Best Practice

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Developing agro-residue biocomposites to meet the needs of farmers

Plastics are omnipresent in agriculture for a broad range of applications, but their use and degradation results in persistent micro- and nano-plastic particles that contaminate soils and affect crop production. To tackle this issue, we are developing bio-based and biodegradable composite materials made from agro-residues. Our frugal design approach involves end-users, mainly farmers, from the earliest stage to ensure the materials possess only the necessary functional properties, avoiding the unnecessary replication of conventional plastics. However, agro-residues may contain residual contaminants, such as phytosanitary substances, which can persist through processing and pose risks if returned to the soil. To address this, we introduce a crucial new perspective by integrating safety criteria into the trade-off analysis between material performance, cost and environmental impact.

Project activity

Biocomposites using PHBV* as the matrix and finely ground peanut shell** particles (up to 15% by weight) as fillers, have been developed at the University of Montpellier. Rigid items were then manufactured by injection moulding.

To evaluate the safety of these materials, a ‘challenge test’ methodology was implemented. This involved deliberately contaminating the raw peanut shells with a range of pesticides, then assessing their capabilities throughout the transformation processes, including successive grinding steps and the subsequent production of the composite materials.

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Key findings and recommendations

This technology has delivered encouraging results and demonstrates potential as a cost-effective solution for transforming agricultural residues, especially blends of PHBV with peanut shells, into valuable bio-based materials. Replacing conventional plastics with bio-based materials could solve many problems.

- When these materials biodegrade, they don't produce any persistent particles because the carbon returns to the soil, meaning there's no plastic contamination of the land.
- Using agro-residues avoids the problems of managing this resource as waste. But the residual contamination of the new products obtained from these potentially contaminated residues must be carefully considered, as they could create new environmental issues.
- Involving the end-users, such as farmers, in the early design stage can help to create end-products tailored to specific requirements rather than trying to imitate conventional ones. In addition, including stakeholders helps to raise their awareness of current issues and possible solutions.

*PHBV: Polyhydroxybutyrate-co-hydroxyvalerate, a bio-based and biodegradable polymer (plastic) produced by microorganisms.

**Raw peanut shells were supplied by Shandong Jinsheng Cereals & Oils Foods Co. Ltd, partner of the project.

Contact

For more information about the AgriLoop Project, visit:

agriloop-project.eu

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