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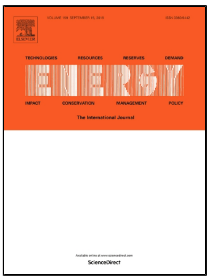

Optimal efficient biodiesel synthesis from used oil employing low-cost ram bone supported Cr catalyst: engine performance and exhaust assessment

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Optimal efficient biodiesel synthesis from used oil employing low-cost ram bone supported Cr catalyst: engine performance and exhaust assessment

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Abstract:

This article reports the preparation of cost-effective bio-hydroxyapatite (ram bone derived) supported mesoporous Cr heterogeneous catalysts and its performance in biodiesel production from used frying mustard oil (UFMO). The optimal catalyst (98.45 m^2/g BET area; pore volume 0.0586 cc/g; modal pore diameter 19.3 nm and 0.78 mmol NH_3/g catalyst acid-site concentration) demonstrated remarkable efficacy in sustainable synthesis of biodiesel from UFMO achieving maximum FAME content (96.85%) at optimal (predicted through D-optimal method) conditions: 4 wt.% catalyst concentration, 8.0 methanol/UFMO molar ratio and 200 °C calcination temperature for catalyst preparation. Biodiesel production through concurrent transesterification-esterification (CTE) of UFMO could be augmented from 40.22% (conductive heating system) to 96.85% FAME yield using energy-proficient infrared radiation. Promising engine operation was recorded in terms of lower exhaust temperature at various blends of petrodiesel-product biodiesel in comparison with unaided petro-diesel. Assessment of exhaust emissions implied a significantly low CO (0.05%) and hydrocarbon (HC) emissions (<0.00002) for product biodiesel conforming to Euro-VI emission standards. Thus, the article demonstrates an inexpensive and efficient avenue for utilisation of waste resources to generate and utilise clean and renewable energy.

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