Lecture Notes in Mechanical Engineering • Pages 437 - 443 • 2023 • 5th International Conference on Advances in Manufacturing and Materials Engineering, ICAMME 2022 • KualaLumpur • 9 August 2022through 10 August 2022 • Code 294689

Document type
Conference Paper

Source type
Book Series

ISSN
21954356

ISBN
978-981199508-8

DOI
10.1007/978-981-19-9509-5_58

Publisher
Springer Science and Business Media Deutschland GmbH

Original language
English

Volume Editors
Maleque M.A., Ahmad Azhar A.Z., Sarifuddin N., Syed Shaharuddin S.I., Mohd Ali A., Abdul Halim N.F.

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Optimizing Tensile Strength of PLA-Lignin Bio-composites Using Machine Learning Approaches

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Abstract

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Abstract

It is imperative to accurately estimate the final performance of composite parts during the initial design phase of the manufacturing process. In generating sustainable bio composites with superior mechanical properties such as tensile strength, the combination of fillers and plasticizers, as well as their concentration in the mixture, are always deemed crucial. In order to reduce the number of experimental runs and their associated costs and timescales, statistical optimization of the core design elements has become increasingly important. The filler and plasticizer concentrations of extruded bio composites were adjusted in this study utilizing both statistical (analysis of variance (ANOVA) and response surface methodology (RSM)) and machine learning (Multilayer Perceptron (MLP)) approaches. Initial ANOVA results indicated that lignin, epoxidized palm oil (EPO), and their respective combinations were the most influential factors in enhancing the durability of lignin/polylactic acid (PLA) bio composites. In this work, RSM and MLP were used to model and predict the data in order to maximize the various solutions and establish the nonlinear relationship between theconcentration of lignin and EPO. © 2023, The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd.

Author keywords

Analysis of Variance (ANOVA); Lignin bio composites; Machine learning; Multilayer Perceptron (MLP); Response Surface Methodology (RSM)

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