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LIFE CYCLE ASSESSMENT OF RECYCLED POLYAL–RICE HUSK BOARDS FOR URBAN FURNITURE

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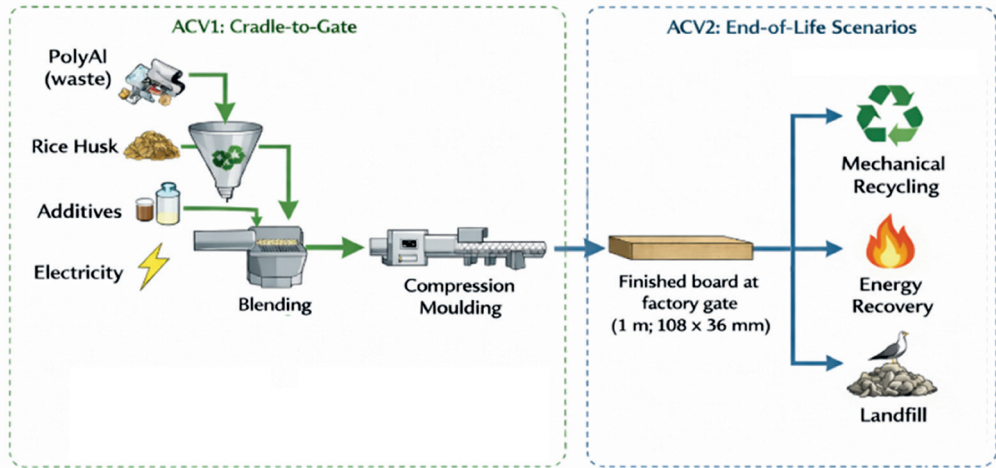
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Abstract – Multilayer beverage cartons and rice husk represent two abundant waste streams with significant yet underutilised potential in circular-economy applications. This work presents a life cycle assessment (LCA) framework for wood-like composite boards manufactured in Valencia (Spain) using 70 wt.% recycled PolyAl from beverage cartons and 30 wt.% ground rice husk. The boards are produced through blending, extrusion and compression moulding, yielding prismatic profiles with an approximate 108 × 36 mm cross-section and lengths up to 3 m. The study is designed as a cradle-to-gate assessment (ACV1) to quantify the environmental impacts of manufacturing the boards and to identify process hotspots. The functional unit is defined as 1 m of finished board at the factory gate (108 × 36 mm). The PolyAl fraction is modelled using a cut-off approach, treating it as a waste-derived input and accounting for impacts from collection/handling and transport to the manufacturing site onwards. Modelling is conducted in openLCA using the Environmental Footprint method (EF 3.1) for impact assessment; background processes such as electricity supply, transport and end-of-life treatments are represented using recognised LCA datasets. In addition, an end-of-life scenario block (ACV2) is included to explore the sensitivity of results to alternative waste management routes for the board, namely mechanical recycling, energy recovery and landfill. The scenario analysis is intended to assess how strongly the overall environmental profile depends on disposal assumptions and to support decision-making for scalable waste-valorisation pathways. The results include quantified impact indicators per functional unit, a contribution analysis distinguishing the role of electricity demand in extrusion and compression moulding versus material inputs and transport, and a comparative evaluation of alternative end-of-life scenarios. The work provides an initial, transparent environmental baseline to complement prior mechanical characterisation and to guide future optimisation and scale-up of waste-based composite boards for low-load urban furniture and related outdoor applications.

Keywords – *Circular economy; end-of-life scenarios; environmental Footprint (EF 3.1); extrusion; hotspot analysis; material recycling; resource recovery; waste valorisation*



System boundaries and end-of-life scenarios of the assessed board

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