NIGERIAN AGRICULTURAL JOURNAL
ISSN: 0300-368X
Volume 53 Number 2, August 2022 Pg. 337-340
Available online at: http://www.ajol.info/index.php/naj
https://www.naj.asn.org.ng

Pasting Properties of Flour Processed from NRCRI Cassava Crossing Block Trial

***Chijioke, U., Osodeke, S. C., Ogunka, N.P., Okoye, B.C., Njoku, D. and Egesi, C.N.**

National Root Crops Research Institute (NRCRI), Umudike, P. M. B 7006, Umuahia, Abia State, Nigeria.
*Corresponding Author's email: ugochijioke4@gmail.com

Abstract
Cassava roots are processed into different types of products such as *gari*, *lafun*, *landang*, *fufu*, flour, chips, starch, *akara*, meal, *ighu*, syrups, dextrins, and alcohol. Characterizing the food and industrial potentials of different cassava varieties may be achieved by understanding the pasting properties of the roots and intermediate products such as flour. Fourteen (14) elite cassava clones and a preferred land race were harvested from National Root Crops Research Institute (NRCRI), Umudike cassava crossing block experimental field. Freshly harvested cassava clones were washed, peeled and cut into chips.The Chipped cassava roots were oven dried at 50°C and milled into flour for pasting properties which was determined using a Rapid visco analyzer (RVA). There were no significant difference (p>0.05) in some of the parameters evaluated as was observed in the Peak viscosity which ranged from 337.50(NR-095-F) –547.96RVA (TMS 98/0505). Trough viscosity ranged from 150.80(TMS13F5110P0008) -292.88RVA (NR-14B-218), while breakdown viscosity ranged from 191.33RVAin TMS13F1343P0044to 315.92RVA in TMS95/0505. Final viscosity of the samples ranged from 159.63-451.84RVA in NR-0957 and NR-14B-218, while set back value ranged from 33.58RVA in NR-095-F to 158.96RVA in NR-14B-218 with no significant difference (p>0.05) among the samples. Peak time ranged from 4.13-5.30min, while pasting temperature ranged from 65.93°C (TMS13F1343P0022) - 87.10°C (NR-095F). The study therefore showed that NR-095Fhad the highest final viscosity, setback value and a good pasting temperature. The good swelling potential exhibited by all the clones reveals their suitability for making confectioneries.

Keywords:* *Pasting properties, Starch, Confectioneries, Swelling potential and shelf-life

Introduction

Cassava, (*Manihot esculenta Crantz)* is a perennial woody shrub grown in the tropics and subtropical parts of the world for its edible roots (IITA, 2009). It is ubiquitous in nature and serves as an important staple food in sub-Saharan Africa where it is grown everywhere owing to its ecological conditions (Obadina *et al*., 2006). It can with stand adverse weather condition, hence used as food security crop. Nigeria is a leading producer of cassava across the globe and produces more than 59 million metric tons of fresh cassava roots which stand for about 18% of the world's total production (FOSTAT, 2019).

Cassava roots although substantial sources of income for small scale farmers are highly perishable and deteriorates soon after harvest. To prevent post-harvest losses, cassava is processed into different products such as gari, lafun, fufu, flour, chips, dextrin and alcohol (Nwabueze and Odunsi, 2007). High quality cassava flour (HQCF) is one of the products of cassava processed from unfermented roots. They are used as composite with wheat flour in production of confectionaries in baking and pastry industries (Shittu *et al*., 2007). HQCF is high in energy, a rich source of vitamins and minerals as well as starch with small quantity of fat, fibre, and ash (Darkwa and Jetuah, 2003).

Globally, there has been decrease in the supply of wheat flour and a number of industries are seeking alternatives to wheat (Okoko, 2018). According to Onyango *et al.* (2011) cassava flour has the potential of being a substitute for wheat; this will reduce the dependence on importation of wheat and increase the livelihood of local cassava farmers. Over the years breeders have emphasized more on improving agronomic traits, this has led to low adoption of the released improved varieties by farmers, food and industrial processors (Acheampong, 2015). It has therefore become imperative that food quality attributes should be integrated into breeding programs to increase utilization of indigenous crops such as cassava which have different food and industrial potential in response to rapid urban growth and dynamics in market development in Nigeria. This study therefore aims at profiling the pasting properties some cassava genotypes within the NRCRI breeding population and select genotypes that meet the need of food industries and are suitable for producing confectioneries and pastries that are acceptable to consumers.

Materials and Methods

Sample collection and preparation

Fourteen (14) elite cassava clones and a preferred land race (*Nwaocha*) were obtained from NRCRI Umudike crossing block experimental field. Fresh roots of the different cassava clones harvested at 12months after planting were washed, peeled and cut into chips. The Chipped cassava roots were oven dried at 50°C for 6 hours and milled to flour using a blender (Silver crest wall extraction machine 4800 watts). The high quality cassava flour samples were sieved with 0.25-mm mesh size sieve; the fine particle flour was packaged and stored in polyethylene sample bags at 4°C for further laboratory analysis. The pasting properties of the flour were determined using a Rapid visco analyzer (RVA 4500 Perten). 2.5g of cassava flour sample was weighed into a previously dried canister and 25ml of distilled water was added into it. The suspension was mixed thoroughly and the canister was fitted into the Rapid visco analyzer. Each of the suspension was maintained at 50°C for 1min and thereafter heated to 95°C with a holding time of 2min and finally cooled to 50°C with another 2mins holding time. Heating and cooling rate was maintained at 11.85°C /min. Peak viscosity, breakdown, trough, setback, peaktime and pasting temperatures were read through thermocline window software connected to a computer (Newport Scientific, 1998). Data were subjected to analysis of variance (ANOVA) using SAS version 8e software (SAS Institute Inc., Cary, NC, USA) at $P<0.05$.

Results and Discussion

Results of pasting properties of the cassava flour presented in Table 1 showed that peak viscosity of the flour sample ranged from 337.50RVU (NR-095-F) - 547.96 RVU (TMS98/0505). There were no significant differences ($p>0.05$) in the peak viscosity of the cassava varieties. Peak viscosity is an index of the ability of starch-based foods to swell freely before their physical breakdown (Adebowale *et al*., 2008). NR-095-F had the highest peak viscosity and starch content compared to the other clones. However, these values obtained for peak variety were lower than 622.50 RVU previously reported by Obadina *et al*., (2014) for yam. Values obtained for trough viscosity ranged from 150.80 RVU (TMS13FS110P0008) to 292.88 RVU (NR-14B-218). Apart from the NR-095-F and NR14B-218, trough viscosity did not differ significantly ($p>0.05$) among the cassava varieties.

The breakdown viscosity of the cassava varieties ranged from 191.33 to 315.92 RVU, no significant differences ($p>0.05$) were observed among the cassava genotypes. The highest value of breakdown viscosity was recorded in TMS 98/0505 (315.92 RVU). The breakdown viscosity is an index of the stability of the starch and a measure of the ease with which the swollen granules can disintegrate under shear stress (Kaur *et al*., 2007). A range of 159.63 to 451.84 RVU was obtained as the final viscosity of the cassava varieties. NR-14B-218 had the highest final viscosity of 451.84 RVU, followed by TMS01/11412 (389.71 RVU). NR-095-F however had the least value for final viscosity (159.63RVU). TMS/130124, TMS01/136810, NR130022, TMS13FS110P0008 and NR-14B-218 were significantly different ($P<0.05$) from other cassava varieties in terms of final viscosity. Final viscosity is commonly used to define the quality of particular starch-based flour since it indicates the ability of the flour to form a viscous paste after cooking and cooling. It also gives a measure of the resistance of the paste to shear force during stirring (Adebowale *et al*., 2008). This study revealed that NR-095-F had the lowest setback viscosity, hence a less tendency to retrograde; indicating long shelf-life and good fridge stability compared to the other cassava varieties.

The values of setback viscosity showed that no significant differences ($p>0.05$) among the cassava varieties apart from NR-095-F and NR-14B-218. The peak time of the flour samples ranged from 4.13 to 5.30min. NR-095-F had the highest peak timevalue (5.30min), while TMS/130124 (4.13min) recorded the lowest peak time. Pasting temperature is one of the properties which provide an indication of the minimum temperature required for sample cooking (Iwe *et al*., 2016). The pasting temperature of the cassava varieties ranged from 65.93 to 87.10°C. Higher pasting temperature recorded in NR-095-F indicated that its starch possess smaller granular size compared to that of other cassava varieties. Zeng *et al.* (2013) indicated that pasting temperature is dependent on the size of the starch granules. Pasting temperature of TMS13F1112P005, TMSIITA000070, NR-095-F, and NR-14B-218 were not significantly different ($p>0.05$) from each, whereas the pasting temperature of TMS13F1343P0022 was significantly different ($p<0.05$).

Conclusion

The outcome of this research revealed that all the clones have a good swelling potential and will be suitable for both baking and confectioneries. NR-095-F had the lowest setback viscosity, hence a less tendency to retrograde; indicating a longer shelf-life and good fridge stability compared to the other cassava varieties. NR-14B-218 is therefore highly recommended because of its perfect pasting quality.

References

Acheampong, P.P., Owusu, V., Gyiele, N., Asante, B.O. and Osei-Adu, J. (2012). Cassava Variety Attributes Preferences In Ashanti, BrongAhafo And Eastern Regions Of Ghana. *Ghana Journal of*

Agricultural Science, 45, 21-29.

Adebowale, A. R. A., Sanni, S. A. and Oladapo, F. O. (2008). Chemical, Functional and Sensory Properties of Instant Yam-Breadfruit Flour. *Nigerian Food Journal,* 26, 2–12.

Darkwa, N.A. and Jetuah, F.K. (2003). Fundamental studies of the characteristics of different cassava flour for adhesive formulation. Final reort 1 project output 2.2.2. Forestry Research Institute of Ghana, Kumasi, Ghana. 12pp.

FAO (2019), FAOSTAT. Food and Agriculture Organization of the United Nations database results, Rome, Italy.

IITA (2009). Annual report. International Institute of Tropical Agriculture. ISSN 0331 4340.

Iwe, M. O., Onyeukwu, U. and Agiriga, A. N. (2016). Proximate, Functional and Pasting Properties of FARO 44 Rice, African Yam Bean And Brown Cowpea Seeds Composite Flour. *Cogent Food and Agriculture*, 2, 1-10.

Kaur, M., Shandu, K. S. and Singh, N. (2007). Comparative study of the functional, Thermal and Pasting Properties of Flour from different chickpea cultivars. *Journal of Food Chemistry,* 104, 259–267.

Newport Scientific (1998). Application manual for the rapid viscomanalyzer using thermocline for windows. Newport Scientific pyt Ltd. Australia. Pp.2-26.

Nwabueze, T.U. and Odunsi, F.O. (2007). Optimization of Process Conditions for Cassava (*Manihot Esculenta*) Lafun Production. *African Journal of Biotechnology*, 6(5), 603-611.

Obadina, A. O., Babtunde, B. O. and Olotu, I. (2014). Changes in Nutritional Composition, Functional and Sensory Properties of Yam Flour As A Result Of Presoaking. *Food Science and Nutrition,* 2(6), 676-681.

Obadina, A.O., Oyewole, O.B., Sanni, L.O. and Abiola, S.S. (2006). Fungal enrichment of cassava peels proteins. *African Journal of Biotechnology*, 5(3), 302-304.

Okoko, J.U., Alonge, A.F. and Ngoddy P.O. (2018). A review of Rheological properties of High Quality Cassava Flour (HQCF) Composites. *Arid Zone Journal of Engineering, Technology and Environment.* 14(14), 208-218. ISSN 1596-2490.

Onyango, C., Mutungi, C., Unbehend, G. and Lindhauer, M.G. (2011) Modification of Gluten-free Sorghum Batter and Bread Using Maize, Potato, Cassava or Rice Starch. LWT- *Food Science and Technology,* 44, 681-686.

Shittu, T.A., Raji, A.O. and Sanni, L.O. (2007). Bread from composite Cassava Wheat Flour: Effect of Baking Time and Temperature on Some Physical Properties of Bread Loaf. *Food Research International*, 40, 280-290.

Zeng, F., Liu, H. and Liu, G. (2013). Physicochemical Properties Of Starch Extracted From *Colocasia esculenta* (L.) Schott (Bun-Long Taro) Grown In Hunan, China. *Starch/Starke*, 65, 1-7.

Table 1: Pasting properties of cassava flour

Clones	**Peak viscosity**	***Trough***	***Breakdown***	***Final viscosity***	***Setback***	***Peak time***	***Pasting temperature***
TMS01/136810	462.2a	162.75b	299.4a	217.58bc	54.84bc	4.30b	78.10a
TMSIITA000070	489.8a	224.09ab	265.7a	350.50abc	126.42abc	4.57ab	80.800a
NR-14B-218	492.1a	292.88a	199.2a	451.84a	158.96a	4.84ab	81.075a
TME 419	449.2a	237.09ab	212.1a	318.58abc	81.50abc	4.54ab	79.200a
TMS13F1160P0004	431.5a	173.21ab	258.3a	227.88bc	54.67bc	4.5ab	79.600a
TMS13F1343P0022	424.8	200.88ab	223.9a	275.50abc	74.63abc	4.53ab	65.93b
NWAOCHA	455.8a	177.46ab	278.3a	243.50bc	66.04abc	4.30b	78.33a
TMS98/0505	548.0a	232.05ab	315.9a	350.05abc	117.96abc	4.47ab	78.650a
TMS13F1112P0005	420.1a	162.96b	251.1a	222.59bc	59.63bc	4.47ab	80.825a
NR-095F	337.5a	126.04b	211.5a	159.63c	33.58c	5.30a	87.100a
NR130022	391.6a	153.96b	237.7a	203.79bc	49.84bc	4.30b	79.150a
TMS13F1343P0044	434.9a	243.58ab	191.3a	319.63abc	76.05abc	4.74ab	79.58a
TMS13F2110P0008	407.5a	150.80b	256.7a	206bc	55.21bc	4.14b	79.23a
TMS130124	413.0a	154.75b	258.3a	206.79bc	52.04bc	4.13b	79.58a
TMS01/1412	521.3a	252.30ab	269.a	389.71ab	137.42ab	4.60ab	78.33a

Means with same letters are not significantly different