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DEVELOPMENT OF POLY(LACTIC ACID)-PHA ALLOYS FOR BIOMEDICAL APPLICATIONS

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Objectives

- Replacement of petroleum-based medical devices by PLA/PHA polymer alloys
- Including original surface treatments and optimization of interfacial cohesion within multiphase materials

Figure 2: Injection to obtain different forms depending on the mold used

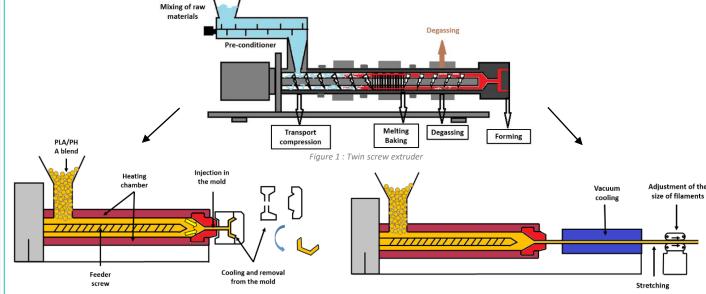
Development of bio-based, biocompatible and biodegradable beauty masks

Material

- PLA, polylactic acid, is a bio-based polymer generally derived from corn starch, cane sugar and beet.
- PHA, polyhydroxyalkanoates, is bio-based produced fermentation of sugar or lipids.
 - PHA, P(3HO-3HD-3HDD) UNIVERSITY OF WESTMINSTER! • PHB, polyhydroxy butyrate
 - PHBV, poly(hydroxybutyrate-co-hydroxyvalerate)

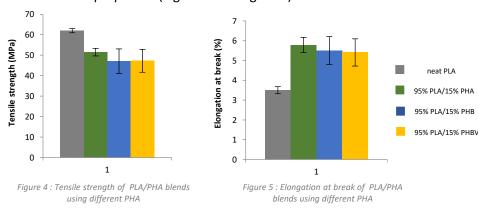
Processing

The PLA/PHA blends are prepared in twin screw extruder (Figure 1). The resulting blend is formed by injection (Figure 2) to developed beauty mask or bandage and by extrusion (Figure 3) to be used in additive manufacturing. The results presented are obtained only using injection molding.



Mechanical properties

Influence of the nature of PHA used in the PLA/PHA blend on the mechanical properties (Figure 4 and Figure 5).

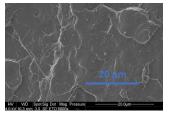


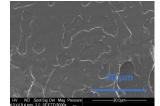
PLA/PHA blend allows a better elongation but decreases the tensile strength compared to the neat PLA. The results are similar for all types of PHA used.

SEM images

Figure 3: Extrusion to obtain the filament of polymer which is used for additive manufacturing

➤ Influence of the nature of PHA on the microstructure of the PLA/PHA blend (Figure 6, Figure 7 and Figure 8).





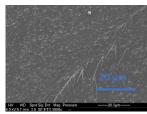


Figure 6 : SEM image of

Figure 7 : SEM image of 95%PLA/5%PHB blend

95%PLA/5%PHBV blend

> Depending on the nature of PHA used in blend, the microstructure of the blends is different but their dispersion in PLA is homogeneous.

Conclusion & Perspectives

- > The blend is not miscible, a compatibilizer could improve the miscibility between the polymers.
- > An experimental design formulation is needed to understand the impact of PHA in the PLA/PHA blends on mechanical properties.
- The safety evaluation of the blends must be followed by cytotoxicology tests and biodegradability in soil.
- This type of materials can be used in others applications. For example in biomedical development by additive manufacturing of technical products with innovative alloys.



