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Physicochemical characteristics of *Manihot esculenta* plant and its waste

T. Balamurugan and S. Anbuselvi

Department of Industrial Biotechnology, Bharath University, Chennai

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ABSTRACT

Starch provides 70-80% of calories consumed by humans in the form of cereals, roots and tubers. Cassava contain 60-70% of starch in tubers and leaves. This Cassava tuber is used as staple food in India. It also contain high amount of protein present leaves (70%) for animal feed production. Cassava waste and pulp can be used as raw material for production of monosodium glutamate starch in food Industry. It is also used as substrate for production of single cell protein, ethanol. Cassava pulp contains maximum amount of non reducing sugar (6.6mg). Vitamin C was highly observed in leaves (300mg and waste (360mg).

Keywords: Cassava, Starch, reducing sugar,Waste.

INTRODUCTION

Cassava (Manihot esculenta cranz) is the world's sixth most important crop and is grown in African, Asian and Amercian countries [1]. There are several advantages regarding Cassava crop. It can adopt to poor soil and drought resistance . It is easily propagated by Stem cutting [2]. Cassava starches are an excellent raw material for modifying the physical properties of many foods like gelling thickening, adhesion, moisture retention, stabilizing texturizing and antistaling application and Monosodium glutamate preparation. Cassava starch has a high potential to serve as a fat replacer in food formulation because it forms a bland and clearer gel and non allergen [3]. Cassava is also widely used a raw material for food industry, animal feed industry, Starch industry and more recently used for production of ethanol. Cassava is a root crop that produces high yield with little to input, increase the economic value of the country.

Cassava pulp contains about 50-70% starch on dry weight basic and 20-30% fibers [4]. Some characteristics of cassava starch are it's high purity, neutral flavour and solubility. It is easily swollen, high viscous and has low ability to retrograde compared with order starches such as Potato, Rice and Corn [5]. In addition Cassava waste as raw material in ethanol production not only reduces waste material created from starch Industry, bust also lowers the cost of ethanol production [6]. The main objective of this work was analyze to Physicochemical characteristics of cassava tubes, leaves and waste.

EXPERIMENTAL SECTION

Cassava samples were collected from Market from farms during the tubers season. The Physical Parameters like pH and temperature were measured by pH meter and thermometer. The turbidity of samples were measured using nephlometry. The moisture contents of the tubers, leaves and waste were determined according to standard methods [7].

Ash content of samples were analyzed by taking cassava 5g of samples were kept in a muffle furnace and ached at a temperature of 525^0 C for 6 hours. The ash was then cooled in a dessiccator and weighed. The ash content was

recorded as a g per 100g – fresh weight (g/100fw) Citric acid content was measured by 10g of cassava, leaves, tubers and waste were mixed with 200ml distilled water, boiled for 1 hour, cooled and filtered. 10ml of filtrate with 0.1m sodium hydroxide upto pH 8.1 measured with pH meter. The results were expressed as % Citric acid [8].

Cassava tuber and leaves were put into a thimble, covered with fat free cotton and then put into the soxhlet apparatus. The flask was filled with 150 cm3 petroleum ether and extraction was done for 16 hours in water bath. The sample was dried at 100^0C in the oven for 1 hour, cooled and re-weighed. The difference in weights give the fat soluble material present in tne sample. The determination of crude fat was calculated in pulp, leaves and waste.

Crude fibre was determined from the residue after the crude fat determination [8]. Carbohydrate content of cassava tubers leaves and wastes were analyzedby using anthrone method. [9]. The reducing sugar content in Cassava samples were determined quantitatively by using 3, 5 dinitrosalicylic method [10]. The protein content in tubers, waste and leaves were measured by using Lowry et al 1951. Minerals such as iron and calcium content of waste , leaves and tubers were analyzed from their ash samples. Vitamin C of samples were measured by colorimetrically using 2, 4 dinitrophenyl hydrazine reagent [11].

RESULTS AND DISCUSSION

The physical parameters of cassava pulp, leaves and waste were summarized in table1. The pH of pulp waste and leaves were found to be acidic. This was due to presence of ascorbic acid. The maximum temperature was observed in leaves(36^0C) when compared with pulp and waste. The maximum turbidity was found in pulp. The high moisture content 82.7% was observed in waste. The ash content in leaves showed maximum amount 20.5 when compared with tubers and waste. The low content of ash 7% was found in cassava waste sample. Renata metal, 2012 has been reported that moisture and ash content of cassava waste were found to be 62.4% in wet basis and 0.7% for wet sample and 1.8% fir dry samples. [12].

The biochemical constituents of cassava, pulp, leaves and waste were summarized in table 2. The cassava is a rich source of carbohydrates. The maximum amount of sugar was observed in cassava leaves (29 mg/10g) when compared with tubers and wastes. Similar results were observed in nutritive value of cassava leaves 18mg/100g and tubers 3.5mg/100g [12]. Cassava pulp contains about 50-70% starch on dry basis. The maximum amount of starch was found in pulp 30.6% and waste 70.8% therefore cassava waste is used as substrate for ethanol production. Renata etal reported that starch content of cassava pulp was found to be 29.3%. The cassava waste showed similar amount of starch concentration 78.16 in teerapatr et.al (2006) work for fuel production in Thailand. [13].

The cassava leaves showed maximum amount of reducing sugar 29mg/100g and non-reducing sugar 6.6mg/100g when compared with tubers and waste. High concentration of protein was observed in leaves and 7.0mg and 7.8mg waste respectively. Most cassava waste can be used as animal feed due to its high content of protein and other nutrients which are necessary for animal growth [14].

The low amount of crude fiber 1.6% was observed in cassava pulp and maximum concentration of crude fat was identified in cassava waste. Cassava starch always contaminated with fibers more efficiently saccharified after treatment with fungal cellulose [15]. Use of enzymes cellulose or pectinase alone not only used effectively to improve starch extraction reported by sriroth et al, 2000 [17]. The maximum amount of calcium 313mg/100g and iron 7.4mg/100g were observed in leaves t [17] Similar results were observed in ogbonna and okoli, 2010 [18, 19]

Table 1: Physical characteristics 0f Cassava plant and waste

S. No.	Parameters	Pulp	Leaves	Waste
1	pH	4.0	2.3	2.1
2	Turbidity	5.9	0.2	4.6
3	Temperature	28^oC	36^oC	35^oC
4	Moisture	79.50	78.64	82.70
5	Ash content	13.7%	20.5%	7.9%
6	Titrable acidity	0.08%	0.12%	0.02%

Table 2: Biochemical Constituents of Cassava plant and waste

S. No.	Parameters expressed per 100g	Pulp	Leaves	Waste
1	Starch			
2	Total sugars	18 mg	29mg	10 mg
3	Reducing sugars	25 mg	29 mg	19 mg
4	Non Reducing sugars	6.6 mg	5.4 mg	2.7 mg
5	Proteins	6.8 mg	7.0 mg	7.8 mg
6	Ascorbic Acid mg	0.2 mg	1.6 mg	3.5 mg
7	Iron	1.9	7.4	6.3 mg
8	Crude fibre %	1.6%	4.2%	3.1%
9	Crude fat %	0.05%	0.01%	0.08%

CONCLUSION

This work evaluated the physicochemical characteristics of cassava leaves and wastes. Maximum use of pulp for production of monosodium glutamate and in food industry and leaves used for animal feed due to high protein content cassava waste used as a substrate of ethanol waste used as a substrate for ethanol production. Thus cassava used as a raw material for so many industries to improve the economy of country through its cultivation at cheaper rate.

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