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Short Communication

Effects of processing techniques on the functional properties of wheat-breadfruit composite flour

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Abstract

Breadfruit was processed using three different techniques i.e. Sulphiting, blanching and the control (no treatment). The bulk density (BD) of the breadfruit-wheat composite flour, ranges from (0.75- 0.83) g/ml with 10% untreated breadfruit flour (UBFA) having the highest value. 100% wheat flour (W) had the highest swelling capacity and oil absorption capacity than other blends with values of 0.97 and 1.7 while 20% untreated breadfruit flour (UBFB) had the highest water absorption capacity. Therefore the 10% sulphited breadfruit flour (SBFA) and 10% blanched breadfruit flour (SBFA) were recommended due to their performance after being subjected to series of experimental analyses.

Introduction

Breadfruit *(Artocarpus altilis)* is native to Malaysia from where it has spread through the South Pacific and Caribbean (Adewusi *et al*., 1995). The breadfruit seeds are found in the Eastern and Northern parts of Nigeria, which is among the Igbos, Hausas and Igalas and is a popular food in these areas. It is known as “Ukwa” in Igbo and “barafuta” in Hausa while among the Yorubas, it is known as “Jaloke (Ife)” (Agu *et al*., 2007). Breadfruit is a fruit tree that is propagated with the root cuttings and the average age of bearing first crop is between 4 to 6 years (Amusa *et al*., 2002). It produces its fruit up to three times in a year and the number of fruits produced is very high (Olaoye *et al*., 2007). The fruit has been described as an important staple food of a high economic value (Soetjipto and Lubis, 1981). Adewusi *et al.* (1995) has described breadfruit as a poor man’s substitute for yam. It is consumed the same way as yam; it can be boiled, pounded or processed into flours (Nwokocha and Williams, 2011).

Breadfruit is most often consumed fresh, used as a starchy vegetable. One of the biggest limiting factors for large scale production and international trade is the perishable nature of the fruit (Jones, 2010). Breadfruit is a seasonal crop and during its season, most of the fruit goes into post-harvest losses due to high moisture content of the fruit. The shelf life of this crop can only be extended by converting it into flour which could be used as composite flour for the production of bread, biscuits etc. and also helps to reduce huge post-harvest losses. The breadfruit flour has found limited application in bakery product and several researchers have produced commonly consumed foods from it (Nnam and Nwokocha, 2003; Olaoye *et al*., 2007; Malomo *et al*., 2011; Ajani *et al*., 2012). The objective of this work was therefore to provide information on the effects of processing techniques on the functional parameters of the flour blends i.e. water/oil absorption capacity, bulk density, and swelling capacity.

Materials and Methods

Materials

The breadfruit were purchased from the Oba market in Akure, Ondo state Nigeria. Also, the wheat grain, sugar, salt, margarine, milk powder, and flavoring agents were sourced from the same location as the breadfruit. All the chemicals and reagents used were of analytical grade.

Production of breadfruit flour

The flour was produced according to the method of Olaoye *et al*. (2007) with some modifications. Briefly, the breadfruits were thoroughly washed to remove any dirt and unwanted materials. It was then peeled and washed with clean water. The breadfruits were sliced, diced; some were blanched at 72^{o}C for about 5 minutes, some were sulphited with sodium metebisulphite (2g dissolved in 1liter of water, Ajani

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et al., 2012), while the third batch was not treated (control) and the three different batches (Sulphited Breadfruit Flour, SBF; Blanched Breadfruit Flour, BBF and Untreated Breadfruit Flour, UBF) were then dried in the oven at 87ºC for 16 hours, after which they were milled. The milled breadfruit flour was sieved, using a very fine mesh. The different treatments (SBF, BBF and UBF) were blended with wheat flour at two different ratio levels – 10% and 20%. This gave a total of 7 samples with the 100% wheat flour sample. The various functional properties carried out include bulk density, swelling capacity, oil and water capacity.

Results and Discussions

Bulk density and swelling capacity

Figure 1 shows the bulk density of the breadfruit-wheat composite flour, The values ranged from 0.75- 0.83 g/ml with UBFA having the highest value, while 100% wheat flour has the same value with 20% blanched breadfruit flour (BBFB). Bulk density is a measure of heaviness of flour and an important parameter that determines the suitability of flour for ease of packaging and transportation. Fagbemi (1999) reported that increase in bulk density is desirable in that it offers greater packaging advantage, as a greater quantity may be packed within a constant volume. These values correlate relatively to previous findings in literature (Chau and Cheung, 1998: 0.57 – 0.69 g/ml; Adebowale *et al*., 2008: 0.58 – 0.77 g/ml; Adegunwa *et al*., 2014: 0.87 -0.91 g/ml). Figure 2 shows the swelling capacity (SC) of the breadfruit-wheat composite flour and the values of the SC ranged from 0.94-0.97 mg/g with 100% wheat flour having the highest SC value which may be due to the type of amino acid present in the flour which may be limited in other samples supplemented with differently treated breadfruit flours.

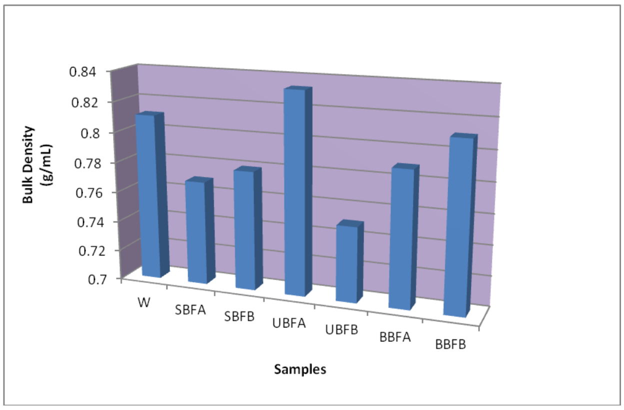

Figure 1. Bulk density (g/ml) of breadfruit-wheat composite flour

W=100% Wheat flour, SBFA=10% Sulphited Breadfruit flour, SBFB=20% Sulphited Breadfruit flour, UBFA=10% Untreated Breadfruit flour, UBFB=20% Untreated Breadfruit flour, BBFA=10% Blanched Breadfruit flour, BBFB=20% Blanched Breadfruit flour

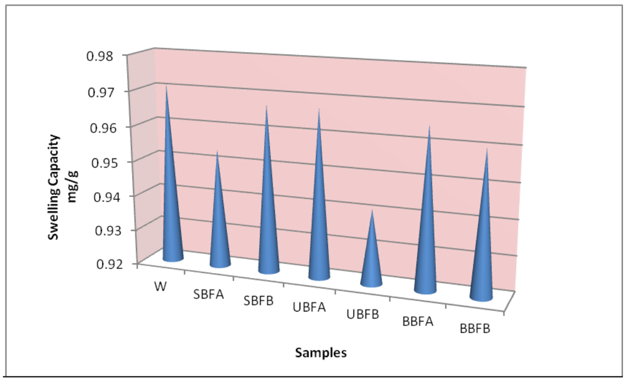

Figure 2. Swelling capacity (mg/g) of breadfruit-wheat composite flour

W=100% Wheat, SBFA=10% Sulphited Breadfruit flour, SBFB=20% Sulphited Breadfruit flour, UBFA=10% Untreated Breadfruit flour, UBFB=20% Untreated Breadfruit flour, BBFA=10% Blanched Breadfruit flour, BBFB=20% Blanched Breadfruit flour

Oil and water absorption capacity

Oil absorption capacity has been reported to be important for development of new food product and has influence on their storage stability, particularly for the development of rancidity (Odoemelam, 2005). In Figure 3 the values of the oil absorption capacity range from 1.2 to 1.7 mg/g with 100% wheat flour having the highest oil absorption capacity which may be due to the high protein content of the flour. Flours with high oil absorption capacity improves the mouth feel and flavor retention when used in food formulation and production (Odoemelam, 2005). Water absorption capacity (W.A.C) indicates the capability of flour to absorb water. Flours with

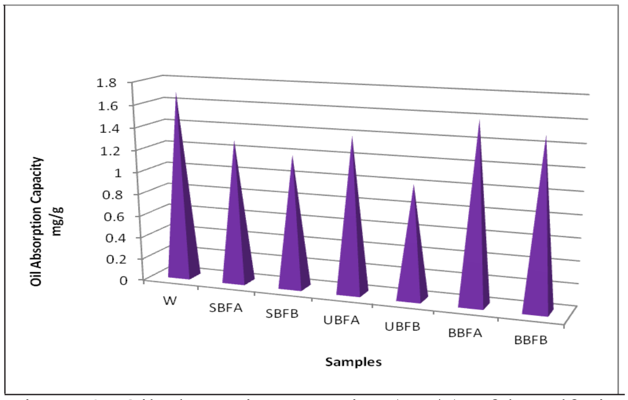

Figure 3. Oil absorption capacity (mg/g) of breadfruit-wheat composite flour

W=100% Wheat, SBFA=10% Sulphited Breadfruit flour, SBFB=20% Sulphited Breadfruit flour, UBFA=10% Untreated Breadfruit flour, UBFB=20% Untreated Breadfruit flour, BBFA=10% Blanched Breadfruit flour, BBFB=20% Blanched Breadfruit flour

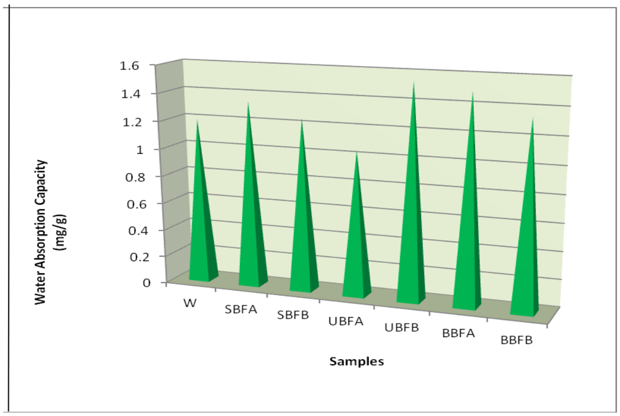

Figure 4. water absorption capacity (mg/g) of breadfruit-wheat composite flour

W=100% Wheat, SBFA=10% Sulphited Breadfruit flour, SBFB=20% Sulphited Breadfruit flour, UBFA=10% Untreated Breadfruit flour, UBFB=20% Untreated Breadfruit flour, BBFA=10% Blanched Breadfruit flour, BBFB=20% Blanched Breadfruit flour

high value W.A.C can be used as a food thickener in a food system. In Figure 4 the values of the water absorption capacity range from 1.05 to 1.55 mg/g with UBFB having higher W.A.C than other samples including 100% wheat which may be due to the high carbohydrate content of this flour. Adebowale *et al*. (2012) also reported a similar trend; the water absorption capacity of sample W was lower than that of the sorghum-wheat composite flour, which may be due to the fact that addition of sorghum flour to wheat flour confers higher water binding capacity to wheat flour, which in turn improves the reconstitution ability (kulkarni *et al.*, 1991; Ajanaku *et al.*, 2012).

Conclusion

The effects of processing techniques on the functional properties of wheat-breadfruit composite flour was studied. The results showed that the various functional properties were affected by the processing techniques used. Generally however, it can be concluded that while sulphiting improves the bulk and swelling capacities, blanching and control (Untreated sample) improve the bulk density and water absorption capacity respectively as the ratios increases, the reserve was observed for other properties tested, that is, increasing the blend ration led to decrease in the functional properties.

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