Bio-based insulation made from banana plant fibres and flower stalks: an innovative response to climate, social and economic challenges

Context: an urgent need for sustainable solutions

Recycling abundant waste

Bananas, one of the most widely consumed fruits in the world, leave behind a surplus of stems and flower stalks (banana trees) that are often thrown away or burned.

Decarbonisation of industries

Growing demand for thermal insulation is pushing manufacturers to use high-performance materials, but their production has a high carbon footprint.

Pressure on resources

The need to increase global consumption while limiting the use of non-renewable resources calls for low-impact alternatives.

In this context, a ‘bio-based’ insulation technology using hemp fibres and banana tree flower stalks offers a solution with multiple benefits.

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Operating principle

Extraction of ultra-micronised fibres

The stalk and flower stem of the banana tree contain a multitude of fibres that can be divided down to a scale of a few microns, creating a very fine network.

Tubular structure of the pseudo-trunk core

The fibres from the heart of the banana tree trunk have a tubular architecture that naturally traps air, improving the thermal resistance of the final material after fraying.

Fire resistance

Unlike many organic materials, these fibres do not transmit the ignition point and show natural flame resistance, a crucial characteristic for construction applications.

Promising preliminary tests and global patent

Initial tests indicate very low thermal conductivity coefficients (approximately 0.025 $W\ m^{-1}\ K^{-1}$) and flame resistance in accordance with Euro 3 standards.

The technology has been patented globally, ensuring intellectual property protection and a competitive advantage.

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Environmental benefits

Recycling of plant waste	15 kg of raw fibre per banana tree → 34 Mt available globally..
Carbon reduction	Low CO_2 emissions production thanks to biomass and lower energy consumption (process at 150°C vs. 700°C for glass wool).
Biodegradability	Compostable material after use, eliminating the problem of plastic waste.
Water savings	Cultivating the stalk requires less water than glass wool, and banana trees can be grown in areas with low water availability.
Renewability	Both raw materials are renewable and can be grown in a closed loop.
Replacement of synthetic materials	Replaces petroleum-based insulation (polystyrene, polyurethane).

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Sustainable Development Goals (SDGs) achieved

 Zero hunger	Recycling agricultural waste (banana trees) to create added value.
 Clean water and sanitation	Stalk crops require little water.
 Affordable and clean energy	Superior thermal insulation reduces energy consumption for heating and air conditioning.
 Industry, innovation and infrastructure	**Patented technology, large-scale production**.
 Responsible consumption and production	Use of waste and reduction of pollutants.
 Climate action	Reduction of carbon footprint and improvement of energy efficiency in buildings.
 Partnerships for the goals	Collaboration between farmers, construction industries and governments.

Integration into global ESG policy

Environment (E)	- 30% reduction in CO_2 emissions per square metre of insulation compared to glass wool. - Recovery of 34 million tonnes of plant waste. - Use of renewable and biodegradable resources.
Social (S)	- Job creation in fibre collection, processing and manufacturing. - Support for local farmers through a new source of income for banana growers. - Improved quality of life through more comfortable and energy-efficient buildings.
Governance (G)	- Global patent guaranteeing protection of innovation. - Compliance with international safety and environmental standards (Euro 3, ASTM, ISO 9001).
ESG impact	- Reduction in building operating costs (energy bills, maintenance). - Increase in property value thanks to superior insulation.

Construction companies, property developers and governments can now align their ESG strategies with this technology: reducing carbon footprints, supporting local farming communities and offering products that comply with the most stringent standards.

Market outlook

Rapid adoption

Green building projects and growing energy renovation programmes are creating immediate demand.

Competitive cost

The manufacturing price, already competitive with synthetic insulation materials, is expected to continue falling thanks to economies of scale and the widespread availability of raw materials.

Synergies

Possibility of combining this material with other green solutions (green roofs, solar panels) for ‘positive energy building’ projects.

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Bio-based insulation made from banana stalk and flower stem fibres represents a major step forward in the development of sustainable and resilient buildings.

By transforming abundant waste into a high-end material, it simultaneously meets climatic, economic and social requirements.

Integrated into an ESG policy, this technology offers a clear roadmap for players in the construction sector to achieve sustainable development goals while creating lasting value for communities and investors.

‘When nature provides the fibres, innovation builds the solutions.’

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