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Euonymus maackii Rupr. Seed oil as a new potential non-edible feedstock for biodiesel

Ju-Zhao Liu [a, 1], Qi Cui [a, 1], Yu-Fei Kang [a], Yao Meng [a], Ming-Zhu Gao [a], Thomas Efferth [b], Yu-Jie Fu [a, c, *]

[a] Key Laboratory of Forest Plant Ecology, Ministry of Education, Northeast Forestry University, 150040 Harbin, PR China
[b] Department of Pharmaceutical Biology, Institute of Pharmacy, University of Mainz, 55099 Mainz, Germany
[c] Advanced Innovation Center for Tree Breeding by Molecular Design, Beijing Forestry University, 100083 Beijing, PR China

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ABSTRACT

In this study, *Euonymus maackii* Seed oil (EMSO) was exploited and evaluated for the first time as a new non-edible oil feedstock for preparation of biodiesel. The EMSO yield was 41.06 ± 2.68 wt%. The fatty acid compositions of EMSO involved palmitoleic acid (2.01%), palmitic acid (14.5%), stearic acid (3.1%), oleic acid (49.8%), linoleic acid (29.3%), 11-Eicosenoic acid (0.1%) and arachidic acid (0.07%). Microwave-assisted transesterification with methanol provided a high conversion yield in short duration under low temperature. The 2.0 wt% of catalyst amount, 10:1 of methanol/oil molar ratio, 40 min of reaction time and 60 °C of temperature were found to be the optimum process conditions for the maximum biodiesel yield of 94.74 ± 2.09%. Using pseudo first-order kinetic model, the reaction rate constants were 2.145×10^2, 3.550×10^2 and 6.447×10^2 min^{-1} for 40, 50 and 60 °C, respectively. The thermodynamic property for biodiesel preparation was determined as activation energy = 47.67 kJ/mol. The fuel properties of the biodiesel product were evaluated and comparable to ASTM D-6751 and EN 14214 standards. Overall, this study revealed and confirmed the potential of *Euonymus maackii* seed oil as the appropriate alternative feedstock for biodiesel production.

1. Introduction

In recent years, the process of industrialization demand for energy has increased significantly meanwhile fossil fuels are going to be exhausted [1,2]. Anthropogenic carbon dioxide emissions are thought that cause many environmental concerns such as global warming [3]. The use of energy in future must be sustainable. The development of substitute petroleum-based fuels with bio-derivatives is the best solution for energy challenge and climate change [4]. Accessing to green, clean, eco-friendly, natural affinity and renewable energy has been a cornerstone of development since the beginning of the industrial revolution [5].

Lots of renewable energy resources such as biodiesel, nuclear energy, solar power source, wind power source and hydrogen gas fuel have been widely used. Among them, biodiesel has attracted much attention due to the benefits of being a carbon neutral fuel, higher cetane number, sulfur-free, nontoxic, lower aromatic emission, and biodegradability [6]. Biofuels represent an essential contribution to the future energy supply, and more importantly it will contribute to a reduction of CO_2 emissions, hereby validly contribute to a reduction in global warming [7]. Second to none substitution of fossil fuels is developing biodiesel, a renewable energy source. The biodiesel is produced by a transesterification reaction from plant oils including herbage oils and tree born oil, such as soybean oil, peanut oil, corn oil, rapeseed oil, coconut oil, rubber seed oil and curcas oil. Plant oils for producing biodiesel are classified into edible oils and non-edible oils. However, the extensive use of edible oils for biodiesel production may occupy and contend farm land to cause food shortage [8,9]. Therefore, the necessity and potentiality of non-edible oils from energy plant for biodiesel production is remarkable. Considerable literature shows that most of energy plants grow in the areas near the equator, concentrating in the tropics and temperate zones. In high northern latitude area, native energy plants have few been reported, which is attributed to the short duration of sunshine, low average annual

* Corresponding author. Key Laboratory of Forest Plant Ecology, Ministry of Education, Northeast Forestry University, 150040 Harbin, PR China.
E-mail address: yujie_fu@163.com (Y.-J. Fu).
[1] These authors contributed equally to this work.

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