

New materials development from natural resin by-products



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Keywords

resin derivatives

resinous forests

biodegradable plastic

NWFP

Resins

Scale

Global



Context

Plastic is a widely used material in the world, with an annual production of around 335 million tons. The use of plastic derived from petroleum presents a serious environmental problem due to its origin and its great contribution to the longlasting waste generation, as is the case for plastic for packaging and agricultural uses.

One solution is biodegradable plastics use, that quickly transform into compost.

However, bioplastics present poor properties compared with petrochemical counterparts. This is why several natural additives are being used to extend bioplastic industrial exploitation.



Objective

The study compares different formulations based on natural raw materials for plastics production and demonstrates the important role that natural resin derivatives can play in the improvement of biobased and/or biodegradable plastics performance, as an alternative to those derived from petroleum.

The final objective is to provide consumers with biodegradable plastic material of excellent technical qualities for the production of packaging and applications in construction, automotive, electronics or agriculture, in a context of environmental and economic sustainability.



Results

The improvement of the technical and environmental characteristics of a plastic coming from starch (i.e.: poly(lactic acid) (PLA)) and bacterial produced polyhydroxy butyrate (PHB), is demonstrated by adding Limonene, derived from natural resin, in the following aspects:

- Improved processability between PLA and PHB polymers.
- Improvement of the thermal product stability, with an improvement of the general small processing window of PHB.
- Increased flexibility, even while maintaining the mechanical strength of the product
- The disintegrability test under UNE-EN ISO 20200 standard confirmed the biodegradable character of all the tested formulations.



Recommendations

Considering that the bioplastic products are more expensive than traditional petrochemical-based products, the use of pine resin derivatives as plastic additives could reduce the cost of the final product. Biodegradable plastic, used rationally, produces environmental benefits such as plastic waste generation in agriculture.

Pine resin derivatives can be also used in petrochemical-based plastic to increase the biobased content into the formulation and reduce the environmental impact of these plastic products.

The success of the deliberate introduction of resin derivatives into the packaging sector depends on the viability of the resin derivatives production (terpenes, gum rosin, etc.) to supply the plastic industry.



Impacts and weaknesses

Pine resin derivatives can be used as natural raw material for the plastic industry extending the resins field of application.

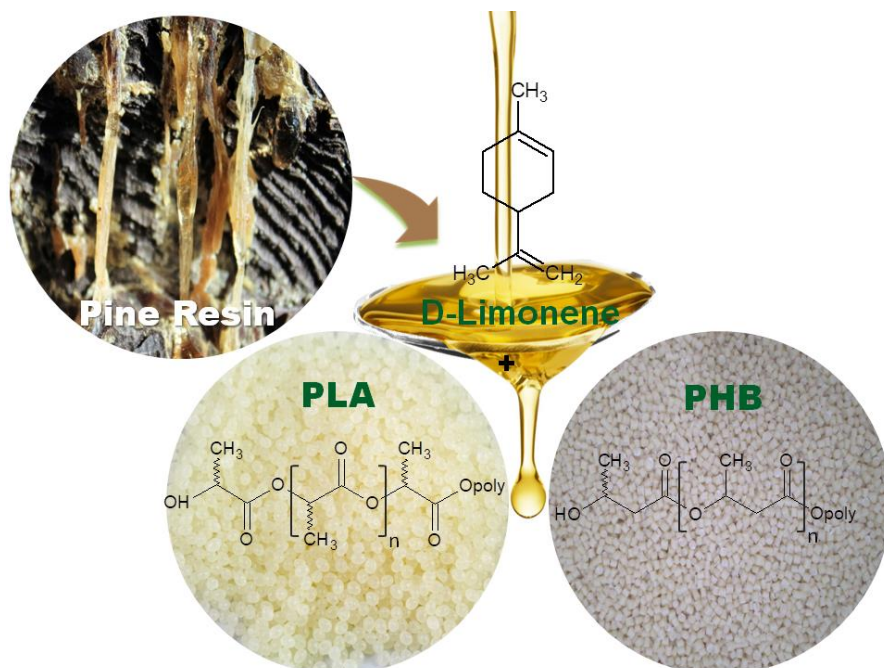
The use of forest products for the manufacture of plastics reduces fossil sources dependence and contributes to the valorisation of rural sustainable resources.

The main weakness is that the petrochemical industry produces very cheap plastic products and good for food packaging. However, the incorporation of the natural resin increases the added value of plastic products by adding functional properties such as antioxidant or antimicrobial.



Future developments

- Certified resin derivatives additives for food contact applications will be required.
- Pine resin derivatives can provide functional properties to plastic materials such as antioxidant and antimicrobial performance to extend food products shelf life.
- The introduction of pine resin into the plastic industry will generate a huge growth of the sector with a consequent increase of employee, industrialization, etc.
- The use of natural resin derivatives in the manufacture of plastics should benefit from proper labelling to allow raw material traceability and its promotion as a product from sustainably managed sources.



Schematic representation of the thermoplastic starch (TPS) preparation and the processing of TPS–resin blend formulations pine resin derivatives. Marina P. Arrieta.

Further information

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About INCREDIBLE Project

INCREDIBLE project aims to show how Non-Wood Forest Products (NWFP) can play an important role in supporting sustainable forest management and rural development, by creating networks to share and exchange knowledge and expertise. 'Innovation Networks of Cork, Resins and Edibles in the Mediterranean basin' (INCREDIBLE) promotes cross-sectoral collaboration and innovation to highlight the value and potential of NWFPs in the region.



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