Application of response surface methodology to optimize the process characteristics of cassava flour used for cassava-plantain *fufu* flour

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ABSTRACT

Cassava flour was produced from blanched cassava (var. *Yebeshie*) slices which were air-dried and then milled into flour. The effect of varying these process characteristics on the functional properties of the resulting cassava flours was studied using response surface methodology. The central composite rotatable design for k=3 was used to study the combined effect of drying temperature (50-70°C), blanching time (5-15min) and size of slices (2-5 mm) of the root on moisture, water binding capacity, swelling power, swelling volume and solubility. Regression models were developed to predict the variables. The best process variables for producing cassava flour were found to be from 3.5 mm cassava slices, hot-water blanched for 15 min and dried at 60 °C.

INTRODUCTION

- *Fufu* flour is a convenience form of traditional pounded *fufu*, a staple in most West African countries.
- The cassava starch used in the manufacture of *fufu* flour can be replaced by cassava flour (Johnson *et al.*, 2006).
- The method of production of this cassava flour could influence functional properties like the water binding capacity, water solubility and paste viscosity, all of which are important for determining the quality of the reconstituted *fufu* flour.

OBJECTIVE: To study the effect of drying temperature, blanching time and size of slices on the functional properties of cassava flours using response surface methodology.

MATERIALS AND METHODS

Raw Materials

- Freshly harvested_Cassava (var. *Yebeshie)*

Sample Preparation:

- Sliced to 2- 5 cm
- Hot-water blanched (5 to 15 min)
- Shallow-dried in a mechanical dryer at 50 to 70° C to m.c 8 -10%
- Dried cassava slices milled to flour particle sizes 118 to 250 micron

Analytical Methods:

- Water binding capacity (WBC) (Medcalf & Giles, 1965)
- Swelling power (SP), swelling volume (SV) & Solubility (Leach et al., 1959)
- Moisture (AOAC, 2000)

Experimental Design & Statistical Analysis:

- Central Rotatable Design (Table 1), Stepwise multiple regression
- Models were developed to relate drying temperature, blanching time and size of cassava slice with the functional properties of the flour. (Gacula & Singh, 1984),

Table 1: *Process variables used in central composite rotatable design for K= 3*

Independent variables	-1.682	-1	0	1	1.682
Size of slices (mm)	2	2.60	3.50	4.39	5
Blanching time (min)	5	7	10	13	15
Drying temperatures (°C)	50	54.1	60	65.9	70

RESULTS AND DISCUSSION

- The water binding capacity, swelling power, swelling volume and solubility of cassava flour decreased with increasing blanching time, but increased with drying temperature.
- More starch granules become gelatinized with increased blanching time and thus less starch granules bind water and swell, but high temperature breaks H-bonds and thus more water is absorbed (Rickard *et al.*, 1991).
- Both models (Fig. 1 and 2) indicated that the quadratic terms of the blanching time best influenced the water binding capacity and swelling volume.
- Models developed for swelling power and solubility were inadequate in explain the variations observed (Table 2).

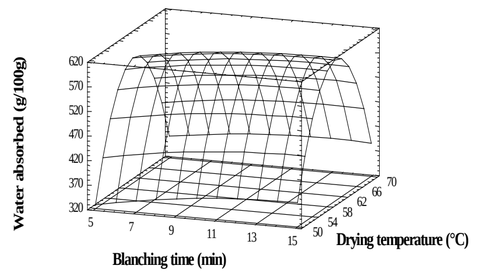

Fig. 1 Water Binding Capacity

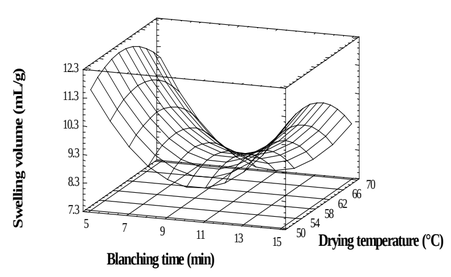

Fig. 2 Swelling Volume

Table 2: *Analysis of variance for the full regression of the models- Yebeshie cassava flour*

Sources of variation	Water binding capacity	Swelling power	Solubility	Swelling volume
Model	99268.9	63.0096	883.573	19.1292
R^2 value	0.9576	0.2781	0.2985	0.6722
Lack of fit	0.38725	0.66046	3.51617[a]	0.7297

[a] Significant at 95% confidence level

CONCLUSION

The study established that the best process variables for producing cassava flour are using 3.5 mm slices of cassava hot-water blanched for 15 min and air-dried at 60 °C.

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