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Functional Properties of Melon's Pulp Flour of Four Varieties of Melon (*Cucumis melo* L.) Creeped in Northern Area of Cameroon

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Abstract: Four varieties of melon (*Cucumis melo* L.) (var. cantaloup, var. brode, var. perlita, var. charentais) were sampled from Northern area of Cameroon. Their flour was dried and grinded in a miller. The constituents of the flours were then analysed for their functional properties such as water absorption capacity, density, gelifying power and gelification time using standards methods. Results obtained revealed that cantaloup variety has a good gelifying power (20%). On the other hand, the brode variety was found to have a very high water absorption capacity. The density of the different flours had high correlation with the gelification time and gelification power of the flour. The flour of charentais variety was characterised by a good swelling power and easy solubilisation temperature. The gelatinisation of melon flour started at 55°C with a maximum at 65°C. A potential use of this flour for the preparation of infant porridge requires a temperature less than 65°C in order to keep the functional properties of starch granules unaltered. The charentais variety flour could be used as a gelifying in bakery and pork-buthery products.

Key words: Melon, functional propriety, melon flour powder, starch

INTRODUCTION

Cucumis melo L. (Cucurbitaceae) is a creeping plant that produces round fruits which are firmly and moderately sweet and are yellow or orange in colour (Anonym, 1981). Its composition (water content and total sugar content) as well as its position on the ground in the field offer possibilities for its rapid degradation due to contact with soil microorganisms (Dupriez and De Leener, 1987). In the framework of its valorisation and future study on its conservation through storage, the melon's pulp is transformed into flour. The interest of its study resides in a future enrichment of infant's pulp with melon flour. Studies consisted in determining functional properties of 4 types melon's pulp flour (cantaloupe, brode, perlita and charantais) as well as some characteristics associated with their starch.

MATERIALS AND METHODS

Plant material: The biological material used was made up of 4 varieties of melons bought from various markets in the northern area of Cameroon during melon harvest period (September). These melons were classified based on their morphological aspect (form, colour of the back) (Table 1). Figure 1 represents the different types of melon studied.

Table 1: Physical characteristics of four varieties of melon

Characteristics	Varieties cantaloup	Brode	Perlita	Charentais
Form	Oval	Elongated	Spherical	Globular
Back	Dark green	Banded with white	Banded with red	Doted with white
Pulp	Orange	Yellow	Orange	Orange

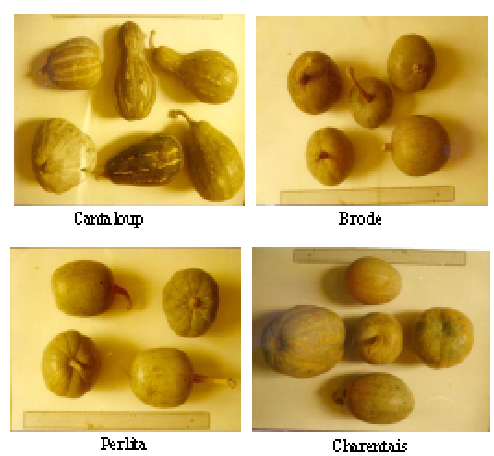

Fig. 1: Types of melon

Preparation of plant material: Melons were peeled up and sliced into small chips of about1 cm thick. The

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seeds and fibers inside were removed. The pulp was cut into fine chips, then dried in an electric drier at 45°C for 24 h.

Dried chips were then ground in *Moulinex*-like grinder. The resulting flour was sieved of 400 μm diameter in order to obtain more fine flour that would be suspect to different analyses for the determination of functional properties.

Water retention capacity and density (Okezie and Bello, 1988), the gelifying power, the gelification time and the smallest gelified concentration (Jongsma and Van Pijkeren, 1985) and finally, the swelling and solubility with respect to temperature (Leach *et al*., 1959) of the melon flour were determined.

Starch was extracted from different flours and was dried at 40°C for 10 h (Delpeuch and Favier, 1980). Iodine spectrum (Robin, 1976) was determined in order to observe modifications that could undergo the starch granules during cooking.

Starch content was determinated using polarimetric methods (BIPEA, 1978). The iodine spectrum was carried out on this starch (Robin, 1976). In view to observe any eventual modifications that starch granules could undergo during cooking.

The experimental design applicable to the analyses was completely randomised. All obtained results were analysed statistically using STATGRAPHIC 3.0 for multiple comparison tests (ANOVA and DUNCAN).

RESULTS AND DISCUSSION

Table 2 presents results on the water absorption capacity, density and gelifying power and gelification time.

Water absorption capacity: Water absorption capacity indicates the amount of water that a given amount of flour can retain. All analysed samples present significant difference at 5% following Duncan multiple comparison test. Flour from the melon brode may offer better yields for water retention, capacity to gelify rapidly and the swelling of constitutive particles for the preparation of baby pap.

Density: The density of different studied flours varied from 0.48 mL (cantaloupe) to 0.98 g mL^{-1} (charantais). This factor gives an idea about the granulometry and eventual effect of storing conditions that could act on the flour (Gray, 1968). Results showed that charantais melon may present low porosity.

Table 2: Functional properties of the studied melon's pulp flour

Functionnal properties	Varieties of melon			
	Cantaloup	Brode	Perlita	Charentais
Water absorption capacity (mL g^{-1})	86±0,01^{c}	99±0,02^{d}	74±0,01^{b}	*51±0,03*^{a}
Density (g mL^{-1})	0,48±0,01^{a}	0,72±0,05^{b}	0,87±0,05^{c}	0,98±0,01^{c}
Gelifying power (%)	4^{a}	8^{b}	8^{b}	20^{c}
Time of gelification (min)	3^{a}	5^{b}	5^{b}	55^{c}

Numbers in the same line followed by the same letters are not significally different at 5% according to Duncan multiple comparison test

Gelifying power and gelification time: The properties of gelification vary depending on the nature of the polysaccharides. This specificity is due to the difference in their chemical structure, the gelification mechanism, the rheological properties of gel and their stability as well. For melons which pulp has a low rate of gelification (4% for cantaloup) gelification time was 3 min. Flour of charantais melon showed a higher gelification time and rate (55 min and 20%, respectively) than other varieties. This difference may be attributed to the fact that the macromolecule structures (rate of amylase and amylopectine) making up the difference melon varieties are not identical. It appears that the studied melons offer many possibilities of choice in terms of gelification time and gelifying power. Therefore, cantaloup melon will be considered if one is interested in flour that gelifies fast but has low concentration.

On the other hand, one is oriented towards charentais melon if one prefers flour that takes time to gelify but has high concentration.

Starch content: From different varieties of melon, results obtained showed the following starch content: 35.54±2.98 g 100/g MS (cantaloup), 38.78±1.75 g/100g MS (brode), 20.20±3.50 g/100g MS (perlita) and 26.04±2.80 g/100g MS (charentais). This non negligible starch content has led to the knowledge of the behaviour of the two constituents of starch (amylase and amylopectine) during elevated temperature.

Iodine spectrum: Iodine spectra of aqueous suspension of starch from different varieties of melons as well as these of the 2 controls (cassava and maize) were determined between 300 and 700 nm at the following temperatures 25, 35, 45, 55, 65, 75, 85 and 95°C (Fig. 2- 6). These spectra revealed the maximum absorption wavelengths of the studied melon flours, as well as those of white maize (*Zea mays*) and white cassava (*Manihot esculenta*). The later were studied in order to compare starch rich les plant species.

Between 55 and 75°C, a high absorption rate was noticed, which could be due to the swelling of starch and

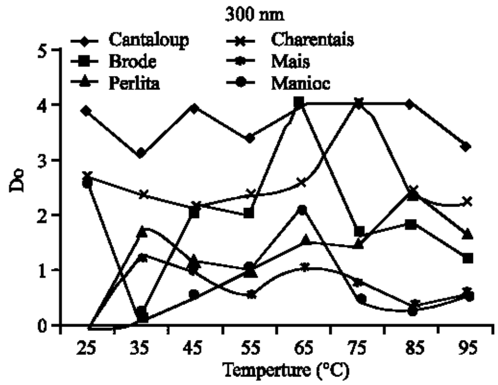

Fig. 2: Iodine spectra of starch aqueous suspension at wave length 300 nm

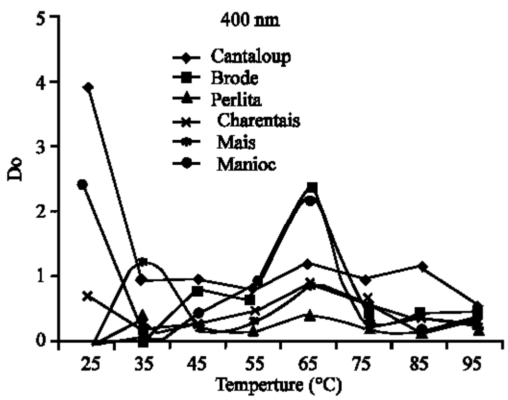

Fig. 3: Iodine spectra of starch aqueous suspension at wave length 400 nm

exposure to hydroxyl groups that are ready to fix the molecules of lugol iodine.

Analysis of these spectra indicated maximum absorption at 300 and 400 nm for all studied species. This study also revealed the state of starch granules in the course of temperature increase.

Polysaccharides have functional properties that are largely exploited today in food industries. These properties derived from the "thickening" power which is common to all hydrosoluble polysaccharide polymers. The low level (less than 5%) of those polysaccharides will completely modify the rheological properties of great water quantity, bringing about the desired modifications in the food texture (Thibault and Colonna, 1988).

Figure 7 and 8(a,b) showed the solubilisation spectra of two constituents of starch (amylose and amylopectine) that were determined per melon variety.

The estimated solubility ratios between amylose and amylopectine enable us to appreciate the most soluble constituent on the basis of variety and temperature.

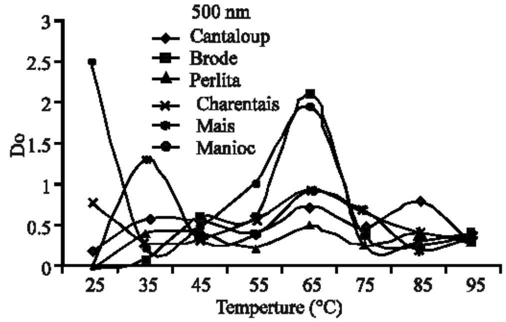

Fig. 4: Iodine spectra of starch aqueous suspension at wave length 500 nm

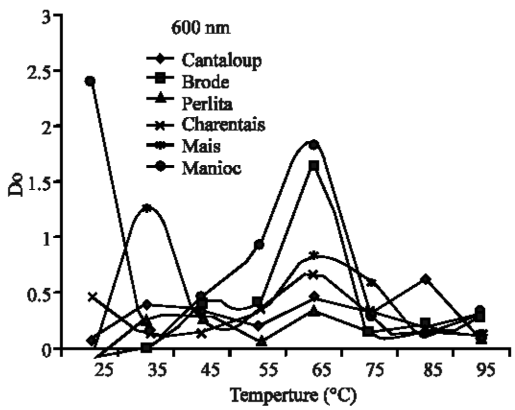

Fig. 5: Iodine spectra of starch aqueous suspension at wave length 600 nm

The plots showed that amylose and amylopectine solubilised almost simultaneously and reached the maximum at 70°C.

Cantaloup and perlita varieties (Fig. 7 and 8a) presented plots with 3 peaks, respectively at 35, 70 and 90°C. It was noticed that at these different temperatures, amylopectin solubilised faster than amylose.

Unimodal plots were observed (at 70°C) for brode and charentais (Fig. 7 and 8b) showing always a higher solubilisation of amylopectin than that of amylose as in the case of *Xanthosoma sagitifolium* (Amani *et al*., 1993).

Swelling and solubility: Figure 9 illustrates the swelling and solubility with respect to temperature.

Cantaloup melon flour swells slightly and has a high parallel solubility at 25-35%. The general trend remains uncharged. The flour of brode swells rapidly, hence its higher solubility. The plot of swelling versus solubility of this type of melon is the most interesting one. It showed at which point the three

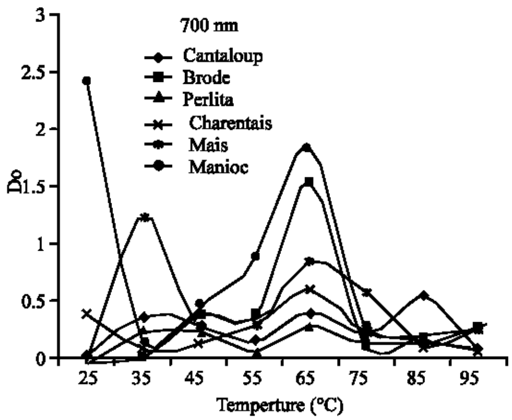

Fig. 6: Iodine spectra of starch aqueous suspension at wave length: 700 nm

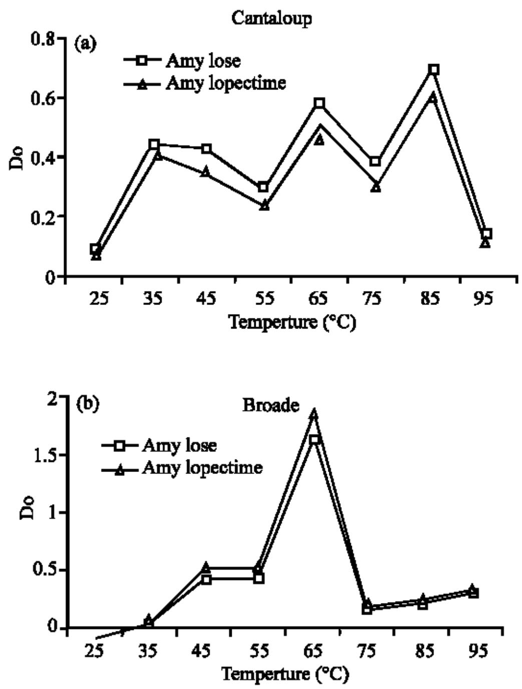

Fig. 7: Solubility ratio between amylose and amylopectine based on temperature for *C. melo* L. var cantaloup and var brode

parameters namely, swelling, solubility and temperature are strictly bound.

In the course of temperature increase, the starch granules gelatinised. This could be explained by the increasable variations (rupture of the hydrogen bonds, water absorption and swelling) and the loss of the native structure that leads to retrogradation. These events are generally followed by an increase of the viscosity (Zobel and Stephen, 1995).

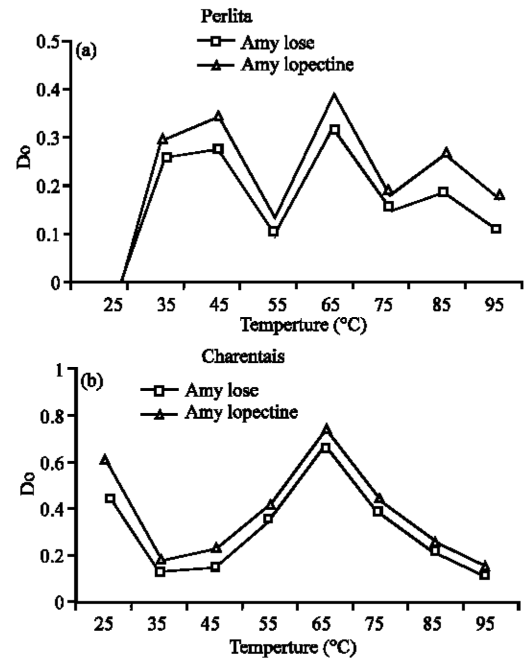

Fig. 8: Solubility ratio between amylose and amylopectine based on temperature for *C. melo* L. var perlita and var charentais

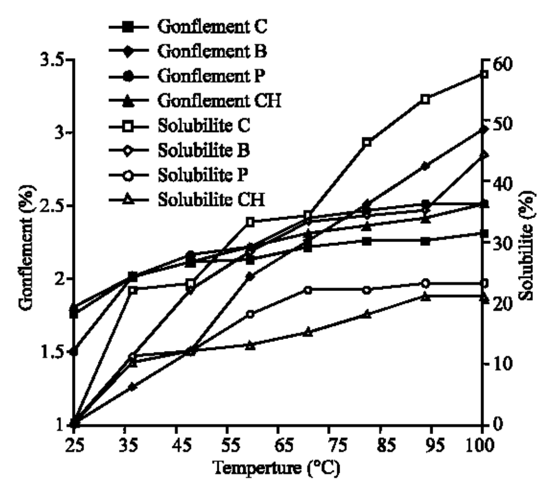

Fig. 9: Swelling and solubility of melons pulp flour with respect to temperature

CONCLUSION

Flour from charentais melon may be used as gelatising agent in many foods products. The iodine spectrum of starch of starch showed that starch granules swelled faster in hot water and offered better yield at temperature between 55 and 75°C. The most important effect to notice is the faster solubilisation of amylopectin than amylose of the starch firm melon's pulp. Following it's gelatinisation temperature, the starch from maize or cassava may be substituted by that of brode's melon.

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