IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 11, Issue 11 Ver. I (November. 2017), PP 24-27
www.iosrjournals.org

Determination of Sugars in Yams Under Storage During the Dry Season.

[1]Makanjuola, Olakunle Moses,[2]Osinfade, Basiru Gbolahan.
[1]*Department Of Food Technology Federal Polytechnic, P.M.B, 50 Ilaro, Ogun State. Nigeria*
[2]*Department Of Science Laboratory Technology, Federal Polytechnic P.M.B, 50 Ilaro, Ogun State, Nigeria.*
Corresponding Author: Makanjuola, Olakunle Moses

Abstract: *The sugar contents in three species of yams viz white yam (Dioscorea rotundata), water yam (Dioscorea alata) and yellow yam (Dioscorea cayenensis) under storage during the dry season were investigated using standard methods. The sugars determined for a period of 4 months during storage at ambient conditions were maltose, sucrose, glucose, raffinose, fructose, galactose, arabinose and xylose. Generally the trends as revealed by the result showed that total sugars in all the three yam species increased as the storage time prolonged. Maltose sugar for example increased to 24% and 64% at the end of 2 month to 4 month storage for white yam, 26.7% and 60% for yellow yam and 66.7% and 123% for water yam suggesting that sugar contents in yam tubers has the tendency to increase meaningfully during storage due to the breakdown and subsequent hydrolysis of starch into sugars in addition to considerable variations in composition not only between species, but also with a single specie according to cultural, climate and adaptic factors of environment in which the yam are grown, the maturity at harvest as well as the length of time which they have been stored.*

Keywords: *Sugar contents, yam species, storage, dry season*

Date of Submission: 12-09-2017 Date of acceptance: 14-10-2017

I. Introduction

Yams are major food crops in West Africa, the Caribbean Islands of the south pacific, southwest Asian, India and parts of Brazil. [1]. about ten species of yams can be considered domesticated and in Nigeria, the edible yams are classified according to shape, colour and quality of the tubers [1]. Yams are members of the genus *Dioscorea* in the section, Enatiophypllum. *Dioscorea* containing the largest genus of the Family *Dioscoreaceae*, containing between three and six hundred species [2,3]. Yam is grown and cultivated for its energy-rich tuber [2,3]. The Tubers of various species of *Dioscorea spp* constitute one of the stable carbohydrate foods for the people in many tropical Countries [4]. Many Different forms and cultivars of the edible yam species are available in different areas and it is likely that they differ in composition and nutritional value [5,6]. The yam tubers can be stored for periods up to 4 or even 6 month at ambient temperature (30 ± 2^0C) better than cassava, potato, sweet potato and aroids [7,8].

Root and tuber starches have unique physiochemical properties mostly due to their amylase and amylopectin ratio [9,10,11]. [12,13] reported that crystallinity decreased with increasing amylase content in maize starches. The most important aspect of yams starches is the influence of the properties of starch on the texture and rheology or flow characteristics of food yams [13,10,11]. Several researches have been carried out on yams and reported in the literature. [6] reported the effects of post harvest storage on some biochemical parameters of deferent parts of two yams species; [11] investigated the effect of varieties on physicochemical and pasting characteristic of water yam flours and starches, [8] reported on the chemical, functional, and sensory properties of water yam-cassava flour and its paste while the impact of cooking on the proximate composition and anti-nutritional factor of water yam was investigated by [3]. However the present work aims to determine different sugar present in three yam cultivars under storage for a period of 3 months during the dry season.

II. Materials And Methods

Three varieties of yams, white yam (*Dioscorea rotudata*), water yam (*Disocorea alata*), and yellow yam (*Dioscorea cayenensis*) harvested from the botanical garden of the department of Science laboratory Technology of the Federal Polytechnic Ilaro, Ogun state, Nigeria. All the three varieties of yam were harvested at maturity state and transported in a heap aired store, and then stored under prevailing tropical ambient condition 26.56^0C$\pm3^0$C and 82%±5% relative humidity for a period of 4 months [6].

Preparation Of Yam Flour

The methods described by [1] were used in the preparation of yam flour. One tuber of each variety of yam randomly picked every two month during storage form a period of 4 month. The yam tubers were washed, sliced into 2.0 cm thickness and heated in water bath (Cliftoon, England) at 50^0C for 2 hours. After heating, the yam slices were then stepped in the same water for 24 hours. The yam slices were then drained in a LEEC cabinet dryer at 60^0C for 2 days to obtain constant moisture content of 8%. The dried yam slices were then milled into flour using a local fabricated plate mill, sieved with a 90 µm sieve to obtained yam flour which were then used for subsequent analysis.

Analysis Of Sugar By Thin Layer Choromatography.

The flours produce were first hydrolyzed using concentrated sulphuric acid. Sugars produced by the hydrolysis of the raw native starches with crude amylase of a niger AMO 7 were identified by thin layer chromatography (TLC). Commercially prepared TLC plate (Polygram, U.K) were used as the stationary phase. Aliquot of each starch hydrolysate was spotted on the TLC plate along with standard mixture of Known sugars. The reference sugar solution contained 0.1g of maltose, sucrose, glucose, raffinose, fructose, galactose, arabinose and xylose in 100ml of 10% isopropanol. A one dimensional ascending chromatography was done at room temperature using a solvent system of N-butanol: acetic acid: diethyl ester: water (9:6:3:11) (v/v/v/v). After 2 hours, all the chromatography were treated by dipping in locating reagent made up of 4 amino-benzoic acid in methanol. The plates were air dried by placing in oven at 100^0C for 15 minutes. The sugars spot appeared as dark brown spots. Identification of sugars were done by comparing the Relative Fraction (RF) values of the sample with that of standard. All reagents used were of analytical grade and determinations were carried out in triplicates.

III. Statistical Analysis

Data generated were subjected to statistical analysis using SPSS. 15. The Scores were ranked and Analysis of Variance (ANOVA) was computed where significant differences were separated using Duncan's Multiple Range Test.

IV. Results And Discussion.

Table 1: Sugar Contents of Three Varieties of Yam Under Storage During the Dry Season (Zero Level).

	SAMPLES		
Parameters	**White Yam**	**Yellow Yam**	**Water Yam**
Maltose (%)	0.25^a±0.01	0.15^c±0.01	0.21^b±0.08
Glucose (%)	1.20^c±0.02	1.75^b±0.61	2.32^b±0.02
Frutose (%)	2.65^b±0.05	2.50^c±0.04	3.47^a±0.01
Sucrose (%)	58.28^a±0.01	47.91^c±0.01	56.50^b±0.02
Rhamnose (%)	6.43^c±0.01	7.50^b±0.04	9.43^a±0.02
Galactose (%)	10.52^a±0.03	8.61^c±0.05	9.13^b±0.05
Arabinose (%)	7.18^a±0.07	4.90^c±0.01	5.27^b±0.07
Xylose (%)	0.91^a±0.01	0.81^b±0.01	0.65^c±0.05

Means ± standard deviation of triplicate determinations.

Values with different superscripts in the same row are significantly different (P<0.05).

Table 2: Sugar Contents of Three Varieties of Yam at After Two Months of Storage During The Dry Season.

	Samples		
Parameters	**White yam**	**Yellow yam**	**Water yam**
Maltose (%)	0.31^b±0.007	0.31^c±0.07	0.38^a±0.07
Glucose (%)	1.54^c±0.01	1.54^b±0.01	3.46^a±0.07
Frutose(%)	3.67^b±0.04	3.37^b±0.07	5.20^b±0.04
Sucrose(%)	66.50^a±0.07	52.17^e±0.07	61.15^a±0.04
Rhamnose(%)	7.80^a±0.07	10.78^b±0.07	11.15^a±0.04
Galactose(%)	13.31^c±0.07	11.16^b±0.04	11.32^b±0.07
Arabinose(%)	9.16^a±0.04	5.17^c±0.03	7.10^b±0.07
Xylose(%)	11.78^a±0.07	0.96^b±0.07	0.83^a±0.04

Means ± standard deviation of triplicate determinations.

Values with different superscripts in the same row are significantly different (P<0.05).

Table 3: sugar contents of three varieties of yam after 4 months of storage during the dry season.

	Samples		
Parameters	**White yam**	**Yellow yam**	**Water yam**
Maltose	0.41 ± 0.04^{b}	$0.24^{b}\pm0.07$	0.47 ± 0.04^{a}
Glucose	$1.98^{c}\pm0.07$	$2.60^{b}\pm0.04$	$4.50^{a}\pm0.07$
Frutose	$4.30^{b}\pm0.04$	$3.97^{c}\pm0.07$	$6.14^{b}\pm0.04$
Sucrose	$72.44^{a}\pm0.07$	$12.83^{c}\pm0.04$	$14.60^{a}\pm0.07$
Rhamnose	$8.57^{c}\pm0.04$	$11.75^{b}\pm0.07$	$12.49^{b}\pm0.04$
Galactose	$14.40^{b}\pm0.07$	$12.83^{c}\pm0.04$	$14.60^{a}\pm0.07$
Arabinose	$9.62^{a}\pm0.04$	$6.10^{c}\pm0.07$	$8.73^{b}\pm0.04$
Xylose	13.19±0.07	1.40±0.04	1.25±0.07

Means ± standard deviation of triplicate determinations.

Values with different superscripts in the same row are significantly different ($P<0.05$).

V. Discussion

The % sugar contents of the three species of yam viz white yam, yellow yam and water yam are as shown in table 1. The sugar contents determined in all the three yam species are maltose, glucose, fructose, sucrose, rhamnose, galactose, arabinose, and xylose. The % maltose for all the three yam varieties ranged from 0.15%-0.25%, Glucose ranged from 1.20%-2.32%, fructose ranged from 2.50%-3.47%, sucrose ranged from 47.91%-58.28%, rhamnose varied from 6.43%-9.43%, galactose varied from 8.61% from 8.61%-10.52%, arabinose ranged from 4.90%-7.18% and while xylose varied between 0.65%-0.91% respectively at zero storage. After 2 months of storage as revealed in Table 2, maltose sugar present in the three yam species ranged from 0.91%-0.38, glucose ranged from 1.54%-3.40%, fructose ranged from 3.37-5.20% sucrose varied between 52.71%-66.50%, rhamnose varied between 7.80-11.15%, galactose ranged from 11.16%-13.31%, Arabinose ranged from 5.17%-9.16% while xylose varied between 0.96-11.78%. Table 3 showed the sugar contents for the three yam varieties at the end of 4 months storage. Maltose sugar ranged from 0.24%-0.47%, glucose from 1.98%-4.50%, fructose ranged from 3.97%-6.14% while sucrose varied between 56.93%-72.44%. Results further revealed that Rhamnose ranged from 8.57-12.49%, galactose ranged from 12.83%- 14.60%. Arabinose varied between 6.10%-9.10% while zylose ranged from 1.25%-13.199 respectively.

Generally, the trend in the total sugar contents in all the three Tables revealed an increase in all the sugar contents present in the yam species as the storage time increased. For example, maltose sugar increased to 24% at the end of 2 months storage and 64% at the end of 4 months storage for white yam. Maltose in yellow yam also increased to 26.7% and 60.0% at the end of 2 months and 4 months of storage respectively while in water yam, the increase were 66.7% and 123.0% of maltose sugars at the end of 2 months and 4 months of storage. According to literature, there is considerable variation in composition not only between species, but also within a single species or even a single cultivar, according to the cultural, climatic and adaptic factors of environment under which it was grown, its maturity at harvest and the length of time for which it has been stored [1].Stored yam tubers do respire at reduced levels in the dominant state i.e after harvesting. Consequently several physiological and biochemical changes are known to occur which may negate or enhance the food quality of tubers [10]. Glucose and sucrose are the main free sugars reported in yams [17] while the organoleptic properties such as taste and mouthfell are reported to improve during storage probably due to the increase in sugar content. It was also reported in a previous work that sugar contents in yam tubers increased meaningfully during storage, where the increasing levels of sugars in the tubers with storage were suspected to be brought about by the breakdown and subsequent hydrolysis of starches into sugars after harvesting [6,16]. Similar trends have been recorded by [18], who reported the most predominant changes occurring in yam tuber after harvest, when stored in non-freezing environment below 40-45^{0}C

VI. Conclusion

This study has revealed the different levels of sugars present in three yam species under storage at ambient temperature for a period of 4 months. Sucrose were found to be in abundance in all the yam species stored and maltose sugars with the least amount. The levels of all sugars were found to increase at the storage time increases probably due to the gradual breakdown of starch to component sugars.

References

[1]. A.I Ihekoronye and P.O Ngoddy, Integrated Food Science and Technology for the Tropical, 1st Edition, Macmillan Publishes, London; 1985:266-276

[2]. P. Vernier, J. Berthand, N Brices and L.Marchad, Lintensificationdes Techniques de culture l'igname, acquires contraintes. In ligrame plate seculaire et culture d'avenir, actes du seminaire international cirad-inra-orstom-corat, 3-6juin 1997, mont pellier, france monpellier, france: CIRAD: 1998:93-101

[3]. V.C Ezeocha and P.C Ojimelukwe, The Impact of Cooking on the Proximate Composition and Anti-nutrient factors of water yam (Dioscorea alata), Jounal of stored products and post harvest research 3 (13):2012)1173-176.

[4]. N. Akissoe, J. Hounhoui, C Mestres and M.Nago, How Blanching and Drying Deffect the Colour and Functional Characteristics of Yam (Discorea Cayenensis-rotundata) Flour, Chain, 82:2003:257-264

[5]. M.R Bhadari, J. Kawa Bata and T. Kasai, Nutritional Evaluation of wild yam (Dioscorea spp) tubers of Nepal, Food chem., 80:2003:619-623
[6]. D,J,E Martin Kouakou, D. Soumaila, T.A Simplice and P.K Lulien, Effect of Post harvest Storage on some Biochemical Parameters of Different Past of Two Yam Species (Dioscorea spp), African Journal of Food Science and Technologu 1(1):2010:001-009
[7]. D.G Coursey, The magnitude and Origin of storage losses in Nigerian yams, Journal of Food Science and Agriculture, 12(8):1988:574-580
[8]. J.M Babajide and S.Olowe, Chemical, Functional and Sensory Properties of Water yam-cassava flour and its paste, international food research journal 20(2):2013)902-909.
[9]. P. J. Jekins and A.M. Donald, The Influence of AMylose on Starch Granule Structure, Int. J Bio Macro Mole 17(1995:315-321)
[10]. A Yen, C. Yzu-Yin and C.C. George, Effect of Water Content and Macilage on Physico-chemical characteristic of yam (Diosorea alata purpurea) starch, J Food Eng 95:2009:106-114.
[11]. M.O Oke, S.O Awonorin and T.S Workneh, Effects of Varieties on Physico chemical and Pasting characteristic of water yam flour and starches, Africa Journal of Biotechnology, 12(1):2013:1250-1256
[12]. N.W.H Cheatham and L.P Tao, The Effects of Amylose conteant on the Molecular size of amylase and on the distribution of amylopectin chain length in maize starches, carbohydr. Polym. 33:1997:251-251.
[13]. G.S ayernor, The Yam (Diosocea) Starches, in Advance in yam research 1st ed, Godson Osuji Anambra state University of Technology Publishers Nigeria: 1985:78-88
[14]. B.O Duncans, Multiple Range and Multiple F Test Biometric, 1955:11,1-5
[15]. T Tschannon, O.Giranchi, C. Nindjun, D.Fao, Z. Farah, P.Stamp and F.Escher, Improving the Application of Gibberelliaacid to prolong Dormancy of yam Tubers (Diosocorea spp). Journal of the science of Food and Agriculture , 83:2003:787-795
[16]. E.O Afoakwa and S. Sefa Dedeh, Chemical Composition and Quality Changes Occuring in Discorea Dumentorum Paz tubers aafter harvest Food Chem, 75:2001:85-91
[17]. O.O Mensah, Processing Factors that Affects the textural and Rheological properties of yam (Dioscorea rotuda) dlour, Phd thesis cornell university, uthaka, U.S.:1995
[18]. S. Trenche and E.Agbor, Composition Chinque Disigrames Consommess AU Cameroun Rev Sci et tech (sci santé) 2:1996:23-44

Makanjuola Determination of Sugars in Yams Under Storage During the Dry Season." IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT), vol. 11, no. 11, 2017, pp. 24-27.