



Garden cress (*Lepidium sativum* Linn.) seed oil as a potential feedstock for biodiesel production

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HIGHLIGHTS

- *Lepidium sativum* seeds contain 26.77% of oil.
- *Lepidium sativum* seed oil (LSO) was transesterified into its methyl esters (LSOME).
- The properties of LSOME were evaluated against ASTM standards for biodiesel.
- LSOME fuel properties indicate that it is suitable for use as a biodiesel fuel.

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ABSTRACT

Lepidium sativum L. (garden cress) is a fast growing annual herb, native to Egypt and west Asia but widely cultivated in temperate climates throughout the world. *L. sativum* seed oil (LSO) extracted from plants grown in Tunisia was analyzed to determine whether it has potential as a raw material for biodiesel production. The oil content of the seeds was 26.77%, mainly composed of polyunsaturated (42.23%) and monounsaturated (39.62%) fatty acids. Methyl esters (LSOMEs) were prepared by base-catalyzed transesterification with a conversion rate of 96.8%. The kinematic viscosity (1.92 mm²/s), cetane number (49.23), gross heat value (40.45), and other fuel properties were within the limits for biodiesel specified by the ASTM (American Standard for Testing and Materials). This study showed that LSOMEs have the potential to supplement petroleum-based diesel.

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1. Introduction

Vegetable oils such rapeseed, soybean and sunflower oil are the most used raw materials for biodiesel production, but these oils are expensive and also used for food production. Therefore, non-food oils have been evaluated as renewable resources for biodiesel production (Ruan et al., 2008, 2012). One of the possible alternative oils for biodiesel production is oil from the seeds of garden cress (*Lepidium sativum* L.), a fast growing annual herb belonging to the Brassicaceae family that is native to Egypt and west Asia. Garden cress is also widely cultivated in temperate countries for various culinary and medicinal uses (Gokavi et al., 2004). The brownish-red oval seeds of *L. sativum* contain approximately 22.7% oil (LSO), mainly consisting of unsaturated fatty acids such as linolenic, linoleic, gadoleic, oleic, and erucic acid (Moser et al., 2009; Diwakar et al., 2010). Shehzad et al. (2011) found that a maximum seed yield of 305.9 kg per hectare can be obtained when

grown without competition from weeds. Garden cress can be sown and harvested several times throughout the year, although January, February and November are the most suitable months of the year to sow garden cress in a Mediterranean climate (Tuncay et al., 2011). These findings show that *L. sativum* seed is a potential source of oil and hence justifies the study on possible industrial uses. This paper presents the process development in the production of biodiesel from *L. sativum* seed oil. The first objective of this study was to optimize the reaction condition for weight ratio of catalyst to methanol at 65 °C. The second objective was to analyze the fuel properties such as gross heat value, cetane number, viscosity, density, flash point, cloud point and pour point.

2. Methods

2.1. Materials

Mature pods of *L. sativum* were collected in August from different plants in the same field located at latitude 48°24'N; longitude 13°74'E; altitude: 17 m in Sidi Thabet (Tunisia). The mature pods

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