Production of Industrial Organic Acid From Cassava using Fungi

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Abstract— Citric acid ,an industrial organic acid produced by Aspergillusniger from Manihotesculenta peel with different carbon and nitrogen sources. Glucose enriched medium showed maximum yield of citric acid. Ammonium chloride and ammonium persulphate reduced the formation of citric acid. The highamount of citric acid was observed in ammonium dihydrogen phosphate enriched source. The optimum yield of organic acid from cassava pulpin the presence of fungi was found in 20 days of fermentation with pH3and room temperature.

I. INTRODUCTION

Citric acid is anindustrial organic acid which found in many citrus fruits. It is a natural occurring caking preservative.It is also gives sour taste to foods and soft drinks. It is important intermediate in the TCA cycle of all living things. It also serves as a bleaching agent and acts as an antioxidant. It is a white crystalline powder which can exist either in anhydrousform, or monohydrate[1].Citric acid can generate heat in an alkaline state..

Citric acid is used in animal feed formulations to form soluble, rapid digestible with essential metal nutrients. It enhances best flavor to increase food uptake by an animals. It also helps to control gastric pH and maintain the efficiency status of the feed.Sodium citrate is used as abuffer in detergent making. Citric acid is produced fromAspergilusnigerby utilizing starchy and sugar sources [3,4]

Organic acid is also mixed to cosmetics formulations to adjust the pH, act as aion stabilizer and cleave metal ions to prevent discoloration and decomposition. It is used in fruit flavors and to impart a bettertaste . It helps tomaintain stability of the active ingredients in food products[5].

The marketing use of citric acid in syrups, elixirs, oral suspensions and solutions are good industrial applications. The citric acidused in pharmaceutical industry especially in anacids production[6].The amount of starch was found in cassava pulp 31.6%.Thereforecassava is used asbest substrate for ethanol and citric acid production[7].It is recognized as safe for applicable use in food industry which is readily metabolized and eliminated from the body. The main objective of this study was to produce industrial organic acid from cassava pulp in fungal medium and its yield was analyzed.

II. MATERIALS AND METHODS

Aspergillusniger was extracted from onion and cultured in a nutrient of potato dextrose agar media.Cassavapulp was washed , sliced and dried ina hot air oven at 60°C. This dried sample was powdered and subjected into acidhydrolysisand autoclaved for 20 minutes. The hydrolyzed materials were subjected to fermentation medium [8].

The fermentation media was enriched with cassava powder . Its approximate composition wasdetermined. Different carbon sources of sucrose, glucose, maltoseand nitrogen sources of ammonium chloride,potassiumdihydrogen phosphate ammonium persulphate and ammonium e were used for its optimization.The fermentation process was carried outat300ºCfor 20 days[9].

Different carbon and nitrogen enriched media was carried out after three days of incubation. These were filtered into a clean beaker with the help of whatmann no.1 filter paper.1 M NaOH was prepared and taken in burette.The filtrate was titrated against NaOH with phenolphthalein as indicator till pink colour appears.The readings were noted and amount of citric acid produced was calculated.

III. RESULTS AND DISCUSSION

The cssavapulp powder was used as a nutrient source for growth of fungi to produce citric acid.r and its maximum yield through optimization parameters.Pandey et.al showed that Cassava pulp and waste disposal in the environment can cause serious environmental pollution due to its high organic material and biodegradable [5,10]. For optimum withpH, media with different pH were titrated and the optimum pH range was found to be within 1-3 where the amount of organic acid produced was estimated to be less than 1%.. The yield of citric acid was observed in glucose enriched medium.Husseiny reported that15% of sucrose enriched medium showedhigh yield n of citric acid.[11]. Suitable carbon source was showed to be as glucoseas the best yield of citric acid .

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Table 1: Citric acid production from cassava peel using different carbon sources

Sl.no.	Volume of cassava filtrate (ml)	Carbon source	Volume of naoh added (ml)	Normality of citric acid (m)	Weight of citric acid in 1000 ml G/lt	Weight of citric acid in 100 ml %
1	50	Glucose	0.6	0.012	0.768	0.0768
2	50	Sucrose	0.4	0.008	0.512	0.0512
3	50	Maltose	0.4	0.008	0.412	0.0412

In case of nitrogen source, NH¬¬¬¬¬¬4Cl was found to be showed lower contribution for the citric acid which produced was estimated to be 0.058% The medium contained ammonium nitrate and sodium nitrate did not show any change in citric acid production but ammonium dihydrogen phosphate yield more amount of citric acid. Many of them explained that ammonium ionsplay ansignificant role in regulation of citric acid cycle.

Art (1987) stated that the higher concentration of ammonium constituents within cellscould lead to prevent the citrate activity via PFK inhibitor[12].The substrates of urea,yeast and ammonium dihydrogen phosphate also showed high yield of citric acid (Xie and West) . The greater concentration of phosphate led to decline in fixation of carbondioxide with certain amount of sugars and acids.[13]

Table 2: Citric acid production from cassava peel using different nitrogen sources

Sl.no.	Volume of cassava filtrate (ml)	Nitrogen source	Volume of naoh added (ml)	Normality of citric acid (m)	Weight of citric acid in 1000 ml G/lt	Weight of citric acid in 100 ml %
1	50	NH_4Cl	0.7	0.014	0.058	0.058
2	50	APS	0.7	0.014	0.896	0.0896
3	50	$NH_4H_2PO_4$	0.9	0.018	1.152	0.1152
4	50	NH_4NO_3	0.2	0.01	0.64	0.064

In case of temperature, the amount of citric acid produced was maximum (0.064%) at room temperature.The maximum yield of 0 .1152% was obtained in optimized media after incubating for 6 days at room temperature.

IV. CONCLUSION

The *Aspergillusniger* strain was grown on nutrient media and was used for thegreateryield of citric acid. The optimization of culture and nutritional conditions were done for high and consistent yield of citric acid. Rapid amount of citric acid yield was observed in optimized media was found to be the maximum when compared with normal medium.

V. REFERENCES

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