DEVELOPMENT OF SUSTAINABLE FLEXIBLE PACKAGING SOLUTIONS USING NOVEL BIODEGRADABLE AND COMPOSTABLE POLYMER BLENDS

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BACKGROUND

Plastic packaging has changed positively the way food products are delivered, reducing poverty and hunger due to the better protection of the goods, allowing their preservation for longer times throughout their supply chain. However, waste management represents a significant challenge. In Ireland, 26% of the packaging waste generated correspond to plastic packaging, and its recovery rate is very low (31 %) compared to the traditional materials (paper, glass, wood, and metal) (Figure 1) [1]

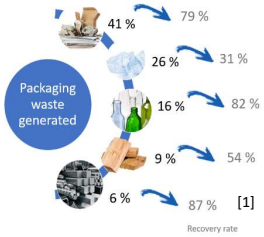


Figure 1: Packaging waste generated

Among the different types of plastic packaging, high-performance flexible packaging contributes to reducing climate actions, as it offers excellent versatility on its design, it is adjustable, contains less material per weight of product contained, and it is lightweight [2] (Figure 2), requiring less energy for transportation and reducing gas emissions.

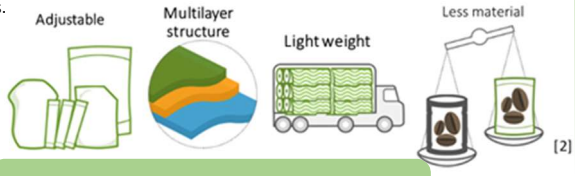
KNOWLEDGE GAP

High-performance flexible packaging consists of multilayer structures of different types of materials intimately combined, either by coextrusion or lamination [3]. The presence of different materials allows the design of light items with outstanding performance that meet the required properties to ensure the preservation of food products. However, this mixture of materials, together with the presence of food contamination after its use, and its lightweight aspect, make flexible packaging challenging to recover.

Therefore, the gap linked to the use of flexible packaging is related to waste management. Vast amounts of flexible packaging waste are disposed of in landfills and remain there for a long time without an appropriate destination, contaminating lands, and rivers. Incineration is widely used as a fuel alternative to solve this problem. However, the release of toxic gases (CO2 and acid gases) released to the environment results in environmental and health damage [4].

The development of sustainable high-performance flexible packaging through the use of biodegradable materials for its manufacture, stand as a novel strategy to tackle this waste management issues.

Figure 2: Flexible packaging properties



METHODOLOGY

To overcome the old linear consumption perspective (single-use: make- take – dispose) and reduce environmental impact, the use of alternatives routes to improve the flexible packaging waste management through the design of a biodegradable film is explored.

This project aims to develop a more sustainable packaging through the use of biodegradable and compostable polymer blends, with good mechanical and barriers properties (Table 1).

The workflow of the overall project and methodology is presented in Figure 3 and Figure 4, respectively. Biodegradability (marine and soil conditions) and composability tests will be done with the samples, and its mechanical properties and degradation rate will be evaluated through mechanical tests, thermal and analytical tests (Figure 4).

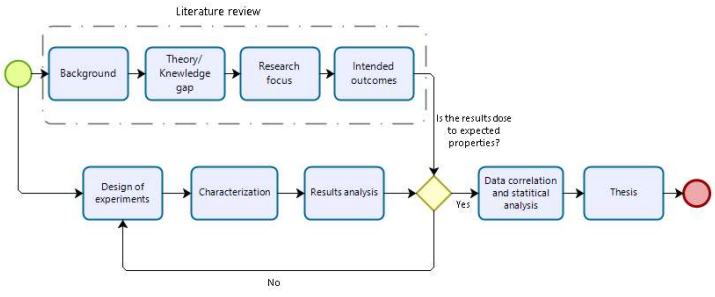


Figure 3: Project workflow

INTENDED OUTCOMES

Data compiled from current high-performance flexible packaging films in the market

Target properties to achieve with the formulation of novel biodegradable blends

Table 1: Expected properties of the flexible film

	Intended outcomes [5-7]		
Properties	**Units**	**Test method**	**Range target**
Thickness	µm	-	10.0 - 18.0
Tensile Strength (MD/ TD)	N/mm²	ASTM D882	140 -220 (MD)/ 190 -280 (TD)
Elongation (MD/TD)	%	STM D882	100 -220 (MD)/ 60 -100 (TD)
WVTR	g/m²/24 hr	ASTM E-398 (37.8°C, 90% RH)	0.2 - 2.33
OTR	cc/m²/24 hr	ASTM D-3985 (23°C, 50% RH)	0.5 - 2.95

WVTR: Water vapour transmission rate
OTR: Oxygen transmission rate
MD: Machine direction
TD: Transverse direction

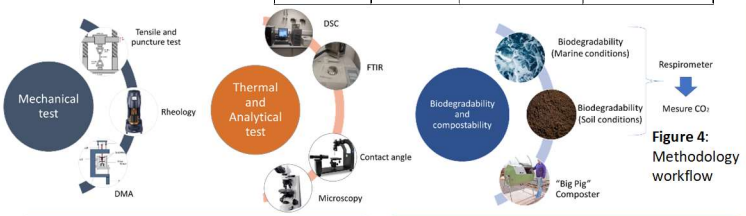


Figure 4: Methodology workflow

FINAL CONSIDERATIONS

Compostable materials seem to be a very interesting alternative; once a vast amount of flexible packaging is contaminated with food, it is difficult to be cleaned and recover through mechanical recycling. The design of a compostable film is an alternative with great potential to solve multilayer films' waste management problem.

There is a vast range of expected properties to flexible packaging. This work will focus mainly on its resistance barrier, moisture barrier, oxygen barrier, biodegradability, and composability, using a range of techniques available in Applied Polymer Technology (APT) and Materials Research Institute (MRI) from Athlone IT.

REFERENCES

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