

Predicting the potential of agro waste fibers for sustainable automotive industry using a decision making model

ABSTRACT

Developing a sustainable industry requires proper utilization of the available and compatible natural resources. Selecting a proper natural fiber type to form a reinforced polymer composite suitable for sustainable automotive industry is considered as a multi criteria decision making problem. This work (i) ranks different natural fiber types according to their appropriateness for the sustainable automotive industry using a decision making technique for the first time. (ii) Predicts the potential of the date palm fiber (DPF) as a reasonable cheap alternative for the sustainable automotive industry. A combined informative/expert-feedback decision making model utilizing the analytical hierarchy process (AHP) was built to rank and predict the potential of the natural fibers. This model can optimize finding the most appropriate available, cheap, eco-friendly alternative material to enhance not only the sustainability and productivity of the automotive industry but also the environmental performance too. A pilot questionnaire was conducted to ensure the appropriateness of the used model. The natural fiber options considered were: coir, date palm, flax, hemp and sisal. The flax fiber type is the best choice for automotive applications as it ranks highest, followed by the date palm fiber as a reasonable competitive cheap alternative choice. This decision was made based on simultaneous technical and economic standpoints. Date palm fiber was found to be the best choice regarding many criteria like Fiber's Specific Strength to Cost Ratio one. Results demonstrated that the most AHP model priority stack was occupied by both Mechanical Properties and Specific Performance for Automotive Applications criteria. Sensitivity analysis illustrated the reliability of the results and the drawn judgments in this study.

Keyword: Date palm; Bio-composites; AHP; Fiber selection; NFC; Automotive industry