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Natural Fibre Polymer Composites - A game changer for the aviation sector?

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ABSTRACT

As part of the efforts to reduce the environmental impacts caused by the aviation sector, the use of bio-based instead of fossil-based materials has been proposed as one possible mitigation option. Natural Fibre Polymer Composites have proven to have a higher environmental performance in the automotive sector and are emerging as an option for weight reduction in aircrafts. This study quantifies, through Life Cycle Assessment, the environmental performance of specific flax-based composite panels intended for aircrafts as interior fitting elements (i.e. partition panels, tray tables, baggage compartments) compared to a glass fibre/epoxy composite with a honeycomb core. Through system expansion, the fate of co-products issued from the production of the flax fibre technical textile used as reinforcement in the biocomposite material was considered in the assessment.

Results: showed that for an application in the aeronautics sector, the weight of the panels is the upmost critical parameter shaping the overall environmental performance of panels. Focusing on the panel production only, the biocomposite panel showed a higher environmental performance in the categories of climate change and marine eutrophication compared to the conventional panel, and the fire suppressant agent was identified as the main contributor to the environmental impacts of the bio-based panel. Yet these gains were negligible when considering the full life cycle of the panels, due to the higher weight (14%) of the bio-based panels; which is linked to the bio-based panel being still at the prototype stage.

In order to improve the environmental performance of the biocomposite panel and thus reduce its weight, it was shown relevant to optimize the geometry of the panel itself, especially its core, so less resin could be used.

1. Introduction

Though it only represents a little over 2% of global greenhouse gas (GHG) emissions (Graver et al., 2019), aviation is becoming a growing public concern in the light of the current climate urgency (IPCC 2018). Because fuel represents ca. 25% of operating expenses for the global air transport industry (IATA 2019), efforts to reduce fuel consumption have already been undertaken by the sector. In 2011, the European Commission, through the Advisory Council for Aviation Research and Innovation in Europe (ACARE), published five goals to be achieved in the *Flightpath 2050* report. One of these goals targets a 75% reduction in CO_2 emissions and a 90% reduction in NO_x emissions per passenger kilometre, while another goal aims for aircrafts to be recyclable (ACARE 2011).

In an attempt to achieve these goals, lighter materials have been researched to replace those currently used, this allowing for lower fuel use. Indeed, jet fuel used during an aircraft lifetime is in fact responsible for more than 75% of the GH emissions in the whole life cycle (Bachmann et al., 2017). Moreover, these GHG emissions are more environmentally damaging compared to those emitted at ground level due to the increased interaction of gases at higher

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