UTILIZATION OF OILY WASTES RESULTED FROM SOME FOOD PROCESSING INDUSTRIES IN BIODIESEL PRODUCTION

Submitted by:

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B.Sc. of Science, (Chemistry-Zoology), Faculty of Science,

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A Thesis Submitted in Partial Fulfillment

Of

The Requirement for the Doctor of Philosophy Degree

In

Environmental Science

Department of Environmental Basic Sciences

Institute of Environmental Studies and Research

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Approval sheet

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Abstract

Non-renewable mineral fuels are sources of energy which lead to pollution by particulate matters, hydrocarbons and greenhouse gases emissions. To overcome these environmental problems, we need to use another ecofriendly source of energy. The renewable source of energy such as biodiesel has many feed stocks to generate it such as vegetable oils (either edible or non-edible), animal fat wastes and poultry. The current work aims at finding new source for biodiesel production via the transesterification of liquid oil resulted from chicken' skin upon roasting and barbequing chickens by using methyl alcohol and sodium hydroxide as a basic catalyst. To produce biodiesel the net amount of final product of Chicken Fatty Acid Methyl Esters (CFME) ranged from 79.1 —84.9 percent for liquid fat wastes upon roasting and barbequing respectively. All quality control parameters for the final product (B100) were generally tested according to ASTM requirements, the tested parameters are flash point which are(190 for both B100 biodiesel from chicken fat upon roasting and barbequing) and after blending the values are B10 and B20 for chicken fat upon roasting (91,95 respectively)while for are B10 and B20 for chicken fat barbequing (98,97 respectively) , cetane number which are (64.65 for B100 biodiesel from chicken fat upon roasting while for chicken fat barbequing is 65.54) while cetane number after blending the values are B10 and B20 for chicken fat upon roasting (59,56 respectively)while for are B10 and B20 for chicken fat barbequing (62,54 respectively) comply with ASTM permissible limits , also we found other studied parameters comply with ASTM standards . It can be concluded that the chicken fat resulted upon roasting and barbequing were perfect, cheap feed stocks for biodiesel.

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CFME	Chicken Fatty Acid Methyl Ester.
ASTM	American Society for Testing and Materials
FAMEs	Fatty Acid Methyl Esters
FFA	Free Fatty Acid
ICCT	International Council on Clean Transportation
IEA	International Energy Agency
CO	Carbon Monoxide
WCO	Waste cooking oil
DDPO	Distillate that is produced by deodorization of palm oil
UCO	Used Cooking Oil
UVOs	Used vegetable oils
CO_2	Carbon Dioxide
TAG	Triacylglycerols
MMT	Million Metric Tons
USDA	United States Department of Agriculture.
FAAEs	Fatty Acid Alkyl Esters
USA	The United States of America
ULSD	Ultra-low Sulfur Diesel Fuel
NOx	Nitrogen Oxides
EN	European Standard
Wt. %	Weight Percent
Vol.%	Volume Percent
AV	Acid Value
CaO	Calcium Oxide
˚C	Degree Celosias
SZ	Sulphonated Zirconia
MeOH	Methyl Alcohol
(MgAlH)	Magnesium Aluminum Hydrotalcite
w/w	Weight by Weight
cSt	Standard units centistokes
^{a}C:^{b}N	^{a}C: no. of carbon, ^{b}N, no. of carbon-carbon double bond

1. INTRODUCTION

Energy is needed for applying the requirement of a necessary input to achieve the main requirements of life and technological progression. Energy needs has been elevated well due to huge technological revolutions in all activities and fields, transport, power, industrial, welfare, and other miscellaneous sector. Now, cook, mineral diesel and natural gas, are the main sources to achieve and fulfill all of these energetic requirements all over the world. By the elevation of the energy consumption from non-renewable sources this will depleted as well as will causes environmental problems due to elevated loads of pollutants which will affect negatively on the environment, this aspect of great attention all over the world (World energy Outlook, 2016). Approximately ninety percent of non-renewable fuels used in transport section, thermal and power production facilities, while the remaining amount of this fuel used in petrochemical industries as raw materials for this type of products (Carlsson, 2009). Due to elevated energy uses with the shortage in non-renewable energy sources and the threatening of its depletion, many researchers go ahead to find out other means of energies from renewable sources (Bhatti *et al*., 2008).

Recently, biodiesel had gained a hug importance all over the world in order to get another source of renewable energy, it blended with mineral oil diesel by certain percentages to be used instead of mineral one in motor engines. Biodiesel was known as a combination of fatty acid alkyl esters, attained from renewable oily sources as a raw material for it, such as plant oil and/or animal fats. Consequently, in the preparation of biodiesel either methanol or ethanol is used as

reactant; the resulted esters will be either a mixture of fatty acid methyl esters (FAME) or fatty acid ethyl esters (FAEE), respectively. Biodiesel was produced by the reaction at which the main backbone of lipid/oils/fat which is triglycerides transesterified with alcohol in presences of catalyst to generate biodiesel and glycerin which is released as secondary product. The production process of biodiesel had more than type such as pyrolysis, transesterification, enzymatic production process. There were several type of catalysis like, solid catalysis, acidic catalysis and basic catalysis (Fazal *et al*., 2011). There were many kinds of raw materials which is suitable for biodiesel production one of them the first generation were vegetable oils, as reported by many authors that biodiesel may be produced by using edible vegetable oils, which will generate the problem of food competition with human needs (Aransiola *et al*., 2014). The second generation of feed stocks for biodiesel production was the use of nonedible oil plants which characterized by several features firstly, they can grow at high temperatures "arid conditions" with low moisture contents so they survive dry conditions, on the other hand, they did not affect human food resources as they have high toxic content so they are not compatible with human needs for nutrition , there were several palnts used as a source for crude oil which used for biodiesel production, the most common were jatropha, karanja, tobacco, mahua, neem, rubber, sea mango, castor, cotton (Azam *et al*., 2005). The third generation for biodiesel production was waste cooking oil "WCO", which used by the concept of recycling for waste minimization concepts (Chen *et al*., 2009). Another type of feed stocks appears as a good reliable source but much expensive is the use of microalgae as a raw material for biodiesel production, microalgae