IMPACT: International Journal of Research in Applied, Natural and Social Sciences (IMPACT: IJRANSS)
ISSN (P): 2347-4580; ISSN (E): 2321-8851
Vol. 4, Issue 6, Jun 2016, 83-88

DEVELOPMENT OF A PROCESS FOR UTILISATION OF BANANA WASTE

DAWN C.P AMBROSE & RAVINDRA NAIK

Central Institute of Agricultural Engineering – Regional Centre, Coimbatore, Tamil Nadu India

ABSTRACT

Banana centre core, a biological waste in banana plantations could be effectively utilized as a source of food material by converting them into flour which could be used as a food product in bakery preparations and soup mix. In this study, an attempt was made to develop a process for the value addition of banana central core, by drying and powdering. Cleaned and sliced banana centre core was dried in a cabinet dryer at 50, 60 & 70°C temperature. The dried samples were ground to flour in a pulveriser. The drying characteristics and the quality of the dried material and flour obtained were analysed. The sample dried at 60°C temperature, was found to be better in terms of colour and quality of the flour.

KEYWORDS: Banana Centre Core, Cabinet Drying, Temperature, Drying Characteristics, Flour, Quality

INTRODUCTION

The banana is an important global commodity. The stem of the each plant is of concentric sheaths with the tender core at the centre. Banana plantations face the problem of disposing the pseudo stem which goes as a waste after harvesting of the trees. In a hectare, on an average about 60 to 80 tonnes is of pseudo stem alone. The stem of banana, commonly known as pseudo stem is an aggregation of leaf stalk bases in cylindrical form. Pseudo stem of Banana normally goes as waste though it could be used in pulp and paper industries due to its cellulosic content. The middle of the pseudo stem is tender and edible which is known as the banana central core. In many parts of India, banana centre core is consumed as a vegetable. It is also consumed as juice in fresh form. The banana central core finds use in South Indian cuisine. Banana stem is a rich source of fibre and helps to control obesity. It also aids to detoxify the body. In Southern India, it is consumed as a fresh juice to prevent kidney stones.

Since banana pseudo stem comprises of more moisture, it is highly perishable and has a limited shelf life. Drying is a primitive method of preservation and could be done by conventional and mechanical means. The pasting profile and chemical of banana centre core flour has been explored and resulted in the presence of high amount of resistive starch suitable for human digestion (Ho et al., 2012). Banana pseudo stem which goes as a waste in the fields could be processed and fortified for food uses. However, no systematic study has been carried out on the development of a process to convert the banana centre core into flour. Hence this study aimed at developing a process to convert this waste into a value added product.

MATERIALS & METHODS

Sample Preparation

The pseudo stem of Banana variety, Nendran procured from a vegetable market in Coimbatore, Tamil Nadu was used in this study. The banana pseudo stem was first cleaned to remove the outer sheath. After removing the outer sheath, the inside found central core was washed and sliced using a stainless steel knife. The slices were then soaked in a solution of 0.2% concentration of Potassium Meta bi sulphate (KMS) for ten minutes in order to control browning. They were then dried in a cabinet dryer at 50, 60 & 70°C temperature, from an initial moisture content of 90 % to final moisture content of 6 % (w.b). The dried samples were powdered in a laboratory pulveriser (Wiley mill) to a fineness that 90 percent of the powder passed through 400 micron sieve. The flour obtained was packed in Aluminium foil pouches, sealed and stored at ambient condition till further analysis.

Drying of Banana Centre Core

Drying was carried in a cabinet dryer of size 36”×24”×21”. The dryer consists of an insulated cabinet, equipped with a fan, an air heater and a space occupied by trays for drying. There is a thermostat controlling the temperature. These are digitally controlled to maintain the temperature. Their double walled insulation keeps the heat in and conserves energy, the inner layer being a poor conductor and outer layer being metallic. There is also an air filled space in between to aid insulation. An air circulating fan helps in uniform distribution of the heat. These are fitted with the adjustable wire mesh plated trays or aluminium trays and may have an on/off rocker switch, as well as indicators and controls for temperature and holding time.

Drying studies were conducted at 50, 60 & 70°C temperature. About 500 g of cleaned banana centre core slices were kept for drying in each drying experiment. The weight of the samples was noted at an interval of 30 minutes. The weight was taken until the concordant value was obtained.

Grinding

The dried banana centre core samples were ground in a laboratory model Wiley mill. These mills prepare materials for analysis with minimal moisture loss. Well-dried samples are preferred. In the grinding mill, the material was loaded by cutting into crude pieces or lumps. The material drops by gravity into the path of a set of revolving hard tool steel blades driven by an electric motor. The revolving knives work against stationary knives and the resulting powder is forced through a steel screen. The powdered material then drops into a waiting collection vessel underneath.

The samples were ground to fineness such that more than 90 per cent passed through 400 micron sieve.

Quality Analysis

Moisture content of fresh banana centre core was found by drying the samples in a hot air oven at 70°C (Ranganna, 1995). Colour was measured using Colour Flex Meter (Hunter model), by determining 'L', 'a' and 'b' values. Crude fibre of the dried centre core was estimated according to the standard procedure by Sadasivam & Manickam, 1992. Total ash content of the pseudo stem samples dried at different drying temperature was determined by standard procedure IS: 1797-1985. Also the functional properties of the flour were studied. The water holding capacity was determined according to standard procedure (Gould et al., 1989). Oil absorption was determined by blending with refined oil and centrifuging the flour. The bulk density was measured by tapping the flow in a graduated measuring cylinder and expressed as ratio of volume to weight (Roy et al., 2012).

Statistical Analysis

Experimental data were analyzed using analysis of variance (ANOVA) and Duncan’s multiple range test to determine significantly different means using the statistical software AGRES.

RESULTS & DISCUSSIONS

Drying Characteristics of Banana Centre Core Slices

Figure 1 shows the changes in moisture content versus drying time at 50°C temperature. It took 360 minutes drying time to dry banana centre core from an initial moisture content of 3821.56% (d.b) to a final moisture content of 22.76% (d.b). Since the drying was performed in a controlled condition, the drying process was fast and the heat flow was uniform and constant during the process of drying when compared to sun drying (Dawn et al., 2016).

In the case of banana center core dried at 60°C, it was found that that the initial moisture content was 1304 % (d.b) and it took around 270 minutes to reach till a final moisture of 12.71 % (d.b) (Figure 2)

At 70°C temperature (Figure 3), the time taken was 180 minutes to reach a moisture content of 14.67% (d.b.) from an initial value of 2749% (d.b.). The drying period was less when compared with other drying temperature, as the temperature was high. It was seen that for the drying at different temperatures the moisture loss increased with the increase in temperature (Shahzad Faisal *et al.*, 2013).

It could be seen that the drying was faster during the initial period at all the temperatures. This may be due to the high free moisture available which depleted during the initial stages of drying (Garware et al., 2008)

Effect of Drying on the Quality of Banana Centre Core Flour

Physiochemical Properties

Color measurement is an important quality indicator as it reflects the sensory attractiveness and the quality of the powders produced (Siew et al., 2007). The 'L' value indicates the difference between lightness and darkness, where a low number (0-50) indicates dark where as a higher number (51-100) indicates light color. It was observed in the table that the L value was highest in the Tray drying 50°C followed by drying at 60°C. There were significant changes ($P < 0.05$) in the colour of the samples as influenced by the drying condition. Prolonged time of drying and higher temperature greatly influenced the colour scores of the samples.

From the table 2, it was seen that there was significant difference in the crude fibre content ($p > 0.5$) with the increase in temperature. The crude fibre content was maximum for the sample dried at 60°C. The crude fibre decreased with the increase in temperature. Similar reports were found on drying green banana (Adeboye et al., 2014). This may be due to higher yield of dry matter at higher temperature. In the case of total ash content of the samples, there was not much significant difference ($p<0.5$) at 50°C & 60°C temperatures, whereby the ash content decreased at 70°C.

Functional Properties

From the table 3, it could be seen that there was no significant differences ($p<0.05$) noted for Water Holding Capacity of the cabinet dried samples at different temperatures. The water holding capacity was found to be maximum for the sliced sample dried at 70°C. This was contradicting to the results obtained by drying banana centre core dices at 70°C (Lakshman et al., 2015). The water holding capacity depends on capillary, pore size and the charges on the protein molecules. The structure of powder reflects more porous leading to increased weight of sediment reflecting more Water Holding Capacity (Ankita et al., 2013). There was no much significant difference ($p<0.05$) between the samples dried at 50 & 60°C temperature, whereas oil absorption capacity for the sample dried at 70°C was lower. The oil holding capacity is also due to enhanced hydrophobic character of proteins in the flours. Higher oil absorption capacity is suitable for baked products (Natt & Narasinga, 1981). The results for bulk density of the flour showed that there was significant difference ($p>0.05$) between all the samples. Bulk density of the flour was more at 70°C dried samples. Bulk densities of the dehydrated powder were found to have increasing trend with increase in temperature of dehydration for tray dried samples. The low values of bulk densities make the flour suitable for high nutrient density formulation of foods. These values were comparable to the results observed for lotus flour (Muhammad et al., 2011).

CONCLUSIONS

The study revealed that banana centre core could be dried and made into flour which could be effectively utilized as an ingredient in bakery and for preparation of soup based on the physical and functional properties.

REFERENCES

1. O. A. Adeboye, R.A. Iyanda, K.A. Yusuf, A.M. Olaniyan, and K.O. Oje, "Effects Of Temperature, Pretreatment And Slice Orientation On The Drying Rate And Post Drying Qualities Of Green Plantain (Musa Paradisiaca)", *International Journal Of Technology Enhancements And Emerging Engineering Research*, 2 (7): 92-99, 2014,

2. Ankita and Prasad K., "Studies on Spinach Powder as Affected by Dehydration Temperature and Process of Blanching"', *Int. J. of Agri. & Food Sci. Technol*., 4(4):309-316, 2013.

3. Dawn C.P. Ambrose, Laxman, R. and Ravindra Naik, "Studies on the drying kinetics and quality assessment of Banana pseudo stem waste for effective utilization as a value added product", *International Journal of Farm Sciences*, 6(2): 276-285, 2016.

4. T. Garware, N. Sutar., and B. Thorat,, "Drying of tomato using different drying methods: comparison of drying kinetics and rehydration ratio," in *Proceedings of the 16th International Drying Symposium(IDS '2008)*, pp. 1427–1432,Hydrabad, India, 2008

5. J.M Gould, B.K Jasberg and G.L Cote, "Structure-function relationships of alkaline-peroxide treated lignocellulose from wheat straw", *Cereal Chem*., 66:213–217,1989.

6. L.H Ho, A.A Noor Aziah and Rajeev Bhat,", Mineral composition and pasting properties of banana pseudo-stem flour from *Musa acuminata* X *balbisiana* cv. Awak grown locally in Perak, Malaysia", Intl. Fd. Research J., 19(4):1479-1485,2012

7. R. Lakshman, D. C. P Ambrose, D. Chelvame, "Studies on the on the quality of banana centre core flour prepared by different drying methods", Curr Agri Res 3(1): 55-59, 2015

8. Muhammad Aslam Shad, Haq Nawaz, Mazhar Hussain and Beena Yousuf, "Proximate composition and functional properties of rhizomes of lotus (*nelumbo nucifera*) from Punjab, Pakistan", *Pak. J. Bot*., 43(2): 895-904, 2011

9. J. P. Natt and M. S. Narasinga, "Functional Properties of Guar Proteins", *J. Food. Sci*., 46:1255, 1981

10. S. Ranganna, *Handbook of Analysis and Quality Control for Fruit and Vegetable Products;* 2nd ed. Pp.589, Tata Mc Graw Hill Publishing Company Ltd., New Delhi, India,1986.

11. Roy Chowdhury, A.K Bhattacharya, and, P. Chattopadhay, "Study on functional properties of raw and blended jack fruit seed flour (a non conventional source) for food applications", Indian Journal of Natural Products and Resources, 3(3): 347-353, 2012

12. S. Sadasivam. and A., Manickam, "Biochemical methods for agricultural sciences, Wiley eastern Ltd.", New Delhi, Pg.20-21,1992

13. Shahzad Faisal., Ruhi Tabassum. and Vishal Kumar, "Performance Evaluation and Process Optimization of Potato Drying using Hot Air Oven", J Food Process Technology, 4(10), 2013

14. Siew Yung Quck., Ngan King Chok and Peter Swedlund, "The physicochemical properties of spray- dried watermelon powders", Chemical Engineering and Processing: Process Intensification, 46(5):386-392, 2007.

APPENDICES

Table 1: Effect of Color on L, A, B Value for Banana Center Core Flour

Drying Temperature	"L"	"A"	"B"
50° C	73.29	2.74	14.35
60° C	72.41	2.49	12.21
70° C	72.77	0.20	10.47

Values are mean of triplicates

Table 2: Effect of Drying on the Chemical Constituents of Banana Center Core

Drying Temperature	% of Crude Fiber	Ash(G)
50° C	23	0.5
60° C	28	0.48
70° C	26	0.33
SED	1.0715	0.0071
CD(.01)%	3.5955	0.0224
CD(.05)%	2.4710	0.0158
CV%	3.57	2.31

Table 3: Effect of Drying on the Functional Properties of Banana Center Core Flour

Drying Temperature	Whc (G/G)	Oac (Ml/G)	Bd (G/Cm^3)
50° C	10.08	0.25	0.202
60° C	10.64	0.28	0.385
70° C	10.71	0.19	0.527
SED	0.1754	0.0058	0.0086
CD(.05)%	0.3908	0.0129	0.0192
CV%	2.41	3.30	2.66

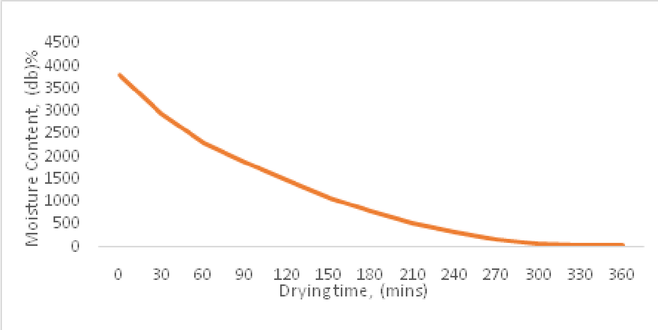

Figure 1: Drying Characteristics of Banana Centre Core at 50°C

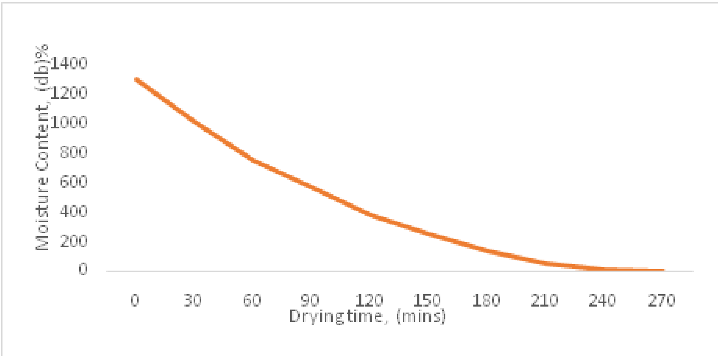

Figure 2: Drying Characteristics of Banana Centre Core at 60°C

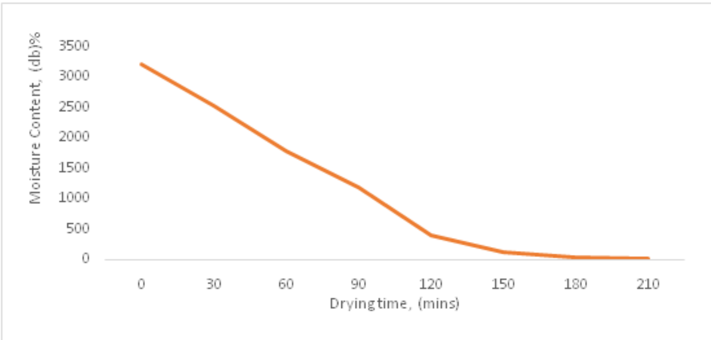

Figure 3: Drying Characteristics of Banana Centre Core at 70°C