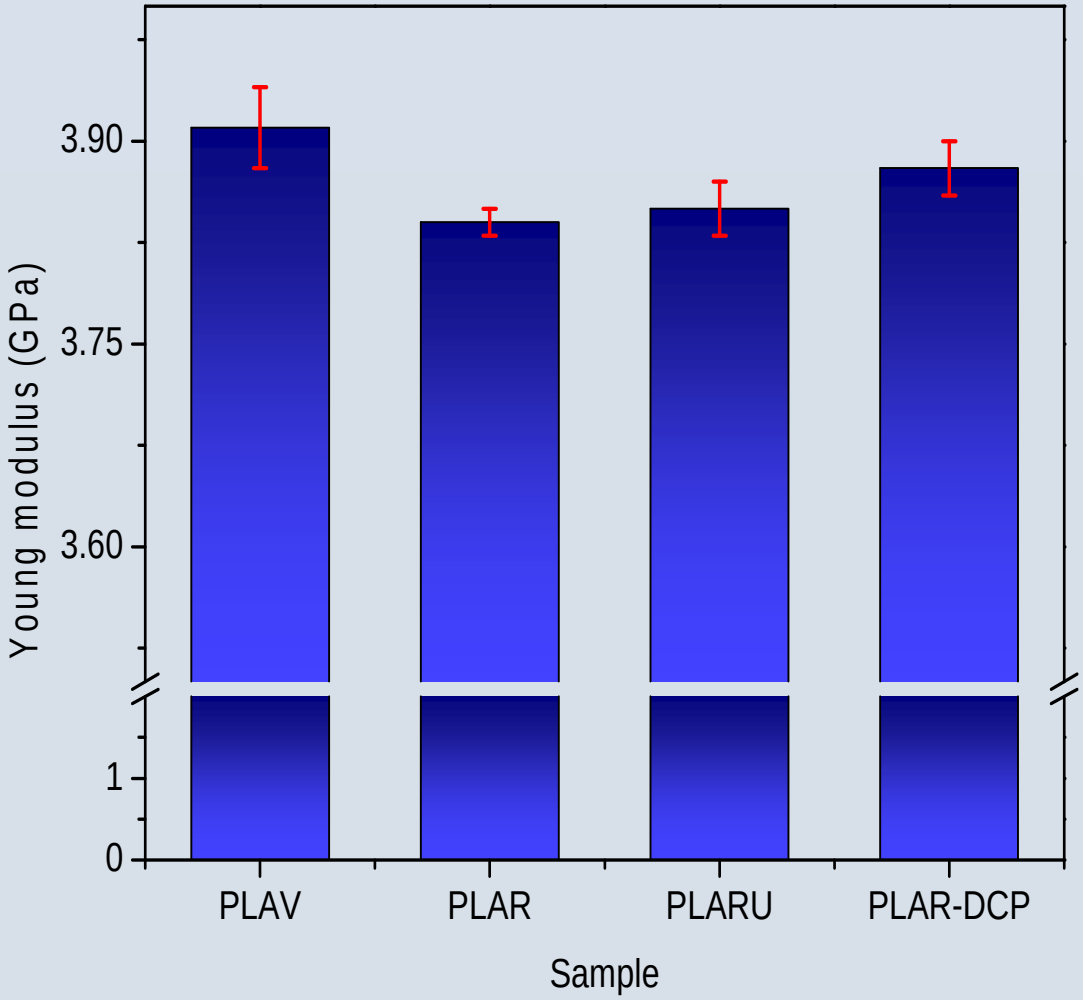
- Recycling causes a decrease on the thermal stability of PLA
- The addition of unprocessed PLA slightly improves thermal stability
- The addition of DCP decreases thermal stability



TGA curves of the samples

Mechanical properties

- Recycling causes a small decrease on the modulus of PLA
- The addition of unprocessed PLA slightly improves Young modulus
- The modulus of PLAR-DCP is close to that of PLAV



Young modulus of the samples

Conclusions

- Mechanical recycling is one of the most promising alternatives for the valorization of PLA wastes.
- Recycling causes the degradation of PLA, and decreases its performance, thus is necessary to upgrade recycled PLA.
- The addition of unprocessed PLA increases the molecular weight of recycled PLA, and improves the thermal stability of the material.
- The addition of DCP causes an increase of the molecular weight. However, the thermal stability of the material decreases.

Conclusions

Recycled PLA could be effectively upgraded, in order to improve its properties. However, other alternatives should be considered.

Thank you for your attention

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Questions

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