Int J Pharm Bio Sci 2013 July; 4(3): (B) 510 - 515

Research Article **Biotechnology**

International Journal of Pharma and Bio Sciences **ISSN 0975-6299**

``A COMPARATIVE STUDY ON PHYSIOCHEMICAL AND NUTRITIVE CONSTITUENTS OF *MANIHOT ESCULENTA CRANZ* AND *IPOMOEA BATATAS*

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ABSTRACT

(1) Human beings consumed starch in the form of cereals and tubers which provides 70-80% of calories to our body. Sweet potato plays a significant role in tribal Indian diet. It contains β-carotene and anthocyanin(antioxidant) rich. Recently it has been found out that sweet potato can control blood sugar levels and insulin resistance. The World Health Food Organization has labeled it as anti-diabetic food .Studies estimated that a daily intake of 100g of orange fleshed sweet potato prevent vitamin A deficiency in children and lactating mothers. Cassava contain 60-70% of starch in tubers and leaves. This Cassava tuber is used as staple food in India. It also contains high amount of protein present leaves (70%) for animal feed production. Cassava pulp and waste serve as a raw material for starch and monosodium glutamate production. It is also used as aubstrate for production of single cell protein and ethanol. Cassava pulp contains the maximum amount of non reducing sugar (6.6mg). Vitamin C was highly observed in leaves (300mg and waste (360mg). The proximate moisture, fat,proteins,crude fibre,ash and carbohydrates were determined in sweet potato and cassva samples

KEYWORDS: Sweet potato, cassava, starch, sugars, proteins

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INTRODUCTION

Ipomoea batatas L. (Lam.)(Sweet potato), is a dicotyledonous plant belonging to Convolvulaceae family. It is an extremely important crop mainly seen in tropical countries. It ranks seventh in the world from the viewpoint of total production. It is also a storehouse of many important pigments like β-carotene, anthocyanin etc which act as good antioxidants[1]. In addition to its nutritional benefits, the crop's easy adaptability to tropical climate and minimal growth requirements, make it a crop of high commercial importance[2]. Sweet potato is a rich source of starch. It has 30% more starch than that of rice and corn and 49% than wheat under same condition[3]. This high starch content is being judiciously utilized for the production of ethanol. The demand for ethanol is being rising day by day due to its potential of being used as a substitute for gasoline. The yeast *Saccharomyces s*pp*.* is used for the fermentation process using sweet potato as a starch substrate. But starchy and cellulosic materials must be hydrolyzed into fermentable sugars by amylase produced using barley before they can be utilized by the yeast[4].Some sweet potato varieties are rich in β-carotene and anthocyanin pigment. To get benefit from these naturally available antioxidants, either sweet potato can be consumed directly or can be incorporated into some other edible items[5].

Cassava (Manihot esculenta cranz) is the world's sixth most important crop and is grown in African, Asian and Amercian countries . There are several advantages regarding Cassava crop. It can adopt to poor soil and drought resistance . It is easily propagated by Stem cutting 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 neutral flavor, solubility, high viscous and fat replacer in food formulation because it forms a bland and clearer gel and non allergen [6]. 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. 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 [7]. 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[8].The cassava leaves are used to treat hypertension, headache and pain. Cubans are commonly used cassava to treat irritable bowel syndrome[9,10] The main objective of this work was analyze to nutritive and physicochemical characteristics of tubes, leaves and waste of sweet potato and cassava.

MATERIALS AND METHODS

Cassava and sweet potato samples were collected from Market from farms during the tubers season. The pulp was collected from starch Industry. The physical Parameters like pH and temperature were measured by pH meter and thermometer. The turbidity of samples were measured using nephlometry. The moisture,crude fibre and crude fat contents of the tubers, leaves and waste were determined according to standard methods [11]. 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 [12].

Carbohydrate content of cassava tubers leaves and wastes were analyzed by using anthrone method. [13]. The reducing sugar content in Cassava samples were determined quantitatively by using 3, 5 dinitrosalicylic method [14]. 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 [15].

RESULTS AND DISCUSSION

The physicochemical characterstics of pulp, waste and leaves of sweetpotato and cassava were analyzed in Table 1 and 2. The pale orange of sweet potato colour is due to the presence of ββ-carotene and anthocyanin. The dry weight of sweet potato (26%) and cassava(32%) was observed. This low dry matter content is due to high moisture content .The average dry matter content is 30% but varies widely depending on location, climate, day length, soil type etc[16]. The pH and temperature of sweet potato were found to be 6.8 and 29º c. The turbidity of pulp was found to be higher in pulp(13) when compared with pulp of cassava (5.9)(Table 2).The pH of cassava pulp(4.0) waste(2.3)and leaves(2.1) were found to be acidic when compared with sweet potato. This was due to presence of ascorbic acid.The titrable acidit was highly observed in leaves of sweet potato and cassava. The maximum temperature was observed in leaves(36^0C) when compared with pulp and waste. The maximum turbidity was found in sweet potato pulp. The high moisture content 82.7% was observed in cassava waste. The ash content in leaves of sweet potato and cassava showed maximum amount 20.5% and 15.8% when compared with tubers and waste. The low content of ash (7%) was found in cassava waste sample. Renataet.al, 2012 has been reported that moisture and ash content of cassava waste were found to be 62.4% and 0.7% for wet sample [17].

Sweet potato tuber is highly rich in starch. It has 30% more starch content than rice and corn and 49 % more starch than wheat . The highest starch content was found in pulp of sweet potato (19.2 %) followed by leaves (18.3 %), waste (11.5 %).The starch content of sweet potato ranges from 7 % to 22 % .[18](Fig1). The maximum amount of starch was found in cassava waste 70.8% than sweet potato, therefore cassava waste is used as substrate for ethanol production. Renata et.al., reported that starch content of cassava pulp was found to be 29.3%[17]. The cassava waste showed a similar amount of starch concentration 78.16% in teerapatr et.al (2006) work for fuel production in Thailand. [19].The cassava leaves showed the maximum amount of reducing sugar 29mg/100g and non-reducing sugar 6.6mg/100g when compared with tubers and waste(Fig2).

The maximum protein content was recorded in sweet potato 4.5 mg/ 100g in raw and pulp than waste. Purcell et al., 1978[20] found that variation was slightly less and another (Bradbury et al., 1985b[16] that it was as great among roots of same plant as between plants. It was also shown that total protein varied by genotype, environment and interaction of genotype and environment ($p < 0.01$) [21]. 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 [22](Fig2) . The maximum amount of crude fibre and crude fat were highly observed in cassava samples than sweet potato.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 [23]. Use of enzymes cellulose or pectinase alone not only used effectively to improve starch extraction reported by sriroth et al, 1977 [24]. The maximum amount of calcium(313mg/100g) and iron(7.4mg/100g)

were observed in leaves and ascorbic acid was found to be higher in cassava waste(3.5mg/100g. ogbonna and okoli reported that maximum amount of calcium and iron in cassava leaves.[25].The leaves of cassava are rich in antioxidants,calcium iron and vitamins A and B.

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°C	36°C	35°C
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
Physical characteristics of Sweet potato plant and waste

S.No.	Parameters	Pulp	Leaves	Waste
1	pH	6.8.	5.4	5.1
2	Turbidity	13	4.6	10.6
3	Temperature	29°C	36°C	30°C
4	Moisture	75%	68.7%	70%
5	Ash content	10.6%	15.8%	6.5%
6	Titrable acidity	0.05%	0.10%	0.01%

Figure 1
Biochemical constituents of sweet potato plant

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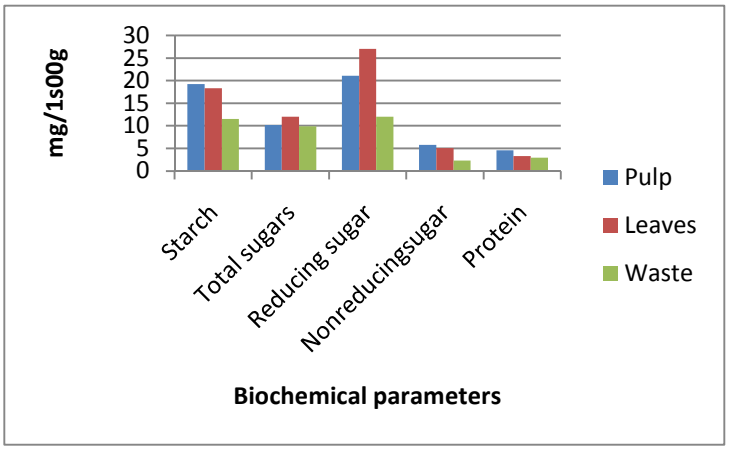
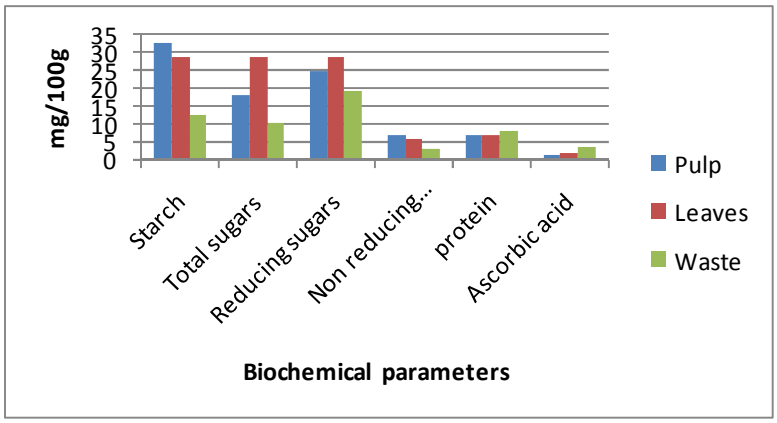


Figure 2
Biochemical constituents of cassava plant



CONCLUSION

This work evaluated the physicochemical characteristics and nutritive value of sweetpotato and cassava plants and wastes. Maximum use of pulp for production of monosodium glutamate and in food industry, pharmacological ingriendents for pharma 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.

REFERENCES

1. Azhar, A., and Handy, M.K. . Alcohol fermentation of sweet potato . I. acid hydrolysis and factors involved. *Biotechnol. Bioeng,* 23, 879-886(1981a).
2. Azhar, A., and Handy, M.K. Alcohol fermentation of sweet potato. Membrane reactor in enzymatic hydrolysis. *Biotechnol. Bioeng,*; 23, 1297-1307(1981 b).
3. Wang, H. The breeding of sweet potatoes for human consumption. In: Villareal, R.L. and Griggs, T.D. (eds.), Sweet potato. Proceedings of the First International Symposium, AVRDC, Shanhua, Taiwan, 297-311(1982).
4. Bottazzi, V.,and Merciner, A. *Bact Brles Locllquea; Aspecta. Fondomentaux et TBchnologlquea, H. do Robinorl and F.M. Luquet eds.,*409(2003) .
5. Bouwkamp,,C . Introduction –Part I. In: Bouwkamp, J.C. (ed.), Sweet potato products: a material resource for the tropics, CRC Press, Inc., Bae Raton, F.L (1985).
6. Nitayavardhana,S.,Shrestha,P.,Ramussen, M.L., Lamsal,BP.,Van Leeuwen,J.,Khanna,SK. Uitrasound improved ethanol fermentation from cassava chips :chips slurry in cassava – based ethanol plants.*Bioresource Technol,*101(8),2741-2747(2010).
7. Pan,S.K., Wu,K., jamd; Kim,J.M.Preparation of glucosamine by hydrolysis ofchitosan with commercial α-amylase and giucoamylase. *J. Zhejiang University Sci (Biomed),*12 (11), 931 – 934(2011).
8. Charocrnrat,T.Batchfermentation of ethanol production from cassava waste. Thesis of Master degree kasotsart University**,** Bangkok, Thailand(2001).

9. StintzingFC,StintzingAS,Carle,FreiB,WrolstadRE,ColrandAntioxidantpropertiesofcyanidin-based anthocyanin pigments. *Agric.Food.Chem,*50:6172-6181(2002).
10. Prawat H,Mahidol C,Ruchirawat S, Prawat U,Tuntiwachwuttikul P,Tooptakong U, Taylor CW,Pakawatchai C,Skeiton WB,White HA. Cyanogenic and noncyanogenic glycosides from *Manioc esculenta*.Phtyochemical,40:1167-1173(1995).
11. AOAC (Association of Official Analytical Chemists)Official Method of Analysis, 16th Edition, Virginia(1995).
12. Ranganna,S. *Handbook of Analysis and Quality control for fruit and vegetable products*, Tata Mc Graw Hill publication, New Delhi pp82-86(1997).
13. Hodge, J.E.,and BT Hofreiter,B.T.,*Methods in Carbohydrate chemistry,* New York,pp32(1962).
14. Miller,G.L., Use of dinitrosalicylic acid reagent for determination of reducing sugar, *Anal Chem***,** 31:426-428(1972).
15. Sadasivam,S., and Theymoli,B., *Practical manual in Biochemistry*, TNAU, Coimbatore pp14(1987).
16. Bradbury,J.H.,Beatty,R.E.,Bradshaw.R.,Hammer,B.,Illoway,W.D.,Jealous,W.Lau,J.,Nguyen, T.and Singh, U.Chemistry and nutritive value of tropical crops in south pacific. *Proc. Nutr. Soc. Austr,* 10, 185-188(1985 a)
17. Renata,C.M., Miklasevicius,V.S., Mariana,MB., Salau,PG.and Terra,M.T.,Optimization of enzymatic hydrolysis of cassava to obtain fermentable sugars. *Biomedicine and Biotechnol,* 13 (7) : 579 – 586(2012).
18. Lee, Y.K. arid Salminen, S. The coming age of probiotics. *Trends in Food Sci. Technol*., **6**:24(1995).
19. Teerapatr;S., Lerdluk,K., and . La,S.,saied.R., Approach of cassava waste pretreatments for fuel ethanol production inThailland. *J. Sci. Res.*, *Chula Univ* 31 (1):77 – 84(2006).
20. Purcell,AE., Walterand,WM., Giesbrecht, F.G.,Distribution of protein within sweet potato roots . *J. Agric;. Food Chem*.1996, 24(1): 64-66(1996).
21. CollensW.W and Walter,W.M. , Potential for increasing the nutritive value of sweetpotato. Proceedings of the First International Symposium, AVRDC, *Shanhua, Tainan*, .355-363(1982).
22. Akpan,I.;Uraih.N., Obuekuwe.C and KenebomahM.J.,Production of ethanol from cassava waste, *Acta. Biotechnological,* 18 (1) :39 - 45(2004).
23. de Menezes.T.J.B., T. Arakaki.T., Delamo.P.R and Sales.A.M. Fungal cellulases as an aid for the saccharification of cassava. *Biotechol Bioeng*., 20 (4) : 555 – 565(1978).
24. Sriroth.K .,Development of Cassava product for Industries. *Food science*, 10 (2); 26-36(1977).
25. Ogbonna,C.N., and Okoli,E.C.,Conversion of cassava flour to fuel ethanol by sequential solid state and submerged cultures. *Process Biochem,* 45 (7) : 1196 – 1200(2010).