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Extraction and Physicochemical characterstics of Ethanol from Pineapple pulp and waste

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Abstract: Pineapple is a rich source of ascorbic acid supplement to our diet. Pineapple pulp waste showed maximum amount of reducing sugars (30.5mg/100g) and ash(1.8mg/100g)respectively. Pineapple waste contains high concentration of biodegradable organic material and suspended particles. Pineapple waste showed higher concentration of crude fibre, non-reducing sugar, protein, ascorbic acid and moisture content. Therefore pineapple waste is used as substrate for growth of microbes in fermentation process to produce ethanol using yeast.
Keywords: pineapple pulp, waste, sugars,ethanol, fermentation.

Introduction

Green mature pineapples are usually allowed to ripen during storage. The pineapple fruits are normally eaten fresh or as fresh pineapple juice. Pineapple fruits are an excellent source of vitamins and minerals. One healthy ripe pineapple fruit can supply of about 116.2% of daily requirement for vitamin C. Several physiochemical parameters like starch, reducing sugar, non reducing sugar, total sugar, protein, ascorbic acid in juice and waste. Pineapple waste contains high concentration of biodegradable organic material and suspended solid. The pineapple solid waste from pineapple processing was estimated about 40-50% from fresh fruit as pineapple peals and core[1].

Pineapple waste contains valuable components which are mainly sucrose, glucose, fructose and other nutrients[2]. The conversion of these nutrients into useful products of higher value added products like ethanol or even as raw material for other Industries or for use as food or feed after its biological treatment. The aim of this investigation was to extract ethanol from pineapple juice and waste.

Materials and Methods

Pineapple fruits were collected from market. Pineapple juice and waste was used for small scale fermentation. The physical parameters like p^H, temperature were measured using p^H meter and thermometer. The turbidity of the juice and waste were analyzed using nephelometer. The moisture content of the fruit sample and waste were determined by hot-air oven method and ash content was a muffle furnace and ashed at a temperature exceeding 525℃ for 6 hours. The ash was then cooled in a desiccator and weighed. The ash content was recorded as 1.8mg/100g of fresh weight[3].

The titratable acidity was calculated by mincing fresh fruit samples (10g) were mixed with 200cm^3 distilled water, boiled for 1 hour, cooled and the mixture was then filtered. The filtrate (10cm^3) was titrated with

0.1M sodium hydroxide upto p^H 8.1 using p^H meter. The results were expressed as 2.03% citric acid/gm fresh weight[4].

The reducing sugar was measured by alkaline 3,5 dinitrosalicylic acid (DNS) method[5] and total sugar content was measured by anthrone method[6].Soluble protein was analysed by Lowry method[7] .The ascorbic acid content was measured by Colorimetric method[8].

Table1: Physico chemical constituents of pineapple pulp subjected to 8-10 days fermentation

Parameters	Raw pulp	sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Starch (mg/100g)	3.6	1.6	2.4	2	2.4	2.6	3
Reducing sugar (%)	22.5	20	17.5	21.5	21.5	20.5	20.5
Protein (mg/100g)	7.2	4.6	3.6	4	4.2	4.2	4.4
Ascorbic acid(m g/100g)	21.5	2.5	3.5	3.5	3.5	3.5	3.5
Ph	4	2.5	7	7	6	5.5	5.5
Temperature (°C)	37	27	26	26	26	26	26
Turbidity(NTU)	350	516	1195	1196	1196	1264	1065

Results and Discussion

Different concentrations of pine apple waste can be treated as samples 1 to 6. The average ascorbic acid of pineapple was 27.4mg /100g-fw. The ascorbic acid was found to be higher in waste (26.5mg/100g-fw) than in pulp (21.5mg/100g-fw). The usual adult dose of ascorbic acid as dietary supplement is between 30–200mg/day. The reducing sugar in Mbezi pineapple was 14.2%. But Indian pineapple shows slightly acidic than Mbezi pineapple[9]. The pulp showed maximum amount of ascorbic acid than waste.

The pineapple fruit and skin waste were subjected to fermentation with different concentration used as a substrate for ethanol production by baker's yeast. The raw pineapple pulp and waste contains 10.5% and 8.5%. The effect of different concentration showed difference in physical and chemical parameters. The carbohydrate content and reducing sugar was rapidly utilized in fermentation. The reducing sugar and starch content was drastically reduced at initial stage of fermentation from 22mg to 20.5mg and 3.6mg to 1.6mg using glucose as substrate. The reducing sugar content was gradually increased from 20.5mg to 36.5mg in 20 days of fermentation.

The reducing sugar was found to be higher in pineapple pulp when compared with pineapple waste. The maximum amount of reducing sugar was observed in pineapple pulp (10.5%) than waste (32%).The reducing sugar content of pineapple was found to be lower in Indian Varieties of pineapple (10-12.5) when compared with Mbezi pineapples (14.2%)[10].The total sugar content of Indian variety was found to be higher in waste(9.75%) than pulp(8.66%).The total sugar content of pearl pineapples of brazil had a total sugar content of 14.5%.

The pineapple waste contained higher amount of crude fibre (0.60g/100g-fw) than fruit(0.41g/100g.fw). The average crude fibre content of 0.41g/100gfw for Mbezi pineapple similar to Indian pineapples 0.399g/ 100gfw)[11].Pineapples pulp had average crude fibre content of 0.45±0.03g/100g.Ramulu and Rao reported that crude fibre content of Indian pineapple had 0.5g/100g-fw in fruit[12]. Fibre helps to maintain the health of gastrointestinal tract,but in excess it may bind some trace elements[13].The pineapple skin waste was found to be higher amount of total sugar (9.75%)and non-reducing sugar(8.8%)than juice, which is essential for growth of microorganism and also found to be higher protein content in waste (10mg)[14]. Total sugar and non-reducing sugar and proteins are suitable for yeast fermentation[15].

Conclusion

The pineapple fruits exhibit moderate acidity, high moisture, high sugars and ash content and low crude fibre. Pineapple is rich in ascorbic acid and it is found to be high in pineapple waste (26.5mg/100g).Similarly, the reducing sugar content was found to be higher in pineapple waste (32mg/100g). Pineapple waste contains maximum amount of non-reducing sugar (8.66%).Thus pineapple fruits exhibit reducing, non reducing sugars and carbohydrates and protein which are used as a nutrient medium for growth of microbes and fermentation using yeast to produce ethanol and single cell protein.

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