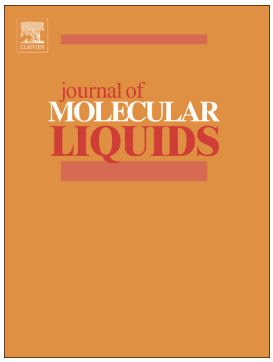

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Transformation of *Jatropha* Oil to Biofuel using Transition Metal Salts as Heterogeneous Catalysts

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Abstract

In this study, *Jatropha* oil was catalytically cracked using $Co(NO_3)_2$ and $Mn(NO_3)_2$ as heterogeneous catalysts at different ratios of 0.5%-3% to obtain different grades of biofuel. The physical and fuel properties of the obtained biofuels were characterized by measuring the following properties: density, viscosity, specific gravity, pour point, flash and fire points, cetane number, carbon and ash residues and sulfur content. The determined properties were located within the limits of the specific standards of ASTM specifications. The type of transition metal and the ratio of the used catalysts were greatly affect the physical and fuel properties of the obtained biofuels. Comparing the reactivity of ($Co(NO_3)_2$ and $Mn(NO_3)_2$) as catalytic cracking catalysts revealed that $Co(NO_3)_2$ is more reactive than $Mn(NO_3)_2$. Using of low catalysts ratio produced biofuel comparable to biodiesel according to ASTM specifications; while higher catalyst ratio produced biofuel comparable to bio-gasoline. Lighter fractions of the biofuel in the range of gasoline were produced at higher catalysts ratios and the optimum concentration was 3%. The reactivity of the two salts were discussed based on their electronic configurations.

***Keywords*:** *Jatropha* oil; catalytic cracking; biofuel; fuel properties; renewable energy.

1. Introduction

Energy is a vital input for economic developments of the industry. The consumption of energy is increased gradually during the last 20 years because of the growing industrial development. The high consumption of petroleum fuels as resources for energy increased the level of greenhouse gases in the environment [1]. That causes several environmental problems including the increase of the global warming. The greenhouse effect and the global warming, in addition to the increase of the petroleum fuel prices directed the industry and research to find alternative fuel sources for energy production. The main resources for the alternative fuels were the biofuels, which produced from environmentally friendly resources such as animal fats, edible and non-edible vegetable oils, waste cooking oils, and algae fats and oils [2-5].

Biofuel are produced generally through two main processes: transesterification reaction and catalytic cracking reaction (pyrolysis) of oils using the suitable catalysts. Transesterification process of oils to form their fatty acid methyl esters is the most talented solution to lower the oils viscosity. Transesterification reaction of vegetable oils can be preceded in the absence or in the presence of catalysts using short chain alcohols with 1 to 8 methylene groups [6-8].