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Ethanol Production from Waste Agriculture Material

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***Abstract*- India's economy mainly based on agriculture, since almost 70 % peoples are dependent on agriculture so for the economic growth of Nation, we have to concentrate on agriculture, so we need to implement advance control strategies, which give maximum profit, with minimum raw material and at minimum cost. It will help for economic growth of former and ultimately that of nation. The main objective of this project was Ethanol production from waste agriculture material such as sweet sorghum, sweet potato, sweet corn etc. Initially, we are extracting juice from stem of sweet sorghum and yeast is added to fermentation tank. In fermentation tank, fermentation process occur i.e. bacteria from yeast consume the sugar content from juice and release Alcohol. Fermentation process requires 48 hours. After become vapour, it is passed through condenser and converted into liquid. This liquid is added to another tank an cyclohexane is added to it. At certain temperature, it again becomes vapour. This vapour is passed through condenser and become liquid form Ethanol.**

***Keywards*-- Ethanol, Fermentation, Alcohol, Sweet Sorghum, Cyclohexane Yeast.**

I. INTRODUCTION

India is a Country of farmer. Now a day, We observe that they are facing many problem such as Drought, less warranty rate (price) for their crop. One of the techniques to proceed in such a direction is to cultivate such a crops which gives maximum yield or by processing on the crops we are getting different by products, which give maximum profit. Thus we step up in the same direction & we have tried to produce ethanol from sweet sorghum. Ethanol is nothing but anhydrous alcohol or ethyl alcohol. When we remove the water contents from the alcohol then it becomes Ethanol. Ethanol is produced form variety of sources such as sugarcane, sweet sorghum, maize, soybean, Karanji, or we can say that from those crops, which contains glucose. Currently the ethanol is produced from sugar cane, but when we compare it with sweet sorghum.

We find that ethanol production from sweet sorghum is to much beneficial. Since in India there is always scarcity of water in same areas. Where sweet sorghum is much more than that of sugar cane. Thus sweet sorghum is one of the great substitutes for sugarcane to produce Ethanol. We find that day need of fuel increases and that why their cost are also increases.

Since ethanol is one of keep the prices of fuel within the certain limit. Thus, we observe that production of ethanol from sweet sorghum will definitely increase the economic growth of farmer & ultimately that of nation. The main objectives of this project was Ethanol production from waste agriculture material such as sweet sorghum, sweet potato, sweet corn etc. Ethanol an important biotechnology product in terms of volume and market values is intensely researched.

II. METHODOLOGIES

What is Ethanol?

Generally, Ethanol is a clear liquid alcohol. It can be made by the fermentation of different biological materials. Ethanol, the most widely used bio-fuel, this process is similar to the beer. At the end it is blended with gasoline. It will cause to improve its vehicle performance and reduce air pollution.

Construction of Model

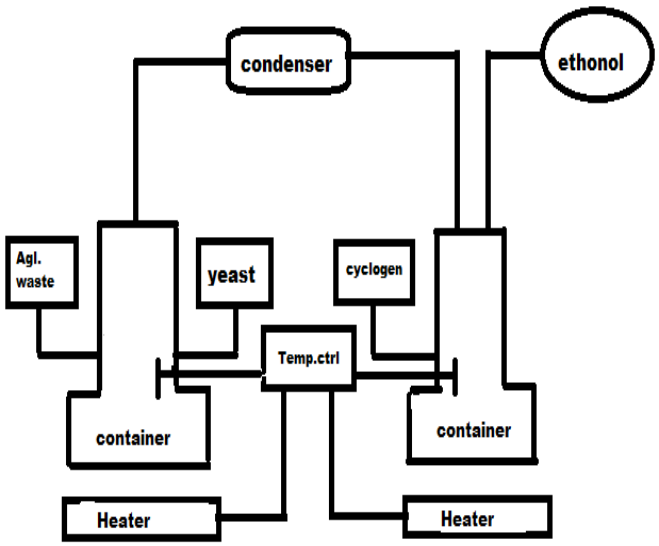

Fig. 1 Block diagram of Ethanol Production Cycle.

The model mainly consist of two distillation columns, juice feed tank, yeast culture tank, fermentation tank, condenser, accumulator, and two solenoid valves.

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The cylindrical juice feed tank & the yeast culture tank are connected to the fermentation tank through the solenoid values SV1 & SV2, on to the fermentation tank the stirrer is implemented for the continuous stirring of the reaction mixture. Also there is provision for co2 removal through the tank.

The output of fermentation tank is given to distillation column 1 as a feed. Distillation column 1 consist of 8 sieve plate below the distillation column 1, heater 1 is mounted for heating the reaction mixture. The top product of distillation column 1 is given to distillation column 2 through the condenser. Distillation column 2 is a hollow tube in this column cyclohexane is added for the ethanol and water separation.The top product of distillation column 2 after passing through condenser given to the column as a reflux. The bottom product of this distillation column 2 is collected in the accumulator as an ethanol.

III. Fermentation Process

Fermentation is process carried out by many micro organisms and which produces a variety of useful compounds. Depending upon the availability of oxygen, there are mainly two types of fermentation.

1. Aerobic fermentation.
2. Anaerobic fermentation.

1. Distillation Process

In this process, liquid mixture generally separated by use of thermal energy. the difference in vapour pressure of different constituents at the same temperature is responsible for such operation this unit operation is also termed as fractional distillation. . In distillation, it consist vapour and liquid phase. vapour phase is produced by providing heat to one another , by vaporization fro liquid & by condensation from the vapour phase.

2. Why Sweet Sorghum

Due to the more disadvantages of ethanol production from sugar cane, we can produce ethanol form sweet sorghum. As the sweet sorghum can yield two times within a year, so we get more amount of biomass. Sweet sorghum crops take less amount of water for growth. Also it has less investment cost than that of sugar cane. The sweet sorghum can be growth in anywhere in India, so the sweet sorghum has most beneficial points over the sugarcane. The following tables show how sweet sorghum is better than sugarcane.

Comparative juice analysis of sugarcane and sweet sorghum:-

Sr. No.	Particulars	Sweet Sorghum	Sugarcane
1	Per day productivity for biomass (kg/day/ha)	435	205
2	Maturity period (months)	4	18
3	Extraction (%)	40-50	55-60
4	Juice purity (%)	68-72	90-92
5	T. S. S.	18-22	18-23
6	PH	4-5	5.5-6
7	Non reducing sugar	12-14	17-18

Economics of ethanol production from sugarcane molasses and sweet sorghum juice:-

Sr. No.	Particulars	Sugarcane (Molasses)	Sweet Sorghum (Stalk)
1	Green cane yield (per ha per annum)	100 tones (1 crop in year)	100 tones (2 crop in year)
2	Yield of molasses / juice	4 tones Molasses	40,000 Lit. Juice
3	Ethanol	1,000 Lit.	7,600 Lit.
4	Returns (@ Rs. 12/Lit)	Rs. 12,000/-	Rs. 91,200/-
5	Cost of production	Rs. 3,300/- (@Rs.3.30/Lit)	Rs. 60,800/- (@Rs.8/Lit)
6	Net profit	Rs. 8,700/-	Rs. 30,400/-

From the above table it is clear that the sweet sorghum is more beneficial to us than that of sugar cane, because the ethanol produced from sweet sorghum is near about 7,600 liter. 4 tones of juice and that from sugar cane is only 1000 liter from 4 tones molasses. This gives the net profit, which we can get about Rs. 30,400/- from sweet sorghum and Rs. 8700/- from sugar cane. So the sweet sorghum is more beneficial we use it instead of sugarcane for the production of ethanol.

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IV. OVERVIEW

System Over View:-

Column 1:-
Height = 85 cm
Diameter = 4 cm
Column 2:-
Height = 78 cm
Diameter = 2.5 cm
Fermenter:-
Height = 25 cm
Diameter = 15 cm
Juice tank:-
Height = 15 cm
Diameter = 13 cm
Yeast culture tank:-
Height = 15 cm
Diameter = 13 cm
Connecting pipe:-
Diameter = 6 cm
Accumulator:-
Height = 13 cm
Diameter = 4.5 cm
Condenser:-
Area = 7.5 x 12.5 x 31 cm

Technical Specification:-

1) Power Supply : 230v ac @ 50 HZ
2) Logic : Micro-controller based
3) Language : 'c'
4) No. of Channels: 02
5) Temperature Sensor : Thermocouple (J type)
6) Temperature range : 0 to 300
7)Heater wattage : 1000w.
8) Relay : 12v, 60mA
9) Solenoid valve : 1/4 inch, 230v
10)Level sensor: Digital
11) Level Sensor: Probe type
12) Displays: LCD display
13) Timer : IC–555 mono stable ON delay timer.
14) AD : IC-0808, 8bit, 8channels, Successive Approximation type

V. PROJECT WORK

System Design:-

System design includes all the hardware & electronic design.

1. Hardware Design:-

It includes distillation column design.

(a) Goals of distillation column design:

Depending on the purpose of the column, type of disturbances, requirement of product purity and economics of the operation different goals are set.

(b) Single Product stream column

It has a given product stream and so the control is relatively simple as only overhead composition control loop is to be tuned tightly to reduce variation. Other loops are able to tolerate disturbances arising from column interactions. Here the simple SISO control methods are used.

(c) Multi-product stream columns

There are many products that must need tight specifications. Control problem is multivariable due to strong interactions between different product streams and MIMO control methods are use.

(d) High purity columns

When high product purity is required the steady state gain and dynamic parameters in the process model become highly non linear as composition varies. A non-linear model is required and the control system design is complicated.

(e) Energy minimization designs

For very high or low temperature columns having large through put energy cost dominates economics. Ex. Crude oil fractionators, cryogenic separations. The goals are to cut energy cost by reducing use of stream and coolant and also maintain product purity.

(f) Distillation column networks

Networks are formed by many sequentially linked columns or if the column is energy integrated. The interaction increases and so multivariable cascade controllers controlling entire network, as the hierarchical multivariable systems are required.

2. Electronic Design

It include Sensor selection, Power supply, On delay timer.

(a) Sensor selection:-

Temperature Sensor:-

We can measure temperature inside the column by using thermocouple, RTD, thermister, etc. Here we are using thermocouple because of the following reasons:-

We are measuring the temperature in bet 100 degree Celsius to 150 degree Celsius.

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As J type thermocouple suitable for this range, having wide temperature range. As RTD is accurate & linear small temperature range. RTD's cost is much greater than thermocouple. Thermocouple follows the tempeature changes with a small time lag & as such are suitable for recording comparatively rapid changes in temperature.

Level sensor:-

Measurement of liquid level is quite important in a verity of industrial processes. The Liquid Level may be expressed in terms of the pressure the column exerts over a datum level or in terms of the length of the liquid held by container. Liquid level may be measured by direct methods such as point contact method, gauge glass or sight glass techniques or by indirect methods such as by measuring the hydrostatic pressure of the liquid column. Thermal & electrical methods including sonic / ultrasonic and other radiation methods are also indirect the sense that secondary means are adopted for level measuring purpose. Here we have selected probe type level sensor to implements & gives digital indication of level.

(b) Power Supply:-

This circuit is used to provide regulated power supply to the different circuits. Here we have designed the power supply to provide +5V, +12V and -12V regulated output. The 230V AC signal is applied to step down transformer of rating 12-0-12 V. The output of step-down transformer is applied to rectifier. The signal is rectified by means of four IN4007 diode arranged to form bridge. The bridge acts as full wave rectifier. During positive half of the sinusoidal AC signal, two diodes would be ON other two would be OFF. During negative half cycle other two are ON and other two would be OFF. The rectified signal is passed to electrolytic capacitor of rating 4700 microfarad/25V. Then the signal is applied to the regulators 7805, 7812 and 7912.

(c) On delay timer:-

Timers are useful for timing delays and oscillator applications in commercial, industrial and military applications. A timer provides accurate timing from microseconds through hours. Timer can be operated in a stable as well as mono-stable operation. We can adjust the duty cycle. Output of timer is capable of sourcing or sinking up to 200 mA current. Also it is capable of driving TTL devices. Timer gives normally ON and OFF outputs. It has high temperature stability of 0.005% / deg. C.

Level Indicator and controller:-

Digital Display Circuit

This circuit comprises of a quad 2 input XOR gate IC1 (C04030) for sum outputs, decimal to BCO code converter using diode matrix of diodes 03 through 07, a BCO to 7-segment decoder driver IC2 (74LS47), a common anode type 7-segmetn display L TS542R. When only the tip of sensor probe (cathode) no. 1 is in touch with the water, the voltage at pin 3 of the IC1 becomes logically high (+5V), and hence voltage at line no.1 (L-1) also becomes high. Now due to conduction of diode 03, the BCO code 0001 (03 02 01 00) is generated and converted to equivalent 7-segmetn codes by IC2 (74LS47) to display the decimal digit 1.

Similarly, when the tips of both the sensors 1 and 2 are in touch with juice, the voltage at pin 3 becomes logic low (OV) while the voltages at pin 4 and line 2 (L-2) becomes logic high (+5V). Now due to conduction of diode 06, the corresponding BCO code 0010 is generated and decimal digit 2 is displayed on the 7-segment displays. When the tank is completely empty, the outputs of all XOR gates of IC1 are low and the display shows decimal digit 0. In this way the display circuit works to show digits 0 through 4, corresponding to the level of water, as defined by the position of the sensors at different heights. Here the resistors R9 through R12 and R19 through R21 have been used for passive pull-down.

VI. Conclusion

Here we conclude that production of ethanol form sweet sorghum plays a vital role not only in the economic growth of farmer but also that of nation. When we add ethanol in petrol it helps to minimize pollution from the vehicles. Also ethanol will help to a great extent of vast foreign currency. Due to vast production of ethanol there is no need to depend on the other countries for fuel. Thus we have produced the ethanol by controlling the whole process by using micro controller, which greatly simplifies our work and we can produce the ethanol at the minimum cost.

REFERENCES

[1] Pragati Awasthi, Smriti Shrivastava*, "Biofuel from agricultural waste: A review", Int.J.Curr.Microbiol.App.Sci (2015) vol- 4, Issue 1, pp 470-477.

[2] Yudi Widodoa*, Sri Wahyuningsiha, "Sweet Potato Production for Bio-ethanol and Food Related Industry in Indonesia: Challenges for Sustainability", Procedia Chemistry, (2015) vol-14, pp 493 – 500.

[3] Soha R.A. Khalil , A.A. Abdelhafez , " Evaluation of bioethanol production from juice and bagasse of some sweet sorghum varieties", Annals of Agricultural Science, (2015) vol-60, Issue-2, pp 317–324.

[4] Pradip Sahaa,*, A. C. Baishnaba, "Production of bio-fuel (bio-ethanol) from biomass (pteris) by fermentation process with yeast", Procedia Engineering, (2014) vol-90, pp 504 – 509.

[5] Neha Patni*, Shibu G. Pillai, Ankur H. Dwivedi, "Wheat as a Promising Substitute of Corn for Bioethanol Production", Procedia Engineering, (2013) vol-51, pp 355 – 362.