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Biodiesel Production from Chicken Skin: a Green Energy for Bangladesh

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ABSTRACT
From the slaughtering and processing of livestock, a huge amount of animal discards are produced. Much of this waste biomass is animal fat and skin and these discards can be used to produce biodiesel. In this study, chicken skin was used as raw materials for biodiesel production. Chicken skin was extracted from a local shop and subjected to transesterification. The products of transesterification were Fatty acid methyl esters (FAME) and glycerol. After separating glycerol it was observed that the yield percentage was 35%. Then FAME produced was tested for two parameters namely calorific value, Kinematic viscosity.

Keywords: Chicken skin; Transesterification; Biodiesel**.**

1. Introduction

Due to the rapid growth of population, consumption of fossil fuels have been increasing day by day. Energy consumption influences increasing energy demand which results in scarcity of energy resources. As a result, reserves of fossil fuels are quickly depleting. Besides excessive use of these fuels result in greenhouse gas emission. So there is dying need of alternative fuels for transportation and power generation sector. During the past few years, biodiesel has attracted attention as an attractive alternative fuel source [1]. Biodiesel comprised of mono-alkyl esters of long chain fatty acids which can be obtained from vegetable oils, animal fats, waste oils by transesterification in the presence of catalysts [2].But food versus fuel, high manufacturing costs play an important role in the development of biodiesel production from vegetable oils in developing countries [3]. So finding the non food feedstock is necessary for development of Biodiesel production in developing countries. Chicken skin and fats are the ultimate solution for ending food versus fuel debates. Chicken skin contains between 8 and 20% of the total weight [4]. During the butchering and organ removal process, the fat in the abdominal cavity is normally removed. But the skin, where the subcutaneous fat is located is not removed.

Bangladesh being a developing country depends much on agriculture. This sector contributes to 14.75% GDP of this country [5].Number of poultry birds for Bangladesh was 320,633 thousand heads in 2016 and number of poultry birds of Bangladesh increased from 62,000 thousand heads in 1967 to 320,633 thousand heads in 2016 growing at an average annual rate of 3.86 % [6].But unfortunately, no of poultry processing industries in this country is few. Chicken fat is used as feedstock for animals. But a large amount of chicken feathers, skin are considered as waste.

This paper deals with the extraction of biodiesel from chicken skin**.** Firstly Chicken Feathers were collected from local shops. Then from feathers, chicken skin was obtained. The skin was subjected to transesterification to obtain biodiesel.

2. Experimental Procedure

2.1 Materials: Waste chicken skin, distilled water, potassium hydroxide (catalyst), methanol (solvent) **.**

2.2 Apparatus:

- 4 beakers
- Electronic balance machine
- 1 magnetic stirrer
- Separating funnels
- Stove
- Glass rods

2.3 Extraction of Fat from Chicken:

Waste chicken skin was bought from a local shop. Then it was manually de-feathered in the kitchen. After de-feathering, the skin was thoroughly washed using tap water. It was then cut into small pieces. Then the skin was cooked for 15 minutes in a pan. Then the oil sample was taken into a beaker (Figure 1) and measured in an electronic balance machine. It was found that the volume of oil was 70mL. Methanolic potassium hydroxide solution was prepared in a beaker using 1.79g of KOH (Potassium Hydroxide) pellets (measured using an electronic balance) dissolved in 60 mL of methanol. After dissolving the pellets into the methanol with the help of a glass stirrer, the methanolic KOH solution was poured into the fat sample. Then it was placed inside the magnetic stirrer apparatus (Figure 2). After stirring for 45 minutes the magnetic bar of the stirrer was taken out by forceps and washed with methanol. Then the stirring sample was placed in a separating funnel for 24 hours

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for separating the layer. It was seen that two layers were formed from transesterification, a red and a yellow layer (Figure 3). The red layer was waste glycerol, the yellow layer was biodiesel. After separating glycerol, biodiesel was extracted (Figure 4). Then it was heated to get rid of any residual catalysts or soaps. In this study, 5 samples were taken and then the samples were taken to test the viscosity and heating value test.

3. Results &Discussion

Table 1 shows the amount of materials involved during the course of Biodiesel.

Table 1: Amount of materials involved in the production of biodiesel

Material	Chicken Skin
Amount of raw material(g)	200
Weight of oil (g)	179
Volume of Methanol Added (mL)	26ml
Mass of KOH Pellets Added (g)	1% of total weight of oil with beaker(179g)
Volume of Biodiesel Produced (mL)	80

3.1.Calculation to find how much methanol and KOH required:

Weight of oil (with beaker) =179mL
Average molecular weight=858.21g
Now converting to mole = 0.21 mol

Considering 1:3 molar ratio, mole of CH_3OH =0.21*3
=0.63 mol
Now 1mol CH_3OH=32gm
0.63 mol CH_3OH=0.63*32gm
=20.16gm
& volume of methanol = 20.16 / 0.79 (density of methanol) = 25.51 mL
Amount of KOH=1% of 179g
=1.79g

Biodiesel obtained from chicken skin=

=Volume of biodiesel extracted / Amount of raw material
= 35% (considering w/w %)
Here m is calculated by using the following equation
m= density * volume

3.2. Thermo physical test:

Table 2: The fuel property comparing with diesel following the testing method of ASTM

Table 2: Thermo physical properties of biodiesel

Property	Diesel	Biodiesel	Experimented Biodiesel	Test Method
Density(g/cc)	0.8-0.85	0.87-0.88	0.874	ASTM D1448
Kinematic Viscosity (Cst)	2-5	2-6	5.8	ASTM D445
Net Calorific value(MJ/Kg) (Lower calorific value)	40-50	40-45	41	ASTM D6751

A typical bomb calorimeter was used to measure net calorific value. To measure viscosity, Saybolt viscometer was used. The thermo physical property result shown above states that, the experimented biodiesel fulfills all requirements of fuel property.

Fig. 1 Manual extraction of oil from pan

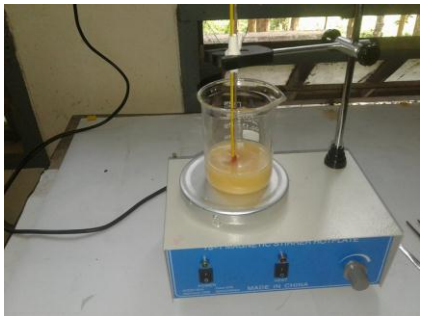

Fig. 2 Magnetic stirring

Fig. 3 Separation process in separating funnel

Fig. 4 Extracted biodiesel after separation

4. Conclusion:

This paper deals with the production of biodiesel from chicken skin. In this paper, the yield percent of biodiesel is found 35% from chicken skin (200gm) and the fuel property are checked to ensure the property of biodiesel. Above property shows that the energy content of diesel is much higher than biodiesel but the density of diesel is lower than biodiesel. The kinematic viscosity of diesel and biodiesel are close enough. By increasing yield percentage of biodiesel, biodiesel can be used as an alternative fuel to diesel.

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