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Biodiesel production process optimization from *Spirulina maxima* microalgae and performance investigation in a diesel engine (Article)

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Abstract

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Biodiesel is a renewable, easily biodegradable, eco-friendly and sustainable alternative energy source. In this investigation, crude oil was extracted from *Spirulina maxima* microalgae through biochemical conversion method with the help of soxhlet apparatus. Biodiesel production process parameters were optimized through base transesterification. Maximum biodiesel yield achieved was 87.75 % at optimal reaction condition after transesterification, when methanol to oil ratio was 6:1, catalyst loading was 1 % KOH (wt.%), temperature was 65 °C, and stirring speed was 600 rpm for a reaction time of 70 minutes. All the physicochemical properties of the produced biodiesel were determined and compared with the ASTM D6751 specification. Finally, performance and emission of an unmodified diesel engine was evaluated with 20 % and 40 % (v/v) biodiesel blends and compared the results with ordinary Diesel fuel (DF). Using biodiesel blends improves Hydrocarbon (HC) emission by 10-15 % and Carbon monoxide (CO) emission by 9.3-13.9 %. However, Brake specific fuel consumption (BSFC), Oxides of nitrogen (NOx), Carbon dioxide (CO₂) and smoke opacity were found to be slightly higher for biodiesel blends, and Brake thermal efficiency (BTE) was found slightly lower than DF. Thus, *Spirulina maxima* serves as a potential feedstock for biodiesel production and prospective fuel in diesel engine application. © 2017, The Korean Society of Mechanical Engineers and Springer-Verlag GmbH Germany.

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