CSIR-FOOD RESEARCH INSTITUTE

COLORIMETRIC MEASUREMENT OF CASSAVA STARCH AND FLOUR FROM FIVE DIFFERENT VARIETIES OF CASSAVA

TECHNICAL REPORT

Submitted by

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Abstract

Cassava starch and flour were obtained from five varieties of cassava. The cassava was three experimental accessions, a high yielding and a local variety. The starch was extracted by the sedimentation method. The colour measurement was determined for the cassava starches and flours in duplicates using the L* a* b* colour system.

Bosom nsia starch showed the highest L-value (lightness values) of 97.92 but cassava starch from cassava variety *065* recorded the lowest L value of 93.93. *Yebeshie* cassava flour recorded the highest L-value of 95.80 and *Bosom nsia* cassava flour however gave L- value of 93.85. The starch extracted from the *094* cassava gave the largest colour differences. However the *Bosom* nsia starch showed the least colour difference. This showed that the sample was very white. The least colour difference was obtained by the *061* cassava flour and the highest colour difference was recorded by the *094* cassava flour. The *061* cassava flour was closer to white. The differences in colour could be attributed to the different processing procedures for the starch and flour and age of the cassava.

Keywords: cassava flour, cassava starch, processing, age

1.0 Introduction

Cassava (*Manihot esculenta Crantz)* is an important tropical crop having high amount of starch (25-35%) and has got extensive application in feed, food and industrial sector (Edison, 2005). The starch content in the tubers varies according to varieties and cassava possesses the highest amount of starch (Nanda *et al.*, 2005). Cassava starch when processed properly is very white in color. When the tubers are crushed without removing the rind, there is s dullness in the color. The reduction in whiteness not only affects the quality but also the price (Balagopalan *et al.*, 1998).

Cassava flour contains fiber, sugars, and smaller quantities of lipids and other components. It exhibits properties different from those of cassava starch, which cooks to a more cohesive paste (Enwere, 1998). There are many processes used for producing cassava flour. They may involve all or some of the following unit operations- peeling of the roots, washing, slicing or grating, drying, milling, sieving, and storage. The flours produced have different properties and are used for various purposes (Enwere, 1998).

Colour is one of the most important attributes of food, both for its aesthetic value and for quality judgement (Vamos-Vigyazo, 1981).

2.0 Materials and methods

2.1 Raw materials

Five varieties of cassava were used in the study.

Table 2.1 gives the varieties, their ages, types and sources.

Table 2.1 Variety, age and sources of raw materials

Sample	Source	Age at harvest (months)	Type
Cassava			
061	Botany Dept. Univ. of Ghana, Legon	24	Experimental accession
094	Botany Dept. Univ. of Ghana, Legon	24	Experimental accession
065	Botany Dept. Univ. of Ghana, Legon	24	Experimental accession
Yebeshie	Ministry of Food and Agriculture, Pokuase	12	High yielding
Bosom nsia	Ministry of Food and Agriculture, Pokuase	12	Local

2.2 RAW MATERIAL PREPARATION

2.2.1 Starch Extraction

Starch was extracted from the five cassava varieties by the sedimentation method (Trim *et al.*, 1993). The harvested cassava tubers were first sorted out, weighed and washed with clean water. The tubers were peeled, washed with clean water to remove all the dirt and cut into chunks of about 0.5-1mm thick. The chunks were milled using a Waring blender (Phillips 8010G, USA) with about 200g of water to blend each 100g sample

smoothly. The slurry was filtered through a clean cheese cloth. The solids retained by the cloth were washed with more water and filtered through the cheese cloth. The washing process was repeated five times until there was little or no starch in the filtrate. Starch in the filtrate was allowed to sediment overnight and the liquid decanted and discarded. The starch was weighed and dried in a mechanical dryer (Apex 27585 Royce Ross Ltd, London) at 50°C for 4h and weighed. The starch was pulverised with a disc attrition mill. The extraction was done in three batches for each of the five varieties of cassava.

2.2.2 Processing of Cassava Flours

The harvested cassava tubers were weighed, washed and peeled. The peeled tubers were weighed again and cut into 2 to 5mm thick pieces using a food slicer (Fold-up electric Food Slicer *mod.CFE 1954, Philips Atlantis*.). After weighing the slices were dried in a mechanical dryer (Apex, Royce Ross Ltd) at 54.0°C for 10 hours, to attain moisture content of about 8-10%. The dried slices were weighed and milled using a disc attrition mill and after cooling stored in air tight containers (Badrie and Mellowes, 1992). This process was carried out for all five varieties of cassava.

2.3 Colour Determination

The colour measurements of the cassava starch and flour samples were determined with the Minolta Chroma Meter (Model CR 310, Minolta Camera Co. Ltd. Japan), using the

L* a* b* colour system in duplicates. The Chroma meter was calibrated with a standard white background. (L* = 97.63 a*=-0.48 b* = +2.12). **ΔE** value which defines the size of the total colour difference, but does not give information about how the colours differ was determined.

ΔE is defined by the following equation:

$\Delta E = \sqrt{(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2}$ (Morrison and Laignelet 1983).

2.4 Data analysis

Statistical analysis of data was performed through an analysis of variance (ANOVA) and the least significant difference (LSD) test at $P < 0.05$ was run and mean comparisons were performed using SPSS 10.0 (SPSS Ltd, Chicago, IL, USA).

3.0 Results

Table 3.1: Colorimetric measuerement on cassava flour and cassava starch

Starch	**L**	**a**	**b**	**ΔE**
Yebeshie starch	97.85± 0.51	+0.16± 0.01	+0.78±0.18	1.50
Bosom nsia starch	97.92± 0.08	+0.12± 0.02	+1.24±0.15	1.10
061 cassava starch	97.45± 0.14	+0.23± 0.05	+0.94±0.19	1.39
094 cassava starch	97.28± 0.14	+0.19± 0.02	+1.30±0.10	1.12
065 cassava starch	93.93± 5.48	+0.22± 0.01	+0.90±0.31	3.96
Flour				
Yebeshie cassava flour	95.80± 0.15	-0.42± 0.04	+6.07± 0.40	4.35
Bosom nsia cassava flour	93.85± 0.21	-0.59±0.03	+8.47± 0.09	7.39
061 cassava flour	95.71± 0.01	-0.32±0.02	+5.88±0.12	4.22
094 cassava flour	93.88± 0.40	-0.97±0.05	+10.22±0.12	8.94
065 cassava flour	94.77± 0.61	-0.62± 0.05	+7.08± 0.24	5.72

Mean of three determinations ± standard deviation

4.0 Discussion

Colour determinations of cassava flour and cassava starch (Table 3.1).

The *Bosom nsia* starch recorded the highest L-value (lightness values) of 97.92 but cassava starch from cassava variety *065* had the lowest L value of 93.93. The starch from the *065* cassava had the darkest colour. The cassava starches from *094* cassava had higher b value (deeper yellow) of +1.30 and a lower b value of +0.90 was recorded by *065* cassava. These could be attributed to the age of the *061* cassava (24months) which may have resulted in the conversion of starch granules to sugars. The *Yebeshie* cassava flour recorded the highest L-value of 95.80 and *Bosom nsia* cassava flour had the lowest L- value of 93.85 (L=100-white). This implies that the *Yebeshie* cassava flour was lighter and whiter than the rest of the samples. The cassava flour from cassava variety *094 had* the highest b value (yellowish) and that from *061* cassava had the lowest b- value. The cassava flour of cassava variety *094* was deeper yellow than the other sample. Cassava flour obtained from *061* cassava was less yellow.

The larger the **E** value, the larger the colour difference (Morrison and Laignelet 1983). The starch extracted from the *094* cassava gave the largest colour differences. However the *Bosom* nsia starch showed the least colour difference. This showed that the sample was very white. The differences in colour could be attributed to the different processing procedures for the starch and flour.

The cassava starch sample which recorded the highest L* value was *bosom nsia* and the least L* value was obtained by *065* cassava starch. The least colour difference was obtained by the *bosom nsia* starch and the highest colour difference was recorded by the *065* cassava starch. The *bosom nsia* starch was closer to white than the other samples.

The colour of the *065* cassava flour was far from white and this could be attributed to the age of 24month of the cassava at the time of processing.

The cassava flour sample which recorded the highest L* value was *Yebeshie* and the least L* value was obtained by *bosom nsia* cassava flour. The least colour difference was obtained by the *061* cassava flour and the highest colour difference was recorded by the *094*cassava flour. The *061* cassava flour was closer to white than the other samples. The colour of the *094* cassava flour was far from white and this could be attributed to the age of 24month of the cassava at the time of processing.

5.0 Conclusion

Bosom nsia cassava starch recorded the highest L* and the least colour difference. The *bosom nsia* starch was closer to white than the other samples.

Yebeshie cassava flour obtained the highest L* value. The least colour difference was obtained by the *061* cassava flour and was very white.

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