Application of Life Cycle Engineering for the Comparison of Biodegradable Polymers Injection Moulding Performance

Introduction
The use of biodegradable and compostable polymers derived from renewable resources (R-BDP) has a rising concern derived from its particular characteristics. In this study a Life Cycle Engineering model is developed to compare the economical, environmental and technical dimensions of performance for 4 different R-BDP blends, differing in their composition of Starch (STA) and PolyLactic Acid (PLA), when processed through injection moulding technology. The proposed model allows for comprehensive alternative comparison, supporting informed material selection decisions in a product-design context. The use of a ternary decision space supports materials comparison and the identification of their “best alternative domains”.

Research methodology

- **R-BDP Life Cycle Phases**
  - Raw material acquisition
  - Mould material production
  - Plastics processing
  - Mould manufacturing
  - Plastic parts manufacturing
  - Parts use
  - Injection wastes
  - Injection moulding
  - Composting

- **Global evaluation**

Conclusions
- The LCE approach revealed to be adequate to assess and compare R-BDP.
- The production phase (injection moulding) has more impact on the cost and environment than the material production phase.
- As the PLA content increases the cycle time decreases, reducing the eco-impact of production phase → Higher the PLA content lower the eco-impact.
- The R-BDP with higher PLA content (90/10) has the better performance on cost and environment, while 80/20 performs better regarding functionality.

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