IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Production Of Ethanol From Jack Fruit (Artocarpus Heterophyllus)

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Abstract

The over production of jack fruit (Artocarpus heterophyllus) during harvest season and its short self-life have caused serious losses for farmers. The unused jack-fruit and its parts also produce environment pollution in the form of odd smell. Since there is high sugar content in the jack fruit pulp makes it a potential substrate for alcohol production. Basically, the fruit juice should contain at least 14% of sugar to be converted into alcohol. If the sugar content is less than 14 % , some amount sugar must be added to compensate the lack of sugar content. Since the sugar content of jack fruit is in the range of 18% without any extra sugar it is possible to convert it in to alcohol. The present work deals with the formation of ethanol from jack-fruit.

We confirmed the ethanol by few basic tests like odor, ignition test, action of sodium esterification and iodoform test. It is found that about 18% of alcohol present in the ripped jack-fruit flesh. In addition to this we extracted the alcohol from the outer part and the waste part of the jack-fruit using same method. It is found that it also contains about 13% of ethanol. We quantitatively studied the variation of ethanol quantity with the number of days needed for fermentation. The addition of yeast accelerates the fermentation process.

Key words: Esterification, Fermentation, yeast, Iodoform test

I. INTRODUCTION

The **jackfruit** (*Artocarpus heterophyllus)* also known as **jack tree**, **jakfruit**, or sometimes simply **jack** or **jak** is a species of tree in the *Artocarpus* genus of the mulberry family (*Moraceae*). It is native to parts of South and Southeast Asia, and is believed to have originated in the south-western rain forests of India, in present-day Kerala, in Tamil Nadu, coastal Karnataka and Maharashtra. The jackfruit tree is well suited to tropical lowlands, and its fruit is the largest tree-borne fruit reaching as much as 40 kg in weight, 36 inches (90 cm) in length, and 20 inches (50 cm) in diameter.

The overproduction of jackfruit (Artocarpus heterophyllus) during harvest season and its short self-life have caused serious losses for farmers. The waste product also produces environment pollution. Since there is high sugar content of the fruit pulp makes the juice a potential substrate for alcohol production. Some are carried out to find the possible sources of wine making process such as banana [2], pineapple [4], kiwi [5], apple [6], addition of sugar at 16-18% w/v to produce wine with mango [7] and other fruit juices. Basically, the fruit juice should contain at least 14% w/w of sugar to be converted into alcohol. If the sugar content is less than 14 % w/w, some amount sugar must be added to compensate the lack of sugar content. In addition to the inherent characteristics of fruit (pH values, sugar contents and nitrogen contents), other factors must be taken into account during fruit alcohol production. Since the sugar content of jack fruit is in the range of 18% [8] without any extra sugar it is possible to form alcohol from it.

II. BACK GROUND STUDY

The reference [1] showed the content of jack fruit flesh. Since lot of jack fruit goes as a waste and even after the use most of the parts are waste. Since all the parts are very sweet and by referring [2, 3, 4, 5, 6, 7,] we started think of alcohol formation from the jack fruit. The 18% sugar content in the fruit flesh supported the formation of alcohol.

III. PROCEDURE

Collect the jack fruit and separate the flesh from it. Weigh 1 kg and put it in to a plastic jar and add half liter of water. Allow it to fermentation. After the fermentation is over (more than 14 days) squeeze the juice from it. Measured quantity of the juice is boiled in distillation flask attached with water cooled condenser. Maintain the temperature of the thermostat at 78.4^0C, the boiling temperature of ethyl alcohol. Collect the solution after condensation and test it for the alcohol. Repeated the steps for the outer part of the jack fruit.

Tests for Alcohol:

Ignition Test:

A small amount of the substance is burn in spatula. It is observed that it burns with non smoky flame. Which confirms the product is aliphatic compound. If it was aromatic it should burn with a smoky flame.

Action of sodium:

3 drops of the compound is treated with a piece of sodium in a dry test tube. It is observed that hydrogen gas is liberated with bubbles. This confirms the compound is alcohol.

Esterification:

5 drops of the liquid are mixed with5 drops of glacial acetic acid and 3 drops of conc. sulphuric acid (H_2SO_4) are added. The mixture is heated and poured into dilute sodium carbonate solution. Fruity smell is observed. This confirms an alcohol.

Iodoform test:

To 5 drops of the liquid in 20 ml of water, 5 drops of strong solution of iodine in potassium iodide are added. A 10% solution of sodium hydroxide is then added until faint yellow colour persists. The test tube is heated on water bath and cooled. Yellow precipitate of iodoform is obtained. This confirms the ethyl alcohol.

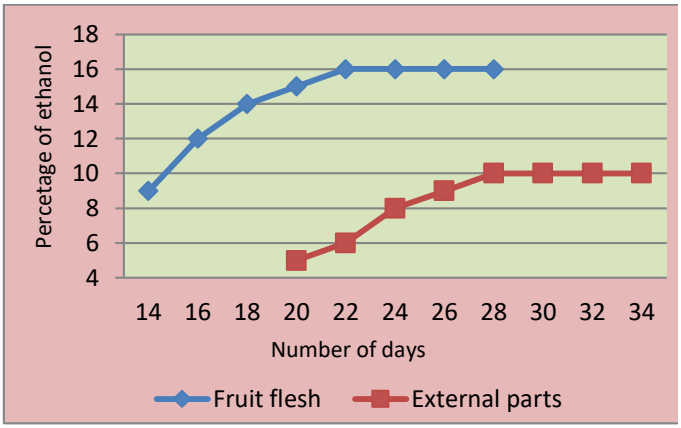
IV. ANALYSIS OF FERMENTATION TIME FOR THE JACK FRUIT FLESH

In a number of jars same amount of jack fruit flesh is allowed for fermentation. Every day verify the smell from the jar for the smell of fruit flesh. After about 14 days it is observed that the smell of the flesh is decreased. Follow the procedure of alcohol formation and measure the quantity. Repeat the procedure for every next two days. Similar procedure is followed to analyse the fermentation time for the outer parts of the jack fruit. It is observed that after about 20 days the smell of the mixture is decreased. Follow the procedure of alcohol formation and measure the quantity. The result is tabulated in Table I. Resultant variation is drawn in Graph 1.

Table I: Variation of Quantity of ethanol with time of fermentation

Si. No.	Initial material: Jack fruit flesh		Initial material: Outer parts of the Jack fruit	
	Time for fermentation in days	Quantity of Ethanol (%)	Time for fermentation in days	Quantity of Ethanol (%)
1	14	9	20	5
2	16	12	22	6
3	18	14	24	8
4	20	15	26	9
5	22	16	28	10
6	24	16	30	10
7	26	16	32	10
8	28	16	34	10

Graph 1: Variation of alcohol production with number of days of fermentation



V. EFFECT OF YEAST ON FERMENTATION

Kumar Y.S and co-workers [8] used yeast to increase the fermentation rate. To study this we used the market available dry yeast. It is observed that the fermentation is accelerated by the addition of yeast, and is tabulated in table II. There is no variation in the production of alcohol.

Table II: Comparison of Time for fermentation with and without yeast

Material	Minimum time for fermentation without yeast	Minimum time for fermentation with yeast
Jack fruit flesh	14	7
Outer parts of the Jack fruit	20	12

VI. CONCLUSION

- Minimum number of days needed to form ethanol from jackfruit flesh is 14 and from other parts of it is 20.
- Quantity of the alcohol production depends on the fermentation days.
- The maximum percentage of alcohol is in fruit flesh after 22 days of fermentation.

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