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Production of Citric Acid from Fruit Waste of Pineapple Using Aspergillus Niger

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Abstract

In this study citric acid production was carried by using pineapple waste from Aspergillus niger. Effect of different carbon and nitrogen sources like glucose, sucrose, yeast extract and peptone were studied on production. Citric acid production was recorded from 3rd day of incubation upto 5thday.The percentage of citric acid ranged from 0.032% to 0.430% maximum production was obtained from glucose as carbon source i.e; 0.530% on 5th day and maximum production was obtained from yeast extract as nitrogen source i.e; 3.331% on 5thday.

Key words: Citric acid, Aspergillus niger

Introduction

Citric Acid is a major organic acid.It is a natural constituent of citrus fruits like lemon and orange. It is responsible for sour taste of the fruit (Apelblat 2004).Citric acid is an industrially important organic acid (Jialong2005).It is mainly required in food and pharma ceutical industries (Pandey, A 2001). Out of the total citric acid produced, 70% is consumed by food industry, 12% is consumed by pharma ceutical industries and the remaining 18% are consumed by other industries (Haq,I2004)

Earlier, citric acid was produced by chemical synthesis, however it is costly process. Many micro bes including bacteria,yeast and fungi are known to produce citric acid(Kapoor1982). The fungus a niger is an organism of choice for citric acid production because of its capability to ferment cheap substrate and produce high yield. Recently there is an increasing trend of utilization of agrowaste for citric acid production(Soccol2003).Use of cheap agricultural waste like apple, orange can reduce the cost of fermentation process(Schuster 2002).

Pineapple is a popular fruit consumed worldwide. Pineapple peel is also used as feedstock for animals like goat,cattles. In maharshtra, particularly in marathwada pineapple is widely cultivated. Nutritionally, pineapple peels contain carbohydrates,proteins,tannin,lipids,fibres. However peels of this fruit are discarded as waste material. Such fruit waste discarded in an in-appropriate way scan create environmental issues. Therefore studies were carried out to test potential of fruit waste like pineapple peels a substrate for citric acid production.

Materials and methods

Isolation of *Aspergillusniger*

Potato Dextrose Agar medium was prepared. Dilutions of soil sample were prepared.This suspension was spread on petriplates containing PDA medium. Plates were incubated at30˚C for 3-4 days.

Identification of *Aspergillus niger*

Identification of *A.niger* was done by micro scopic observation. Black/Green colonies growing on agar pates were taken on slide with the help of wire loop and stained with Lactophenol cotton blue. The identified colonies were sub cultured on PDA medium and preserved for further use.

Fermentation media preparation

Fermentation media was prepared by grinding pineapple peels and mixed with water to make suspension.This suspension was filtered through muslin cloth and sterilized.

Effect of carbon and nitrogen source

Effect of different carbon sources (glucose and sucrose) and nitrogen sources (peptone and yeast extract) was studied on production of citric acid.

Determination of percentage of citric acid

Citric acid was determined titrimetrically by using 0.1 N NaOH and phenolphthalein as indicator [AOAC1995] by using following formula

$$\% \text{ Citric acid} = \frac{\text{Normality X Volume of NaOH X Equiv. Wt. of CA}}{\text{Weight of sample (g) X10}}$$

Results and Discussion

Citric acid is one of the most widely used organic acid and has many applications in food industries. Citric acid is naturally found in many fruits. It is an intermediate organic acid of tricarboxylic acid cycle. Today most of the citric acid is commercially produced by microbial fermentation process.

In the present study production of citric acid was carried out by using pineapple peel as a fermentation medium. Effect of carbon and nitrogen source was also studied on citric acid production. Citric acid production was recorded from 3rd to 5th day of incubation. When glucose (5%) was used as a carbon source. Percentage of citric acid was found to be maximum on 5th day of incubation (0.530%). When sucrose (5%) was used as a carbon source, percentage of citric acid was found to be maximum on 5thday of incubation (3.331%)
(Table 1). So, in this study, sucrose was found to be suitable carbon source for citric acid production.

When peptone (1%) was used as a nitrogen source, percentage of citric acid was found to be maximum on 5th day of incubation (0.15%). When yeast extract (1%) was used as a nitrogen source, percentage of citric acid was found to be maximum on 5th day of incubation (2.20%)(Table 2). So, in this study yeast extract was found to be suitable nitrogen source for citric acid production. A similar study was under taken by Satheesh kumar et.al (2019) and found thatrecycling the waste generated from fruit processing industries.

Damari Priscilla (2020) carried out the production of citric acid using pineapple waste as a substrate.They also optimized the fermentation medium and found that addition of supplements significantly enhanced the yield of citric acid.

It can be concluded that production of commercially important products like citric acid can be carried out by cheap and easily available substrate which will reduce cost of fermentation.

Table1 .Effect of carbon source on citric acid production.

Sr no.	Substrates	Percentage of citric acid(%)		
		3rd day	4th day	5th day
1.	Pineapple peel	0.032	0.138	-
2.	Pineapple peeland5% glucose	0.029	0.033	0.530
3.	Pineapple peeland5%sucrose	0.038	0.019	3.331

Table:2. Effect of nitrogen source on citric acid production.

Srno.	Substrates	Percentage of citric acid(%)		
		3rd day	4th day	5th day
1	Pineapple peel	0.032	0.138	-
2.	Pineapple peeland1%peptone	0.086	0.062	0.132
3.	Pineapple peeland1%yeastextract	0.062	0.088	4.112

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