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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

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Effect of Soaking Time on the Pasting Properties of Two Cultivars of Trifoliate Yam (*Dioscorea dumetorum*) Flours

Olufunmilola Adunni Abiodun, Jacob Adeyosoye Adegbite and Tajudeen Solagbade Oladipo
Department of Food Science and Technology, Osun State Polytechnic, Iree, Osun State, Nigeria

Abstract: This study was carried out to determine the effect of soaking time on the pasting properties of two cultivars of trifoliate yam flour. The tubers were peeled, washed, sliced and kept under running tap water for 30, 60, 90 and 120 min. They were dried at 50°C for 48 h. The dried samples were milled, sieved (600 µm) and packaged. Pasting properties were determined using Rapid Visco Analyzer and statistical analysis was carried out to test for significant difference ($p \leq 0.05$) using one way analysis of variance (ANOVA). Among the white cultivar samples, the sample WH60 had the highest peak viscosity, holding strength and final viscosity of 87.93, 68.34 and 128.34 RVU, respectively. Breakdown value of the untreated white sample (WHR) was significantly different ($p \leq 0.05$) from other white samples. There were no significant differences ($p \leq 0.05$) in setback values for samples soaked for 60, 90 and 120 min. Also, the yellow cultivar follow the same trend with the sample YL60 having the highest peak viscosity, holding strength, breakdown value and final viscosity of 80.32, 73.39, 6.93 and 138.15 RVU, respectively. Setback value for sample YL90 was significantly different ($p \leq 0.05$) from other samples. Pasting temperature and pasting time ranged from 74.25-76.60°C and 4.62-5.35 min, respectively. Among the two cultivars, WH60 had the highest peak viscosity while YL60 had the highest holding strength and final viscosity. The yellow samples had lower breakdown values than the white samples. The flour samples from the two cultivars can be used in the food industries for baking and as thickeners.

Key words: Pasting properties, trifoliate yam, cultivar, soaking time

INTRODUCTION

Yam (*Dioscorea* sp.) is one of the most important food crops in West Africa especially Nigeria and is well accepted as a staple food in most homes (Igyor *et al*., 2004). Yams are annual or perennial tuber-bearing and climbing plants with over 600 species in which only few are cultivated for food and medicine (IITA, 2006). The most cultivated species in Nigeria are the white yam (*D. rotundata*), yellow yam (*D. cayenensis*), water yam (*D. alata*) and trifoliate yam (*D. dumetorum*) (Amusa *et al*., 2003)

Trifoliate yam (*Dioscorea dumetorum*) is however a lesser-known yam among the species and underutilized. The tubers are eaten during the time of famine or scarcity and are usually boiled with the peel and eaten as boiled yam. Trifoliate yam tubers contain alkaloid dihydrodioscorine which causes paralysis of the nervous system (Degras, 1993). These alkaloids are reported to be water soluble and can be dissipated by soaking and boiling (Eka, 1998). Also trifoliate yam hardens few days after harvest and this leads to reduction in moisture and starch content and increase in sugars and structural polysaccharides (Sefa-Dedeh and Afoakwa, 2001).

Triofoliate yam has been reported to be nutritionally superior to the commonly consumed yams with high protein and mineral content (Martin *et al*., 1983). Processing of trifoliate yam tubers into flour have been reported to be a means of adding longer term value to the tubers with a high nutritional potential (Medoua *et al*., 2005). The ultimate quantity of yams that can be utilized in a processed form would depend on availability in many end- use forms. Dry snacks made from yam, with or without nutrient fortification, would encourage its increased use (Okaka and Okechukwu, 1987).

Research has been carried out on the nutritional value, biochemical, textural and physicochemical changes in trifoliate yam (Bell and Favier 1981; Martins *et al*., 1983; Sefa-Dedeh and Afoakwa, 2001; and Medoua *et al*., 2005). Study needs to be done on the effect of various processing methods on the physico-chemical properties of trifoliate yam flour. The objective of this study was to determine the effect of soaking time on the pasting properties of flour from two cultivars (white and yellow) of trifoliate yam.

MATERIALS AND METHODS

Two cultivars of trifoliate yam (yellow and white) were purchased from Ada market in Osun State, Nigeria. The tubers were peeled, washed, sliced thinly and kept under running tap water for 30, 60, 90 and 120 min. They were dried at 50°C for 48 h. The dried samples were milled (Kenwood blender), sieved (600 µm) and packaged in polythene bags. They were stored at ambient temperature.

Analysis of the samples: Pasting properties were carried out on the samples using Rapid Visco-Analyzer

(RVA model 3D for windows) (Newport Scientific 1998). Flour suspension was prepared by addition of equivalent weight of 3.0 g dry flour to distilled water to make a total of 28.0 g suspension in the RVA sample canister. This was placed centrally into the paddle coupling and was inserted into the RVA machine. The 12 min profile used was seen as it runs on the monitor of a computer to the instrument. The starting temperature was 50°C for 1 min and later heated from 50-95°C for 3 min. It was held at 95°C for 3 min before the sample was subsequently cooled to 50°C over a 4 min period. This was followed by a period of 1 min where the temperature was kept at constant temperature of 50°C. Pasting properties were carried out in duplicate and the results obtained were statistically analyzed using one way analysis of variance (ANOVA) (SPSS 10.0 for windows) to test for significant differences between the samples. The mean separation for parameters was done using the Turkeys test.

RESULTS AND DISCUSSION

The result of the flour sample (white cultivar) soaked for 60 min (WH60) had the highest peak viscosity, holding strength and final viscosity of 87.93, 68.34 and 128.34 RVU, respectively (Table 1). These were significantly different ($p \leq 0.05$) from other samples from white cultivar. The untreated sample (WHR) had the highest breakdown value of 21.64RVU and this showed that the treated samples were more stable than the untreated sample. The setback values of samples soaked for 60, 90 and 120 min were not significantly different ($p \leq 0.05$) from each other. The pasting temperature and pasting time varied from 74.25-76.60°C and 4.62-4.83 min, respectively. The peak viscosity, holding strength, breakdown values and final viscosity increased to maximum at WH60 and decreased thereafter. The samples from the yellow cultivar follow the same trend with sample soaked for 60 min (YL60) having the highest peak viscosity (80.32 RVU), holding strength (73.39 RVU), final viscosity (138.15RVU) and breakdown value (6.93 RVU), respectively (Table 2). Samples soaked for 90 min (YL90) exhibited higher setback value (71.96RVU) which was significantly different ($p \leq 0.05$) from other yellow cultivar samples. Pasting temperature and pasting time ranged from 74.35-75.55°C and 4.63-4.89 min, respectively.

The pasting properties of the two cultivars were shown in Table 3. WH60 had the highest peak viscosity (87.93 RVU) followed by WH90 (82.44 RVU) and YL60 (80.32 RVU), respectively. This indicates that the carbohydrate components of the flour samples will not breakdown until it is properly cooked and peak viscosity was reported to be important to the user in order to obtain a useable starch paste (Adeyemi, 1989). YL60 had higher holding strength (73.39 RVU) which was significantly different ($p \leq 0.05$) from all other samples. Generally, high holding strength represents low cooking loss and superior eating quality (Bhattacharya *et al.*, 1999). It showed the ability of the flour samples to withstand heating and shear stress during processing (Newport Scientific, 1998).

The untreated sample from the white cultivar had higher breakdown value (21.64 RVU) which was significantly different ($p \leq 0.05$) from other samples. The breakdown values for yellow cultivar samples were lower than the samples from the white cultivar. Breakdown is a measure of susceptibility of cooked starch granules to disintegration and has been reported by Beta *et al.* (2000) to affect the stability of the flour products. A low breakdown value suggests that they are more stable under hot condition. Samples YL60 and YL90 were not significantly different ($p \leq 0.05$) in final viscosity. These

Table 1: Effect of soaking time on the Pasting properties of trifoliate yam flour (white cultivar)

Sample	Peak viscosity (RVU)	Holding strength (RVU)	Breakdown value (RVU)	Final viscosity (RVU)	Setback value (RVU)	Pasting time (min)	Pasting temp. (°C)
WHR	77.55c	55.91c	21.64a	109.29c	54.38b	4.62b	74.48d
WH30	69.99d	54.86c	15.14d	109.56c	54.70b	4.62b	75.65b
WH60	87.93a	68.34a	19.59b	128.34a	60.00a	4.72ab	75.08c
WH90	82.44b	64.74b	17.71c	125.17b	60.43a	4.83a	74.25d
WH120	75.95c	63.70b	12.25e	124.22b	60.53a	4.83a	76.60a

Mean values followed by the same letter down the column were not significantly different ($p \leq 0.05$), WHR- Untreated white sample, WH30, WH60, WH90 and WH120 - White samples soaked for 30, 60, 90 and 120 min

Table 2: Effect of soaking time on the Pasting properties of trifoliate yam flour (yellow cultivar)

Sample	Peak viscosity (RVU)	Holding strength (RVU)	Breakdown value (RVU)	Final viscosity (RVU)	Setback value (RVU)	Pasting time (min)	Pasting temp. (°C)
YLR	55.73d	50.31e	5.43b	103.16d	52.86d	4.63c	74.65c
YL30	63.15c	57.14d	6.01ab	110.49c	53.35d	4.72c	74.83bc
YL60	80.32a	73.39a	6.93a	138.15a	64.76b	4.68c	74.98b
YL90	69.43b	65.51b	3.92c	137.47a	71.96a	5.35a	75.55a
YL120	62.36c	59.24c	3.13c	114.44b	55.21c	4.89b	74.35d

Mean values followed by the same letter down the column were not significantly different ($p \leq 0.05$), YLR- Untreated yellow sample, YL30, YL60, YL90 and YL120 - yellow samples soaked for 30 , 60, 90 and 120 min

Table 3: Effect of soaking time on the pasting properties of the two cultivars of trifoliate yam flour (white and yellow)

Sample	Peak viscosity (RVU)	Holding strength (RVU)	Breakdown value (RVU)	Final viscosity (RVU)	Setback value (RVU)	Pasting time (min)	Pasting temp. (°C)
WHR	77.55d	55.91fg	21.64a	109.29e	54.38ef	4.62cd	74.48efg
WH30	69.99e	54.86g	15.14d	109.56e	54.70de	4.62cd	75.65b
WH60	87.93a	68.34b	19.59b	128.34b	60.00c	4.72cd	75.08c
WH90	82.44b	64.74cd	17.71c	125.17c	60.43c	4.83bc	74.25g
WH120	75.95d	63.70d	12.25e	124.22c	60.53c	4.83bc	76.60a
YLR	55.73g	50.31h	5.43g	103.16f	52.86f	4.63cd	74.65def
YL30	63.15f	57.14f	6.01g	110.49e	53.35f	4.72cd	74.83cde
YL60	80.32c	73.39a	6.93f	138.15a	64.76b	4.68cd	74.98cd
YL90	69.43e	65.51c	3.92h	137.47a	71.96a	5.35a	75.55b
YL120	62.36f	59.24e	3.13h	114.44d	55.21d	4.89b	74.35fg

Mean values followed by the same letter down the column were not significantly different ($p \leq 0.05$), WHR- Untreated white sample, WH30, WH60, WH90 and WH120 - White samples soaked for 30 , 60, 90 and 120 min, YLR- Untreated yellow sample, YL30, YL60, YL90 and YL120-yellow samples soaked for 30 , 60, 90 and 120 min

values were greater than the values for the white cultivar samples. This showed that the flour samples from yellow cultivar soaked for 60 and 90 min can form viscous and firm gel after cooking and cooling than white cultivar samples. Setback values varied from 52.86 RVU for YLR and 71.96 RVU for YL 90. Setback value is an index of the tendency of the cooked flour to harden on cooling due to amylose retrogradation (Adeyemi, 1989).

Conclusion: This study has shown that when trifoliate yam tubers are soaked in water, the pasting properties of the flour samples are affected. The sample soaked for 60 min exhibit the best pasting properties for both white and yellow cultivars. The yellow cultivar were significantly different ($p \leq 0.05$) from the white cultivar in breakdown and final viscosity. The flour will be more stable under hot conditions than the white cultivar. Both flour samples from the two cultivars can also be used in the food industries for baking and as thickeners.

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