

Cost and performance vs environmental impact:

Using natural fibres in composite car panels

Suilven RDE Ltd, an automotive design SME, contacted the National Composites Centre (NCC) for help in exploring the use of natural fibre composites in their car body panels.

Project SALSA looked into the likely environmental savings that could be made, as well as impact on the performance of the car.

Challenge

Historically, composite materials were used in the automotive industry for low production volume, high-end sports vehicles for performance benefits. However, the use of composites in the automotive industry is rising due to the benefits offered in terms of light weighting, which results in lower fuel consumption for petrol cars and extended range for electric vehicles. However, as the environmental benefit of lightweighting using composites is realised, focus is turning to the environmental impact of the materials used.

Zero emissions and end-of-life goals are forcing the automotive industry to consider multiple aspects of sustainability, throughout the life cycle of their vehicles. The materials selected for car and other land vehicle components form a key part of these sustainability goals. As a result, natural fibre composites are beginning to gain traction for automotive applications as a more sustainable solution to their petrochemical counterparts. Tesla¹ and Porsche² have recently reported the use of natural fibres for car bodywork, offering a lightweight and lower cost solution with increased crash performance and a reduced impact on the environment.

Innovation

Using a rapid Global Warming Potential (GWP) calculation tool developed at the NCC and commercially available databases, the GWP of fibre selection (jute vs carbon) for the part was assessed. The analysis also included other industry key drivers such as cost of materials and mass of the resulting part, to understand their overall suitability.



The quantities of materials needed to meet strength requirements were calculated for each material option using a simple scaling by specific modulus, and subsequently used in the environmental and cost analyses.

Result

Results from this assessment indicate that the selection of Jute fibres composite would offer both environmental and cost benefits in comparison to the carbon fibre option in the materials selection stage, however this would produce a heavier body panel and therefore the performance of the car would be impacted. The results are summarised in Table 1. Expansion of this LCA to incorporate the use phase would provide additional data on the effect of fibre selection on the environmental impact across the service life of the vehicle.

Material	Mass needed (kg)	Panel mass (kg)	Cost range (£)	GWP estimate (kgCO ₂ -eq)
Carbon fibre	69	100	814-1221	2397
Epoxy	31			
Jute fibre	110	160	308-517	413
Epoxy	49			

Table 1. Cost and environmental impact of different composite options

Impact

Suilven is committed to exploring different sustainable options for the car body work, and this work has provided the key trade-offs between sustainability and performance needed for its design. The use of natural fibre systems could be a game changer for the automotive industry as they seek to reduce their carbon footprint in the fundamental materials and manufacture of the future car. This is reflected in the exponential uptake across all industries in the use of LCA for driving design decisions. The ability to understand key drivers for the sector and consider trade-offs based on environmental data, as well as performance and cost, allow for the best outcome for the design. The SALSA project set the foundations for a follow-up project, SILVIA, which investigated the use of natural fibres with bio-based and bio-degradable resin systems for automotive body panel solutions.

“ This study quickly offered a clear picture on embodied and operational carbon for low volume car designers considering the natural fibre composites currently available.

While the study was at a top level, it provided essential design guidance in this quickly evolving area of product design. ”

Chris Runciman
Owner, Suilven RDE Ltd

References

- (1) <https://netcomposites.com/news/electric-gts-tesla-p100dl-features-bcomp-flax-fibre-technologies/>
- (2) <https://www.racetechmag.com/company/bcomp/>