Journal of Mechanical Science and Technology
Volume 31, Issue 6, 1 June 2017, Pages 3025-3033

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

Rahman, M.A.[a], Aziz, M.A.[ab], Ruhul, A.M.[ac], Rashid, M.M.[b]

[a]Department of Mechanical Engineering, Rajshahi University of Engineering and Technology, Rajshahi, Bangladesh
[b]Department of Mechatronics Engineering, International Islamic University Malaysia, Jalan Gombak, Kuala Lumpur, Malaysia
[c]Department of Mechatronics Engineering, University of Malaya, Kuala Lumpur, Malaysia

Abstract

View references (23)

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 (CO_2) 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.

Reaxys Database Information

View Compounds

Author keywords

Biodiesel | Emission | Optimization | Performance | Spirulina maxima | Transesterification

Indexed keywords

Engineering controlled terms: Algae | Brakes | Carbon dioxide | Carbon monoxide | Diesel engines | Diesel fuels | Engines | Fuel consumption | Fuels | Microorganisms | Neutron emission | Optimization | Transesterification

Compendex keywords: Alternative energy source | Brake specific fuel consumption | Brake thermal efficiency | Diesel engine applications | Optimal reaction condition | Performance | Performance and emissions | Spirulina maxima

Engineering main heading: Biodiesel

ISSN: 1738494X
Source Type: Journal
Original language: English

DOI: 10.1007/s12206-017-0546-x
Document Type: Article
Publisher: Korean Society of Mechanical Engineers

References (23)

View in search results format

All Export Print E-mail Save to PDF Create bibliography

1 Rahman, M.A., Ruhul, A.M., Aziz, M.A., Ahmed, R.
Experimental exploration of hydrogen enrichment in a dual fuel CI engine with exhaust gas recirculation
(2017) *International Journal of Hydrogen Energy*, 42 (8), pp. 5400-5409. Cited 2 times.
http://www.journals.elsevier.com/international-journal-of-hydrogen-energy/
doi: 10.1016/j.ijhydene.2016.11.109

View at Publisher