Recycled Nonwoven Solutions to Close the Loop in Automotive Interiors.

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Abstract

Increasing regulatory pressure, particularly through the EU End-of-Life Vehicles (ELV) Directive and Circular Economy Action Plan, is driving the automotive sector towards higher recycling rates, recycled content integration, and circular design strategies. In this context, Be.Neutral project, and particularly the WP6 (Ligh Vehicle BEN) aims to accelerate sustainable mobility supporting both regulatory compliance and environmental performance. This work develops a circular and sustainable solution for automotive interiors, focusing on a headliner produced from recycled textile waste. The project explored the integration of post-industrial and post-consumer materials, namely textile selvages and ELV automotive seat belts, into high-performance nonwoven structures suitable for thermoforming applications.

A comprehensive process chain was established, including waste collection, sorting, washing, and mechanical recycling for fiber recovery. Recycled fibers were processed into different nonwoven formulations by carding and needle punching including 100% recycled polyester and blends with bicomponent fibers to enhance mechanical integrity and processability. Nonwoven structures were then evaluated in thermoforming processes with complex 3D geometries, under different sets of processing parameters.

An extensive validation plan was followed to guarantee that the materials would be compliant with key automotive requirements such as flammability, fogging, odour, and mechanical behaviour, amongst others. The optimized solution successfully replaced conventional virgin materials with recycled alternatives while maintaining functional performance in demanding applications.

Throughout the project, an approach for circular sustainability was also adopted, including the definition of an end-of-life strategy for the component. Preliminary tests revealed that the recycling process of the components is able to generate new fiber that can be reintroduced in the production process of a new component. In parallel, energy consumption data was collected across all processing stages to support future Life Cycle Assessment (LCA), enabling quantification of environmental impacts and comparison with conventional solutions.

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The results demonstrate a viable pathway towards circular economy practices in the automotive sector, highlighting the potential for valorisation of textile waste from automotive sources, reduce resource consumption, minimize environmental impact, and support the transition to more sustainable mobility solutions.
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