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Comparative study of pasting properties of amaranth and buckwheat flour

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Abstract
Pasting properties of amaranth and pseudo-cereals were determined. Buckwheat flour showed 1158cP, 1100cP, 65.33cP, 2277cP and 1177cP whereas amaranth flour showed 755.3cP, 738cP, 17.33cP, 960.6cP and 222.6cP as peak, trough, breakdown, final and setback viscosity, respectively. It was concluded that the pasting viscosities (peak, trough, breakdown, finaland setback viscosity) of amaranth flour were lower than buckwheat flour.

Keywords: Pseudo-cereals, flour, pasting, quality

Introduction

Now a days there is trends for formulation of high quality, healthy food products for the healthy life style and appropriate nutrition using available food crops. Many of the underutilized food crops are neglected by researchers and policy makers which may be of great potential particularly in improving the quality of diet food. Amaranth and buckwheat are among many such unexploited crops which shows promising potential as a global resource supplying nutritious grains as well as tasty leafy vegetables (NRC, 1984) [11].

The genus amaranthus belongs to the family amaranthaceae and includes more than 60 species, of which three viz., *amaranthus hypochondriacus*, *amaranthus cruentus* and *amaranthus caudatus*, are the essential grain species. Amaranth grain is a rich source of carbohydrates, protein, lipids, dietary fiber and functional components.

Buckwheat belongs to the polygonaceae family, is usually considered a cereal in agriculture and food technology because of its usage and cultivation techniques used. The triangular shaped seeds make it similar to a beech nut therefore, the name is may be modification of “beech wheat” (Singh and Atal, 1982) [17].

The aim of the present work was to examine the pasting properties of flour of amaranth and buckwheat to identify the potential application in end use product.

Material and methods

The experiment was conducted at Choudhary Charan Singh Haryana Agricultural University, Hisar during 2015-2016**.** Amaranth seeds were procured from the Department of Plant Breeding, CCSHAU,Hisar. Buckwheat seeds were procured from Regional Research Centre, Sangla, Himachal Pradesh Krishi Visavavidyalaya, Palampur, Himachal Pradesh. Pseudo-cereals were cleaned for extraneous matter and flour was prepared by milling in Brabender Quardamat Junior Mill.

Samples of amaranth and buckwheat flour were assessed for various pasting characteristics viz. Peak Viscosity, Peak time, Break down, Final viscosity, Set back and Pasting temperature using Rapid-Visco Analyzer, Newport Scientific Australia.

Twenty five ml of distilled water was weighed into a canister. 3.5 g sample was weighed and transferred in canister. Paddle was placed into the canister and jogged to disperse the sample. Paddle and canister was inserted into Rapid-Visco Analyzer (RVA) and wait for the command for pressing down the tower from the thermocline windows till the temperature of RVA reached50ºC. Pressed down the tower and wait till the test was run for 13 min. Canister was removed on completion of test. From Thermocline windows following observations were recorded:

Peak Viscosity: Maximum viscosity developed during or soon after the heating portion of the test.

Trough viscosity: Maximum viscosity after the peak, normally occurring around the commencement of sample cooling.

Peak time: Time taken at which peak viscosity occurred.

Pasting temperature: Temperature where viscosity first increases by at least 25 cP over a 20sec. period using the standard-1 profile.

Break down viscosities: Peak viscosity minus trough viscosity.

Final viscosity: Viscosity at the end of the test.

Set back: Final viscosity minus trough viscosity.

Results and Discussion

Pasting encompasses the changes that occur after gelatinization upon further heating and these include further swelling of granules, leaching of molecular components from the granules and eventual disruption of granules especially with the application of shear forces and usually studied by observing changes in the viscosity of a starch system based on rheological principles (Tester and Morrison, 1990) [19]. Flour paste viscosity mainly varies with flour composition and characteristics of starch (Shevkani *et al.*, 2014) [13].

Table 1: Pasting properties of amaranth and buckwheat

Sample	Peak Viscosity (cP)	Trough Viscosity (cP)	Breakdown Viscosity (cP)	Final Viscosity (cP)	Setback Viscosity (cP)	Peak time (min.)	Past. temp. (ºC)	Gelatinization temp. (ºC)
Pseudo-cereals								
Amaranth	755.3±8.01	738±6.35	17.33±2.60	960.6±9.13	222.6±3.81	6.86±0.07	83.48±0.54	95.01±0.02
Buckwheat	1158±12.38	1100±18.82	65.33±1.76	2277±50.23	1177±33.61	6.97±0.02	72.11±0.24	95.01±0.02

Peak viscosity of amaranth flour was 755.3 cP (Table 1) which was in agreement with peak viscosity (733.33 cP) of amaranth flour observed by Sindhu and Khatkar (2016) [15]. Kaur *et al.,* (2010) [7]; Menagassi *et al.,* (2011) [8]; Muyonga *et al.*, (2014) [10]; Shevkani *et al.*, (2014) [13] and Tanimola *et al.*, (2016) [18] reported higher (879-1906 cP, 94.3 RVU, 1222-1963 cP, 1050-1459 cP and 120.5 RVU, respectively) peak viscosity for different varieties of amaranth than the peak viscosity observed in present study. Peak viscosity of buckwheat flour was 1158 cP (Table 1). Lower value (14.4 RVU) of peak viscosity (Inglett *et al.*, 2009) [6] whereas, higher peak (239.42 RVU, 4430.5 BU and 1637 cP) viscosity of buckwheat flour (Batham *et al.*, 2013; Beitane *et al.*, 2015 and Sindhu and Khatkar, 2016) [1, 2, 16] have been reported than the peak viscosity of buckwheat flour found in present study. In the present investigation, amaranth flour exhibited lower peak viscosity than buckwheat that may be due to higher protein and lipid content in amaranth flour which hinder the starch swelling in flour (Debet and Gidley, 2006 and Nelles *et al.*, 2000) [4, 12]. Trough viscosity of amaranth and buckwheat flour was 738 and 1100 cP, respectively (Table 1). Higher trough viscosity (112.1 RVU) of amaranth flour (Tanimola *et al.*, 2016) [18] and (1528.33 cP) of buckwheat flour (Sindhu and Khatkar, 2016) [16] whereas, lower (681.33 cP) trough viscosity of amaranth flour (Sindhu and Khatkar, 2016) [15] and buckwheat flour i.e. 1.1 RVU (Inglett *et al.*, 2009) [6] have been observed than the trough viscosity found in present study. Variation in trough viscosity of flour of pseudo-cereals may be due to the rate of granule swelling, amylose exudation and amylose-lipid complex formation (Wani and Kumar, 2015) [20]. Breakdown viscosity of amaranth and buckwheat flour was 17.33 and 65.33 cP, respectively (Table 1) which were lower than the breakdown viscosity (167-855 cP, 34.4 RVU, 258-847 cP, 382-475 cP, 8.5 RVU and 56 cP) reported for amaranth (Kaur *et al.,* 2010; Menagassi *et al.,* 2011; Muyonga *et al*., 2014; Shevkani *et al.*, 2014; Tanimola *et al*., 2016 and Sindhu and Khatkar, 2016, respectively) [7, 8, 10, 13, 18, 15] and buckwheat flour i.e. 24.2 RVU, 14.67 RVU and 86 cP (Inglett *et al.*, 2009; Batham *et al.*, 2013 [6, 1] and Sindhu and Khatkar, 2016 [16], respectively). Breakdown viscosity of amaranth flour was significantly lower than buckwheat flour (Table 1) and may be due to high protein content in amaranth. A strong negative correlation between breakdown viscosity and protein content has been reported. Lower breakdown viscosity represents greater resistance to shear thinning and higher stability of flour pastes (Shevkani *et al.*, 2014) [13].

Final viscosity of amaranth and buckwheat was 960.6 and 2277 cP, respectively (Table 1). Final viscosity of amaranth flour observed in present study was comparable with the final viscosity (966 cP) observed by Shevkani *et al.*, (2014) [13] for flour of amaranth cultivar IC 35407. Higher final viscosity of amaranth (Kaur *et al.*, 2010; Muyonga *et al.*, 2013 and Tanimola *et al.*, 2016) [7, 10 18] and buckwheat (Batham *et al.*, 2013; Beitane *et al.*, 2015 and Sindhu and khatkar, 2016) [1, 2, 16] whereas, lower final viscosity of amaranth (Menagassi *et al.*, 2011 and Sindhu and khatkar, 2016) [8, 15] and buckwheat flour (Inglett *et al.*, 2009) [6] have been reported than the final viscosity observed in present study. Variation in final viscosity of flour pseudo-cereals may be attributed to the aggregation of the amylose molecules in the paste (Miles *et al*., 1985) [9], high percentage of amylopectin may hamper the aggregation of free amylose chains (Blazek and Copeland, 2008) [3]. The setback viscosity of amaranth and buckwheat flour was 222.6 and 1177 cP, respectively (Table 1). Setback viscosity for amaranth varieties was in the range of values (102-337 cP and 207-508.5 cP) reported by Kaur *et al.,* (2010) [7] and Muyonga *et al.*, (2014) [10], respectively. As compared to the values of setback viscosity observed in present study higher setback viscosity of flour of amaranth (Tanimola *et al.*, 2016) [18] and buckwheat (Batham *et al.*, 2013; Beitane *et al.*, 2015 and Sindhu and khatkar, 2016) [1, 2, 16] whereas, lower setback viscosity of amaranth (Menagassi *et al.*, 2014 and Sindhu and khatkar, 2016) [8, 15] and buckwheat (Inglett *et al.*, 2009) [6] flour have been recorded.

Peak time and Pasting temperature of amaranth and buckwheat flour ranged from 6.86-6.97 min. and 72.11-83.48 ^{0}C, respectively (Table 1). The results for peak time and pasting temperature of buckwheat flour reported by Batham*et al.*, (2013) [1] and Sindhu and khatkar (2016) [16] were in agreement with the results found in the present study. Muyonga *et al.*, (2014) [10]; Tanimola *et al.*, (2016) [18] and Sindhu and Khatkar (2016) [15] observed lower value of peak time and pasting temperature of amaranth than the peak time and pasting temperature of amaranth found in the present study. The differences in pasting temperature of flour of pseudo-cereals may be due to difference in their amylose content (Muyonga *et al.*, 2014) [10] and lipid-starch complexes formation during heating (Shevkani *et al.*, 2011) [14].

Conclusion

It was concluded that the pasting viscosities (peak, trough, breakdown, final and setback viscosity) of amaranth flour were lower than buckwheat flour and lowest pasting viscosities of amaranth flour may be attributed to higher protein and lipid content and lubricating effect of lipids of amaranth.

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References

1. Batham J, Sharma GK, Khan MA, Govindaraj T. Effect of micronisation on properties of buckwheat seed (*Fagopyrum esculentum*). International Journal of Agricultural and Food Science. 2013; 3(1):22-27.
2. Beitane I, Krumina-Zemture G, Sabovics M. Technological properties of pea and buckwheat flours and their blends. In Annual 21st International Scientific Conference: Research for Rural Development, 2015; 1:137-142.
3. Blazek J, Copeland L. Pasting and swelling properties of wheat floyr and starch in relation to amylose content. Carbohydrate Polymers. 2008; 71:380-387.
4. Debet MR, Gidley MJ. Three classes of starch granule swelling: Influence of surface proteins and lipids. Carbohydrate Polymers. 2006; 64(3):452-465.
5. Duatant FJ, Simancus K, Sandoval AJ, Muller AJ. Effect of temperature, moisture and lipid content on the rheological properties of rice flour. Journal of Food Engineering. 2007; 78:1159-1160.
6. Inglett GE, Xu J, Stevenson DG, Chen D. Rheological and pasting properties of buckwheat (*Fagopyrum esculentum* Moench) flours with and without jet-cooking. Cereal Chemistry. 2009; 86(1):1-6.
7. Kaur S, Singh N, Rana JC. *Amaranthushypoc hondriacus* and *Amaranthus caudatus* Germplasm: Characteristics of plants, grain and flours. *Food Chemistry*. 2010; 123(4):1227-1234.
8. Menagassi B, Pilosof AMR, Areas JAG. Comparision of properties of native and extruded amaranth (*Amaranthus cruentus* L.-BRS Algeria) flour. LWT-Food Science and Technology. 2011; 44:1915-1921.
9. Miles MJ, Morris VJ, Orford PD, Ring SG. The roles of amylose and amylopectin in the gelation and retro gradation of starch. Carbohydrate Research. 1985; 135(2), 271-281.
10. Muyonga JH, Andabati B, Ssepuuya G. Effect of heat processing on selected grain amaranth physicochemical properties. Food Science and Nutrition. 2014; 2(1):9-16.
11. National Research Council. Amaranth: Modern prospects for an Ancient Crop. National Academy Press: Washington DC, 1984.
12. Nelles EM, Dewar J, Bason ML, Taylor JRN. Maize starch biphasic pasting curves. Journal of Cereal Science. 2000; 31(3):287-294.
13. Shevkani K, Singh N, Kaur A, Rana JC. Physicochemical, pasting, and functional properties of amaranth seed flours: effects of lipids removal. Journal of Food Science. 2014; 79(7):1271-1277.
14. Shevkani K, Singh N, Singh S, Ahlawat AK, Singh AM. Relationship between physicochemical and rheological properties of starches from Indian wheat lines. International Journal of Food Science and Technology. 2011; 46:2584-2590.
15. Sindhu R, Khatkar BS. Physicochemical and thermal properties of amaranth (*Amaranthus hypochondriacus*) flour. International Journal of Engineering Research and Technology, 2016; 4(6):104-109.
16. Sindhu R, Khatkar BS. Morphological, pasting and thermal properties of common buckwheat (*Fagopyrum esculentum* Moench) flour and starch. International Journal of Innovative Research and Advanced Studies, 2016; 3(7):160-164.
17. Singh VP, Atal CK. Cultivation of buckwheat in the plains as a raw material for rutin. In Cultivation and Utilization of Medicinal Plants. Publication and Information Directorate, Council of Scientific and Industrial Research, New Delhi. 1982, 337-341.
18. Tanimola AR, Otegbayo B, Akinoso R. Chemical, functional, rheological and sensory properties of amaranth flour and amaranth flour based paste. African Journal of Food Science. 2016; 10(11):313-319.
19. Tester RF, Morrison WR. Swelling and gelatinization of cereal starches. Cereal Chemistry. 1990; 67:551-558.
20. Wani SJ, Kumar P. Correlation between rice and maize flour based on physicochemical, functional and pasting characteristics. Journal of Agricultural Engineering and Food Technology, 2015; 2(1):68-72.