

Combined multi-criteria evaluation stage technique as an agro waste evaluation indicator for polymeric composites: Date palm fibre as a case study

ABSTRACT

The final features of natural fiber composites (NFCs) depend on the integrated characteristics of their constituents. In the industry today, natural agro waste fibers are evaluated using a limited number of criteria. In this work, a combined multi-criteria evaluation stage technique (CMCEST) is introduced as a simple efficient systematic indicator to enhance evaluation of the available natural agro wastes for polymeric composites. In this proposed technique, criteria affecting the proper selection of natural agro waste fibers were combined and divided into sequence stages as follows: single-evaluation-criterion (SEC), combined-double-evaluation-criterion (CDEC), combined-triple-evaluation-criterion (CTEC), etc. These stages are based on combined physical, mechanical, and economic evaluation criteria and can be extended to several further stages to include other beneficial characteristics. The effectiveness of this technique was demonstrated by evaluating coir, date palm, jute, hemp, kenaf, and oil palm fibers simultaneously. This combined evaluation criteria can lead to more informative decisions regarding selection of the most suitable fiber type for polymeric composites. The CMCEST enhancements can reveal new potential fiber types through better evaluation schemes, help achieve clearer indications of the capabilities of available agro wastes to enhance composites, and determine proper ecological waste management practices. Utilizing the proposed technique, the date palm fiber type was found to be quite promising due to beneficial characteristics revealed in CTEC, which provides a reasonable, cheap, and eco-friendly alternative material suitable for different applications.

Keyword: Natural fiber composites; Combined evaluation criteria; Agro wastes; Date palm fibers; Waste management practice; Mechanical properties