

# Characterization of biodiesel production (ultrasonic-assisted) from evening-primroses (*Oenothera lamarckiana*) as novel feedstock and its effect on CI engine parameters

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## A B S T R A C T

In this research, *Oenothera lamarckiana* seed oil (OLO) has been investigated as a novel feedstock for biodiesel production in Iran. Ripe shrubs of *Oenothera lamarckiana* were collected from farms in Koh-giluyeh and Boyerahmad (around city of Yasouj) and seeds were extracted after drying of the stems. Then oil was extracted by a chemical method (Soxhlet extraction system). A maximum oil content of 26% has been found by chemical method extraction. Physical and chemical characteristics of *Oenothera lamarckiana* oil (OLO) have been investigated. Biodiesel has been prepared using Ultrasonic set-up. By using the response surface methodology (RSM), the biodiesel production process was optimized to obtain the highest yield of biodiesel conversion. In this research, reaction parameters such as molar ratio (methanol to oil), reaction time, amplitude and pulse are studied. Moreover, the performance and the exhaust emissions of a diesel engine have been investigated. All of the experiments are performed at a constant speed of 2100 rpm at loads of 0%, 25%, 50%, 75%, and 100%. The results of research showed that the conversion of biodiesel was 92.06% under the optimized conditions of 7.73:1 M ratio (methanol to oil), amplitude of 62.59 (%), and 91.22 pulses for a reaction time of 9.65 min. Experimental engine test results indicated that by using the biodiesel-diesel blends, brake power, and concentrations of the CO<sub>2</sub> and NO<sub>x</sub> emissions were increased, while the specific fuel consumption (SFC) and concentration of CO and HC emissions were decreased. Investigation of the properties of fuel, engine performance and emission parameters revealed that biodiesel from *Oenothera lamarckiana* oil complied with the limits prescribed in the ASTM D6751 standards, and this seed oil can be introduced as a new feedstock for biodiesel production in Iran.

*Keywords:* *Oenothera lamarckiana* oil Biodiesel; Ultrasonic; RSM