FUNCTIONAL PROPERTIES OF NATIVE AND MODIFIED JACKFRUIT (*Artocarpus heterophyllus*) SEED STARCHES

Azeez, S.O., Chinma, C.E., Abdul-fatah, T.N and Zubair, A.B.

Department of Food Science and Technology, Federal University of Technology, Minna, Nigeria

Corresponding author: shakirah.salami@futminna.edu.ng

Introduction

Jackfruit is an underutilized food crop with many nutritional benefits. It can function as an alternative source of starch thereby reducing the over dependence on over utilized staple crops such as cassava, wheat and maize and their importation, Native starch shows proneness to decomposition and retrogradation [1] due to their inability to withstand processing conditions like extreme temperatures, diverse pH and high shear rate [2] Physical modification of starches is gaining increased acceptability, since it preserves the granule structure and integrity. Heat-moisture (HMT), annealing (ANN) or dual (HMT-ANN) can be used to modify starch to improve its application profiles. Physical modification of jackfruit seed starch is uncommon. The functional and pasting properties of starch are important in both food and non-food applications. Therefore, the objective of this study was to evaluate the effect of physical modification on the functional properties of native and modified jackfruit seed starches.

Materials and Methods

Jackfruit was obtained from Okigwe market in Imo State, Nigeria. The jackfruit fruit was manually cut open and seeds were removed from the fruits, cut into slices (2 mm thick) using a food processor. The jackfruit seed slices were washed and dried in a hot air oven at 40^0C for 48h, milled and sieved through a 75 mm mesh. Jackfruit seed starch was extracted using the method described by Singh Singh [3] Starch modifications (heat-moisture, annealing and dual (heat-moisture and annealing) were carried out according to method described by Molavi *et al* [4]

Native (raw) jackfruit seed starch served as control. Functional parameters such as bulk density, water and oil absorption capacities, swelling power and water solubility index were determined using standard analytical methods. Pasting properties of the starches were determined using rapid visco analyzer (RVA) (Newport Scientific Pty Ltd, Mew South Wales, Australia) according to standard method. Data obtained were subjected to analysis of variance (ANOVA).

Results and Discussion

The functional properties of native, heat-moisture, annealed and dual jackfruit seed starches are presented in Table 1. All the starches had low bulk density (0.39 to 0.49 g/g). HMT and annealed starches had reduced swelling power compared to native starch while dual modification increased (6.61%). Similar pattern was observed for acorn starch. [4] The decrease in swelling power was observed in HMT and annealed jackfruit starches may be caused by molecular rearrangement of starch granules [5] Starch modification however increased the water and oil absorption capacities. The dual and HMT starches had the highest peak and trough viscosity values. Native starch had the highest values for breakdown and setback viscosities. Peak time however increased with starch modification. Peak temperature decreased for annealing and dual modification compared to the native and heat-moisture treated starches.

Table 1: Functional properties of native starches from jackfruit seed

Parameters	Native	HMT	ANN	HMT-ANN
Bulk density (g/g)	0.46±0.05[ab]	0.41±0.03[b]	0.49±0.01[a]	0.39±0.01[c]
Swelling power (%)	6.23±0.02[b]	5.37±0.02[d]	5.78±0.02[c]	6.61±0.02[a]
Water solubility index (%)	3.50±0.55[c]	9.50±0.03[b]	1.97±0.07[d]	11.70±0.01[a]
Water absorption capacity(g/mL)	0.99±0.03[c]	1.98±0.03[a]	1.51±0.01[b]	1.63±0.20[b]
Oil absorption capacity(g/mL)	1.09±0.04[c]	1.49±0.02[b]	2.00±0.03[a]	1.99±0.01[a]
Peak viscosity (RVU)	369.70±1.52[c]	705.30±0.57[b]	362.00±0.00[c]	897.70±1.15[a]
Trough (RVU)	278.00±0.30[d]	685.00±0.55[b]	306.00±0.13[c]	862.50±1.00[a]
Breakdown (RVU)	904.70±1.52[a]	319.30 ±1.52[d]	506.50±1.00[b]	353.01±0.55[c]
Final viscosity (RVU)	429.00±0.00[c]	810.00±0.00[b]	395.30±1.52[d]	1082.00±1.00[a]
Setback (RVU)	1453.70±0.57[a]	1250.00±0.00[b]	888.00±0.00[d]	1220.00±0.00[c]
Peak time (min)	5.16±0.05[c]	7.00±0.00[a]	5.44±0.12[b]	7.00±0.00[a]
Pasting temperature (^{0}C)	87.30±0.10[d]	99.20±0.09[a]	88.86±0.05[c]	98.63±0.76[b]

Mean±standard deviation of three determinations. Values in the same column with different superscript are significantly ($p \leq 0.05$) different.

Native: raw jackfruit seed starch; HMT: Heat-moisture treated jackfruit seeed starch; ANN: Annealed jackfruit seed starch; HMT-ANN: heat-moisture treated and annealed jackfruit seed starch.

Conclusion

Physical modification of jackfruit seed starch enhanced its functional properties for food and industrial applications. Effect of physical (HMT, ANN and HMT-ANN) modification on the physicochemical and structural properties of jackfruit seed starch was evident.

References

1. Berski, W., Ptazek, P., Ziboro, R., Kowalski, G., Grzesik, M., and Achremowicz, B. (2011). *Carbohydrate polymers*, 83(2), 665-671.
2. Singh, N., Singh, J., Kaur, L., Sodhi, N. S., and Gill, B. S. (2003). *Food Chemistry*, 81 (2), 219-231
3. Singh, J. and Singh, N. (2001). *Food Chemistry*, 75, 67-77.
4. Molavi, H., Razavi, S. M. A., and Farhoosh, R. (2018). *Food Chemistry*, 245, 385-393.
5. Adebowale, K. O., Afolabi, T. A., Olu-owolabi, B. I. (2005). *Food hydrocolloids*, 19, 974-983.