Utilization of olive tree pruning lignin: a sustainable and versatile raw material for industrial applications

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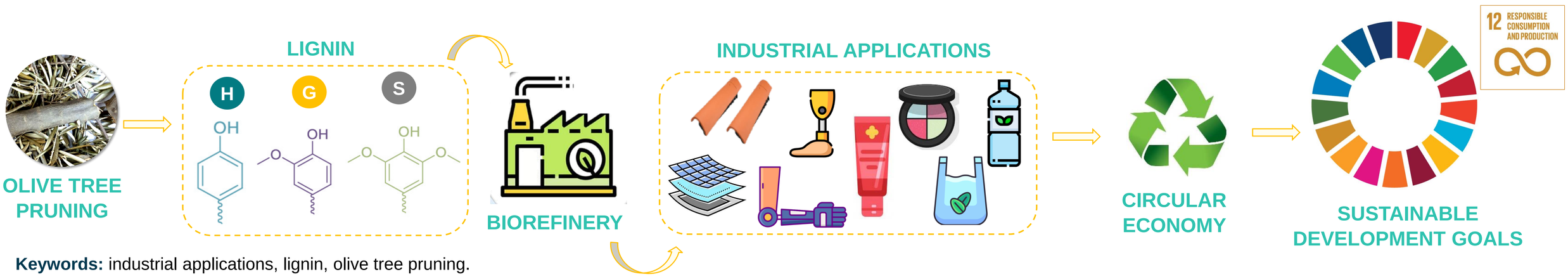
Introduction

- **Olive tree pruning (OTP)** is a lignocellulosic by-product of olive cultivation rich in lignin generated after the removal of unproductive branches of olive trees.
- **Lignin** is a natural aromatic biopolymers of complex and heterogeneous structure
  - Low cost, high thermal stability, biodegradability and antioxidant activity.
  - Applications in the biofuels, biomaterials and food sectors.
- The sustainable use of OTP contribute to the transition towards a **circular economy** and to the achievement of the **Sustainable Development Goals.**

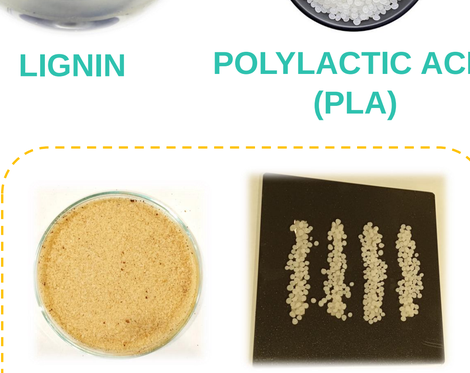


Keywords: industrial applications, lignin, olive tree pruning.

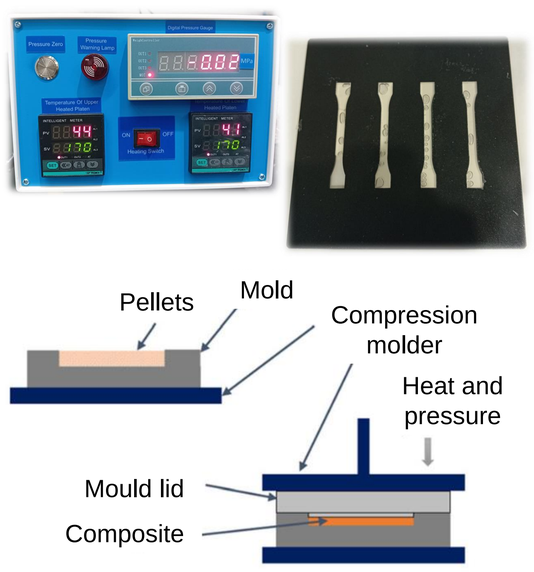
Objective

To explore the **potential of lignin** extracted from **OTP** as a renewable and environmentally friendly resource for **industrial applications** following the **biorefinery model** and aiming at the **circular bioeconomy** of the olive sector.

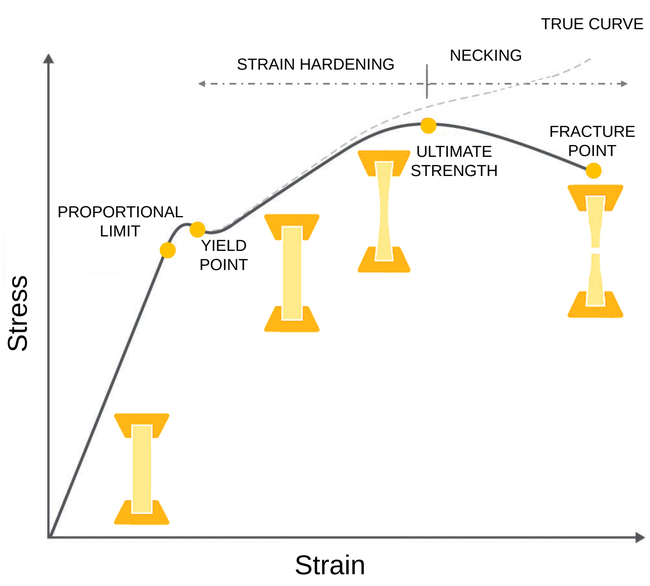
Experimental procedure



THERMOFORMING



TENSILE TEST



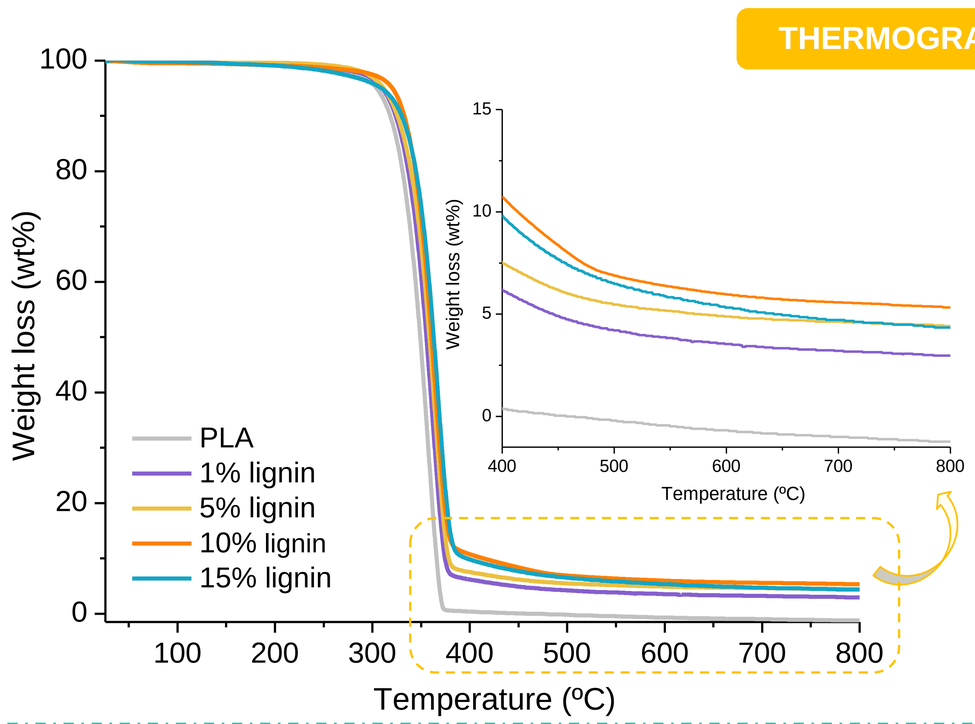
Results

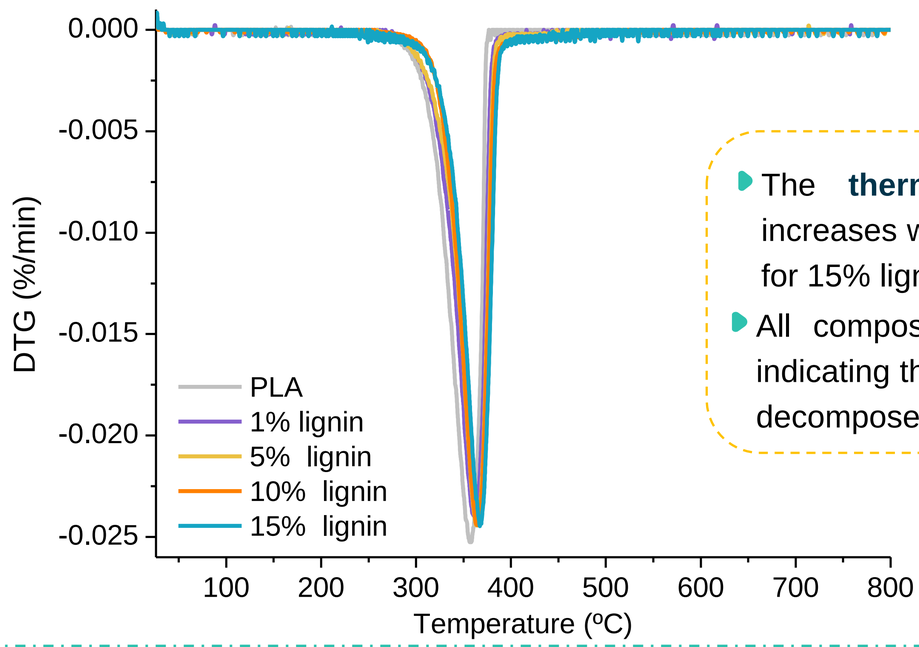
MECHANICAL PROPERTIES

Composite	Tensile strength (MPa)	Elongation at break (%)	Young modulus (GPa)
PLA	46.88 ± 4.73	3.27 ± 0.35	1.99 ± 0.08
PLA-1% LIG	48.01 ± 1.66	3.52 ± 0.05	2.01 ± 0.05
PLA-5% LIG	47.65 ± 0.51	3.35 ± 0.19	2.03 ± 0.04
PLA-10% LIG	49.64 ± 1.39	3.60 ± 0.26	2.10 ± 0.03
PLA-15% LIG	52.55 ± 0.75	3.84 ± 0.05	2.13 ± 0.01

- The addition of 10% and 15% lignin significantly **increases the tensile strength and elongation at break** of the composite.
- The **addition of lignin improves** the ability of the composite to undergo length changes under **tensile stress.**

THERMOGRAVIMETRIC ANALYSIS (TGA)





- The **thermal stability** of the composites increases with the lignin content, being 362 ºC for 15% lignin.
- All composites show a **residue at 800 ºC** indicating that the samples have not completely decomposed.

Conclusions

❖The chemical structure and unique properties of lignin make it an attractive component in the development of sustainable materials.

❖The incorporation of lignin-derived components in composite materials improves their mechanical (strength and durability) and their thermal stability.

❖ This study demonstrates that the utilization of lignin from OTP presents an attractive route to produce composites for industrial applications in various sectors by hot-plate pressing.

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