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Renewable Energy  
Volume 158, October 2020, Pages 202-214

## Ultrasound-assisted process optimization and tribological characteristics of biodiesel from palm-sesame oil via response surface methodology and extreme learning machine - Cuckoo search (Article)

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### Abstract

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The purpose of this study was the improvement of cold flow and lubricity characteristics of biodiesel produced from the palm-sesame oil blend. Extreme learning machine (ELM) and response surface methodology (RSM) techniques were used to model the production process and the input variables (time, catalyst amount, methanol to oil ratio, and duty cycle) were optimized using cuckoo search algorithm. The mean absolute percentage error (MAPE), coefficient of determination ( $R^2$ ), mean square error (MSE), root mean square error (RMSE), and standard error of prediction (SEP) were calculated to evaluate the performance of RSM and ELM. The results showed that ELM model had better performance in prediction than RSM model. The optimum yield of P50S50 biodiesel obtained was 96.6138% under operating parameters of time (38.96 min), duty cycle (59.52%), methanol to oil ratio (60 V/V %) and catalyst amount (0.70 wt%). The cold flow characteristics of P50S50 biodiesel are significantly improved like cloud point (7.89 °C), pour point (3.80 °C), and cold filter plugging point (- 1.77 °C) with better oxidation stability 6.89 h. The average coefficient of friction P50S50 biodiesel was lower than palm biodiesel (B100) and B10 commercial diesel by 2.29% and 12.37% respectively. © 2020 Elsevier Ltd

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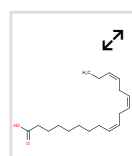
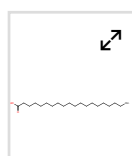
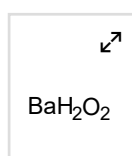
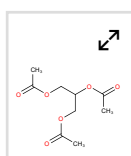
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Universiti Malaya	FP142-2019A	
Ministry of Higher Education, Malaysia		MOHE

## Funding text

The authors would like to thank the Faculty of Engineering at the University of Malaya , Malaysia for their support through the research grant no FP142-2019A under the Fundamental Research Grant Scheme (FRGS) from Ministry of Higher Education, Malaysia; and Higher Education Commission, Islamabad, Pakistan for financial support [Grant No. 5-1/HRD/UESTPI (Batch-VI)/4954/2018/HEC ].

ISSN: 09601481

Source Type: Journal

Original language: English

DOI: 10.1016/j.renene.2020.05.158

Document Type: Article

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