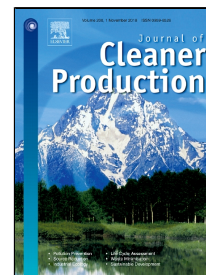


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An Analysis of Liquid-Biofuel Production Potential from Agricultural Residues and Animal Fat (Case Study: Khuzestan Province)

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Abstract

The world today is facing challenging crises like depletion of fossil fuels and environmental pollution. Biofuels can be an alternative solution to fossil fuels. Iran hosts a variety of weather conditions and its soil can grow different types of plants suitable for production of liquid biofuels. In this regard, the present research is an in-depth attempt to explore the potentials of Khuzestan Province as an agriculture hub of Iran to produce liquid biofuels. The studied biodiesel sources included oilseeds, animal fats and fish wastes, and the sources of bioethanol were wheat, sugarcane, sugar beet, rice, barley, maize, alfalfa, potato, grapes, apple, date and other local citrus fruits including orange, grapefruit, sweet lemon, sour lemon and sour orange. Results showed that the province's production potential was 1.04 Gl of bioethanol. A 5% addition of ethanol to gasoline (*i.e.* E5) can save 63.5 Ml of gasoline throughout the province. The estimated biodiesel production from animal fat- and oil-containing products and fish wastes is about 56 Ml in this province that can supply 2% of its total diesel fuel requirement. The estimated fat-based biodiesel production of Iran is 332.56 million liters. By adding the biodiesel production from oilseeds, Iran can produce 1.27 Gl of biodiesel fuel. This amount can supply 4.2% of the country's total diesel fuel consumption. The results for bioethanol and biodiesel production show promising alternatives. As a result of sound management of agricultural residues, E5 (5% ethanol, 95% gasoline) for SI engines and B2 (2% biodiesel and 98% diesel fuel) for diesel engines can be commercially produced as they impose no modifications to these engines.

Keywords: Biodiesel, Bioethanol, Agricultural residues, Animal fat.

1. Introduction

Today, energy has turned into a critical lever that directly affects national benefits and informs international relations. The growing demands for energy and emissions from fossil fuels have attached great significance to development of alternative fuels from renewable sources (Kumar et al., 2012; Somorin et al., 2017). National policymakers are constantly faced with two challenges: supply of energy and prevention of environmental pollutions and global warming (Chynoweth et al., 2000; Shahid and Jamal, 2011). The international approach is to mitigate environmental pollution and to prevent deforestation and grassland/land degradation, followed by desert greening and production of low-emission environmentally friendly renewable fuels (Geller et al., 2004).

Fossil fuels are the main global source of energy that supplies 90% of its requirements. The most important fossil fuels are oil, natural gas and coal. These fuels are used to supply 95% of the total energy requirement for purposes such as heating, transportation, and power generation (Ghobadian, 2012; Mekhilef et al., 2011; Nematizade et al., 2011). A report by International Energy Agency (IEA) suggests that the world's total primary energy has increased from 10,359 Mtoe in 2002 to 13,699 Mtoe in 2014. The contribution of different energy sources in supplying the world's primary energy is as follows: oil (31.3%), coal (28.6%), natural gas (21.12%), biofuels (10.3%), nuclear power (4.8%), hydropower (2.4%) and other sources (*e.g.* solar, wind and geothermal) (1.4%) (Hafeznia et al., 2017; Hosseini et al., 2013). According to recent literature on energy, fossil sources are depleting causing a serious global energy crisis unless alternative sources are found. Thus a major concern of every policymaker around the world is promotion of clean alternative fuels to curb loss of national capitals and mitigate environmental impact (Moosavi et al., 2018; Safieddin Ardebili et al., 2011). Today, green development has taken precedence in every national strategic plan. Green development is characterized as the main topic of economic decisions and a major goal of environmental initiatives (Ghazinoory, 2005; Hamzeh et al., 2011). Several authors have analyzed the feasibility of biofuel production in Asian countries (Ajayebi et al., 2013; Eryilmaz et al., 2016; Lin and He, 2017). In 2009, a study on the social and environmental externalities of biofuels in Asia argued that their role is significant in the future of Asian energy as a source of energy supply (Matsumoto et al., 2009). In

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