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Production of Biofuel Using Corn and Sugarcane

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Abstract: Biofuels include a variety of raw materials and technology transfer which is mostly used to transport and electricity generation. Biofuels for transport such as ethanol and biodiesel. It is one of the fastest-growing sources of alternative energy in the world today. Global production of biofuels has reached 62 billion liters or 36 million tons of oil equivalent (million tons) in 2007 [1]. This is equal to about 2% of the total fuel consumption is vital .biofuel is alternative energy, oil and diesel because it replaced a lot through research conducted in various countries such as Brazil and the United States, this indicates its importance [2]. Low production costs and the rise in oil prices have led to the introduction of vehicles that allows switching between ethanol and oil for the increase in renewable production. In this research It has been observed that the exposed material for fermentation to extract the fuel of which is added to some of the material in which to be effective and inexpensive [3]. In this research work, a method was adopted to extract biofuels from corn and sugarcane: steam distillation. The steam distillation process involves no solvent at all and only distilled water is used to dissolve the desired oil and leave it with water vapor. The boiling point for the distillation process was found to be 78 ° C. The final results showed an effective amount of oil extracted according to the 100 g induced amount of sugar cane and the peak yields oil yields of 10 mL and when the feed doubled to be high-quantity.

Keywords: *Biofuel, corn, sugarcane, steam distillation, ethanol.*

I. INTRODUCTION

Biofuel is the energy derived from living organisms, whether plant or animal ones. It is one of the most important renewable energy sources, unlike other natural resources such as oil, coal and all fossil fuel and nuclear fuels. This experiment was designed to examine the costs and benefits of using corn and sugar cane for economic and environmental fuel. It will integrate scientific analysis of corn and sugar cane fermentation with a discussion of the environmental and economic effects of the production of sugar cane and corn fuel to draw conclusions about the sustainability of the use of these crops as sources of alternative energy[1]. This laboratory experiment can be incorporated easily into the module case on climate change and alternative energy; thus enhancing Interest. Biofuels, in the form of ethanol made from corn or sugar, may represent ways for the United States to reduce its dependence on imported oil and its greenhouse gas emissions [4].

A. Sources and methods of producing biofuel:

1. Bio–alcohol is produced from plants by microbial fermentation where carbohydrates are converted into ethanol alcohol.
2. Biodiesel (esters of fatty acids) produced from vegetable oils or animal fats such as soy beans and palm oil.
3. Biodiesel (methane) is produced from plant residues and animal waste by microbial fermentation.
4. Biofuels are represented by wood and animal droppings that can be burned directly to give thermal energy [4]

II. METHODOLOGY, DESIGN AND EXPERIMENTATION

A. Methodology

a. Steps to extract biofuels from sugarcane:

1. Sugar cane from the farm and then cleaning followed by washing it for impurities and dirt. Repeat the step more than once to make sure you clean the sugar cane and weigh the amount used in the experiment.
2. Extraction of sugar cane using the machines to produce sugar cane juice. The process of the times was repeated more than once to extract pure cane juice.
3. Sugar cane juice was taken to the lab to produce biofuels.

Figure 1: Sugarcane

4. Placed a quantity of sugar cane juice in beaker capacity of 100 ml to 400 ml and add a quantity of 200 ml for the interactions.
5. Add sugar cane juice with 10 ml of sulfuric acid
6. Then weighed eight grams of sodium hydroxide and added distilled water. Add 10 ml in graduated cylinder and added it to sugarcane juice.
7. Add the sample on an electric heater to be the reaction of the substances added to sugar cane juice and are mixed well for one hour at a temperature of 100 and the importance of this process helps to increase the concentration of sugar in the juice of sugar cane then left to cool down.
8. The yeast is prepared by bringing it and mixing it with distilled water to become a heavy solution. It is then added to the sugarcane juice solution and left for five days to ferment. The yeast is mixed with sugar cane solution to facilitate the process of extracting biofuels.
9. After the process of fermentation comes the process of distillation to extract the biofuels add the sample in the conical flask

10. Then insert it in the steam distillation (Separation Stage) device and wait for five hours, but show us the amount of fuel required (temperature for heated 78°C).

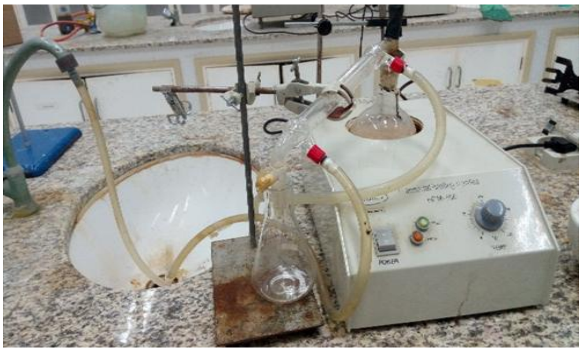

Figure 2 Experimental Set Up

The complete steam distillation for sugarcane (Separation Stage) construction is illustrated in figure 2. The experimental setup consist of a heater to adjust the required temperature, a distillation flask filled with water and solid substance which need to be extracted, this flak is placed inside the heater. Followed by a condenser of two opens one is water inlet and the other as water outlet for cooling purpose. Finished with a conical flask to receive the mixture of oil and water condensate.

b. Steps to extract biofuels from corn:

1. The dry corn is washed and then grinded to have smooth consistency.
2. After that, the required quantity is weighed in the preparation of the solution used to produce the biofuels. The quantity that is weighed is about 100 grams.
3. Add to the corn a quantity of distilled water and stirred well so as not to harden then put it on an electric heater until the mixture is homogenized and becomes ready to complete the last steps. Take it out of the electric heater and let it cool down for a period of time.
4. Add sulfuric acid to the solution of the corn
5. Then prepare a solution of sodium hydroxide through the weight of the amount of sodium hydroxide after which we add distilled water and take a quantity of 10 ml. Add sodium hydroxide solution to the solution of the corn and leave it for a period of time to homogenize and interact with the solution well to facilitate the process of extraction of biofuels.
6. The yeast solution is prepared by weighing 8 grams and the distilled water is added and stirred until it is homogenized and the solution becomes easy to use. Add the yeast solution to the solution and leave it for a period of five days until it is fermented to complete the process of extracting biofuels from the atom.
7. After 5 days of fermentation we take the solution and put it in the distillation device to extract the biofuels from it takes this step about 4 to 5 hours to extract a large quantity of biofuels.
8. Take the sample and put it in a special tube for the material to be extracted then we start the testing phase on the sample produced.

B. Design of shell and tube heat exchanger

Dimensions of double pipe heat exchanger relative data to heat exchanger machine in college lab heat and mass transfer.

Inner pipe outer diameter =13.5 mm, inner diameter=8.5mm

Outer pipe outer diameter = 31.5mm, inner diameter= 26mm

Effective length of heat = 1000mm

Length tube 1 =630mm

Length tube2 =650mm

Height of tube 1 and 2 = 603m

Calculation of LMTD

Assumption counter current

LMTD= $\Delta T_1 - \Delta T_2 / \ln(\Delta T_1/\Delta T_2)$

$\Delta T_1 = 115C^0 - 50C^0 = 65^0C$

$\Delta T_2 = 68C^0 - 25C^0 = 43^0C$

LMTD = 65 – 43/ ln (65/43) = 53.24

Determine the heat load for hot side

$Q = m_H * cp_H * (T_{hot\ in} - T_{hot\ out})$

Q= 96255 *1.874 *(115 – 105) = 1803818.7 J/hr

Unknown mass flow rate of water

$m_c = Q / cp * \Delta T$

$m_{c=}$ 1803818.7 / 4.187 * (43- 65)

$= 9.47*10^{-6}$ kg/ hr

Minimum flow area per pass

Mass = density * area * velocity

No of tubes

= 150.75 * 2= 301.5

= 0.0139 m^2

Tube side Reynolds No

Let, $R_e = D_i\ v\ \rho / \mu$

120627.6

J_H factor of tube side

If Re turbulent or 500 < Re < 10,000 = $J_H = 0.351 / R_e^{\wedge 0.45}$

$J_H = 1.814*10^{\wedge -3}$

Tube side heat transfer coefficient

(hi)

$h_i = J_H * cp * G (cp * \mu / k)^{-2/3}$

h_i = 3342 /3600 = 0.8425k cal/ $m^2\ s\ ^0C$

Calculate of Reynolds No of shell side

Since, Re = D G / μ

$120627.6 *10^{\wedge 6}$

Calculate JH factor of shell side

J_H factor = 0.023 $Re^{-0.2}$

$J_H = 2.77 * 10^{\wedge -3}$

Calculation of shell side heat transfer coefficient

$h_o = cp *G * J_H * (cp* \mu /k)^{\wedge -2/3}$

Since, k = constant = 0.109 kcal/hmc^0

h_o = 1.0000477 * 3462396 * 2.77*10$^{\wedge-3}$ * (1.037* 0.003/0.109)$^{\wedge-2/3}$

= 0.788 kcal/ $m^2 s$ ^{0}C

Calculate of overall heat transfer coefficient

U_i= 1/ 1/h_i + 1/h_{di} + d_i ln (d_o / d_i)/ 2 k_w + d_i / d_o h d_o + di/$d_o h_o$
U_i= 2. 06 kcal/hm^2 ^{0}C

Calculation of heat transfer area

Q=U * A $(\Delta T)_{LMTD}$ * F_t
=0.0486

Calculate of required tube length

Let A= n Π di L
L = A/n Π di = 0.0486 / 322 * Π * (0.0254 * 0.584) = 0.00324 m = 0.01063 f_t

Calculate of actual heat transfer area

A = n * Π* di *L = 322 *3.14 *0.0148 * 1
A = 14.97 m^2

Calculate of actual heat transfer coefficient

Q = U * A *$(\Delta T)_{LMTD}$ * F_t
= 0.2456 kcal/m^{2}hc^0

C Simulation:

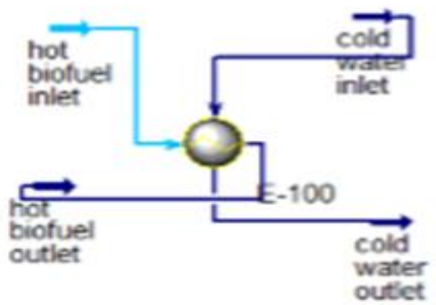

Figure 3: Design of Distillation column using Aspen Hysys

III RESULTS

Sugarcane and core biofuel characterization using GC

The biofuels of the wheat and sugar cane are important and clean, and GC is used in the laboratory to know the amount of hexane and biofuels produced by the experiment. The relationship between time and the responses and the dissociation of the result between the samples of corn and sugar cane.

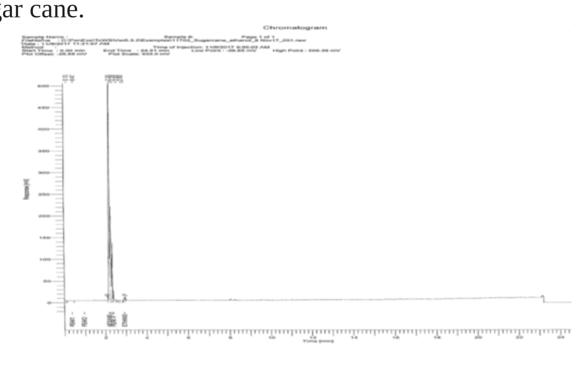

Figure 4 GC analysis for the oil extracted by steam distillation method for sample sugarcane**.**

CONCLUSION

Corn and sugarcane are types of biomass resources. It has been found in farms and thus taking corn and sugar cane to extract biofuels [6]. A search found extraction methods of additive her like Rouge and this has positive results in the future to increase the state's economy and not rely on one source of income increase [7]. Now, most countries are going to this area, a bio-fuel extraction with all its kinds so as to increase the economy. The main objective of this project was to convert pure herbs into useful products, which can be used easily and efficiently [8]. Throughout this research work an effort was made to understand the properties of corn and sugar cane. The main components were identified in sugarcane and corn. In this research work, a method was adopted to extract biofuels from corn and sugarcane: steam distillation. The steam distillation process involves no solvent at all and only distilled water is used to dissolve the desired oil and leave it with water vapor. The boiling point for the distillation process was found to be 78 ° C. The final results showed an effective amount of oil extracted according to the 100 g induced amount of sugar cane and the peak yields oil yields of 10 mL and when the feed doubled to be high-quantity.

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