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Assessment of functional properties of composite flours

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Abstract

The present research was carried out to study the functional properties of composite flours, that is, wheat flour, soybean flour, carrot flour, mushroom powder and apple pomace powder. The functional properties like swelling capacity, water absorption capacity, gelatinization temperature, emulsion activity, emulsion stability and foam capacity of composite flours were evaluated. The functional properties of composite flours were T_{50} has highest functional property.

Keywords: functional property, swelling capacity, water absorption capacity, emulsion activity, emulsion stability, foam capacity and gelatinization temperature

Introduction

Wheat flour which is usually used to make instant noodles is not only low in fibre and protein contents but also poor in essential amino acid, lysine. Wheat flour approximately consists of 72% carbohydrates, 8 to 13% protein, 12 to 13% moisture, 2.5% sugar and 1.5% fat, 1.0% soluble protein and 0.5% minerals salts (Oberoi *et al.*, 2007) [14]. Flour of hard wheat *(Triticum aestivum L.)* is the main primary ingredient (Fu, 2008) and the addition of alkaline salts can help strengthen the structure and hence improve the firmness of the final product (Hou and Kruk, 1998; Kulkarni *et al.*, 2012) [6, 10]. Various epidemiological studies have shown that the diet lacking in fibre may be the cause of various gastrointestinal and cardiovascular diseases (Kumari *et al.*, 2007) [11]. Nutritionally, wheat flour is a good source of vitamins, minerals, protein, carbohydrate and dietary fibre. Soybean (Glycine max L. Merr.) is one of the most important that have the potential to provide the world's increasing demand of food. Humans have consumed bakery products for hundreds of years. The soybean a grain legume, is one of the richest and cheapest sources of protein that can be used to improve the diet of millions of people, especially the poor and low income earners in developing countries (LIU, 2000) [12]. Defatted soy flour at 2-5% improves water holding capacity and sheeting process of dough. Carrot is a rich source of β-carotene and contains other vitamins, like thiamine, riboflavin, vitamin B-complex and minerals (Walde *et al.*, 1992) [23]. The carrot is used in fabricated baby foods, which are most popular throughout the world. Dried carrot has β carotene and ascorbic acid in the range of 9.87 to 11.57 mg and 13.53 to 22.95 mg per 100 g respectively (Upadhyay *et al.*, 2008) [22]. Mushrooms (*Fungal sporocarps*) represent one of the world's greatest untapped resources of nutritious and palatable food and they possess extensive enzyme complexes, which enable them to flourish successfully on a wide variety of inexpensive substrates, such as lignin, cellulose, hemicellulose, pectin and other industrial wastes which are not suitable even for animal feed and human food. Apple pomace is the main by-product of cider industry that is mainly composed of carbohydrates and high amount of dietary fiber, small amount of protein, fat and ash (Ratman *et al.*, 2006; Grajek 2007) [16, 5]. Apple pomace was also used in bakery products by (Wang and Thomas, 1989; Yadav and Gupta 2015) [24, 25]. They examined the drum-dried apple pomace as a source of dietary fibre in bakery products.

Functional properties are the fundamental physico-chemical properties that reflect the complex interaction between the composition, structure, molecular conformation and physico-chemical properties of food components together with the nature of environment in which these are associated and measured (Kinsella, 1976; Kaur and Singh, 2006; Siddiq *et al.*, 2009) [9, 18, 20].

Materials and Methods

The wheat flour, soybean flour, carrot powder, mushroom powder and apple pomace powder were selected for composite flours. The functional properties of flours were analysed that is, swelling capacity (ml), water absorption capacity (WAC, %), emulsion activity (EA, %), emulsion stability (ES, %), foam capacity (FC, %) and gelatinization temperature (GT, °C).

Treatments

T_1: 100% (300g) wheat flour.
T_2: 270g wheat flour, 7.5g soya bean flour, 7.5g carrot powder, 7.5g mushroom flour and 7.5g apple pomace powder.
T_3: 240g wheat flour, 15g soya bean flour, 15g carrot powder, 15g mushroom flour and 15g apple pomace powder.
T_4: 210g wheat flour, 22.5g soya bean flour, 22.5g carrot powder, 22.5g mushroom flour, and 22.5g apple pomace powder.
T_5: 180g wheat flour, 30g soya bean flour, 30g carrot powder, 30g mushroom flour, 30g apple pomace powder.
T_6: 150g wheat flour, 37.5g soya bean flour, 37.5g carrot powder, 37.5g mushroom flour, 37.5g apple pomace powder.

The swelling capacity (WC) was determined by the method described by Okaka and Potter (1977) [15].

The water absorption capacity (WAC) of the flours was determine by the method of Sosulski *et al*. (1976) [21].

The emulsion activity (EA) and emulsion stability (ES) by Yasumatsu *et al*. (1972) [26].

The foam capacity (FC) were determined by Narayana and Narasinga (1982) [13] and expressed as using the formula:

$$\text{Foam capacity (\%)} = \frac{Volume\ of\ foam\ AW - Volume\ of\ Foam\ BW}{Volume\ of\ Foam} \times 100$$

Where,
AW = after whipping, BW = before whipping.

Gelatinization temperature (GT) was measured by Shinde (2001) [19].

Results and Discussion

Various type of functional properties of composite flours were analysed. The swelling capacity (SC) of composite flours ranged from 15.60 to 28.16 ml. The value of swelling capacity was found in composite flour T_{50} (28.16ml), followed by T_{60} (27.43ml), T_{70} (24.76ml), T_{80} (19.16ml), T_{90} (19.0ml) and T_{100} (15.60ml) respectively. The swelling capacity of composite flours depends on size of particles and types of processing methods.

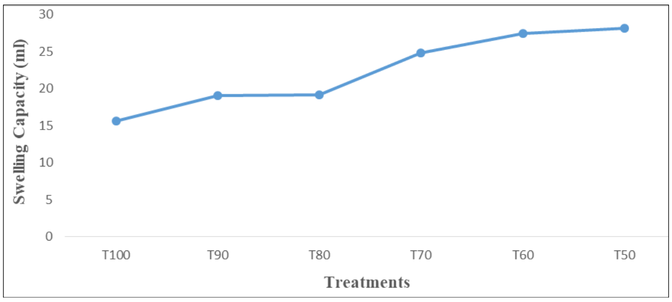

Fig 1.1: Swelling capacity (ml) of composite flours

The water absorption capacity (WAC) was observed highest for T_{50} (172.17) and lowest for control T_{100} (140.26) composite flours. Water absorption capacity or characteristics represent the ability of a product to associate with water under conditions where water is limited (Singh, 2001) [19].

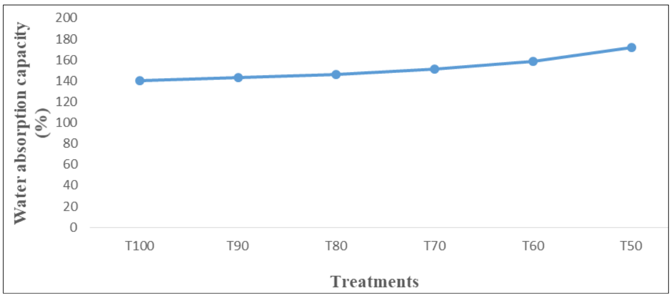

Fig 1.2: Water absorption capacity (%) of composite flours

The emulsion activity (EA) of composite flour was observed in T_{50} (45.18%), followed by T_{60} (43.58%), T_{70} (41.82%), T_{80} (40.23%), T_{90} (40.05%) and T_{100} (40.04%) respectively. Emulsion activity increased with increasing the incorporation of soy bean, carrot, mushroom, and apple pomace powder with wheat flours. Chandra and Samsher (2013) [1]; Kaushal *et al*., (2012) [8] were reported similar trends to find out the emulsion activity.

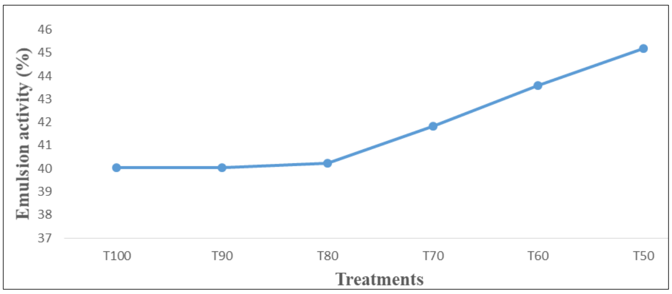

Fig 1.3: Emulsion activity (%) of composite flours

The emulsion stability of composite flour was obtained highest for T_{50} (43.25%) and lowest T_{100} (36.02%) respectively. Emulsion stability can be greatly increased when highly cohesive films are formed by the absorption of rigid globules molecules that are more resistant to mechanical deformation (Graham and Phillips 1980) [4].

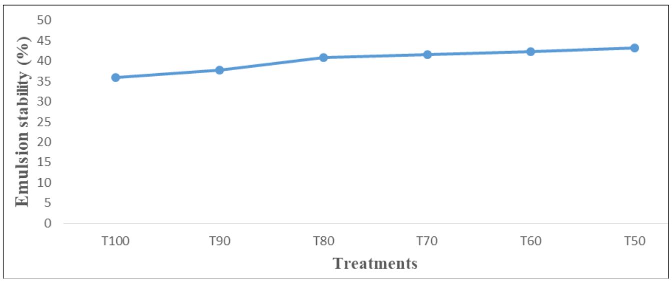

Fig 1.4: Emulsion stability (%) of composite flours

The foam capacity of composite flours is shown in fig.1.5. Foam capacity of composite flours ranged from 12.25% to 17.65%. Highest foam capacity was observed for T_{50} (17.65%) followed by T_{60} (15.99%), T_{70} (14.51%), T_{80} (13.02%), T_{90} (12.41%), and lowest T_{100} (12.25%). Foam is a colloidal of many gas bubbles trapped in a liquid or solid. Small air bubbles are surrounded by thin liquid films. Foam capacity of composite flours was increased with increasing in the blending ratio of different flours. The result of study was also indicated that the decreasing in the proportions of wheat flour increased the foam capacity of the composite flours. Similar trends were found by Fennema (1996).

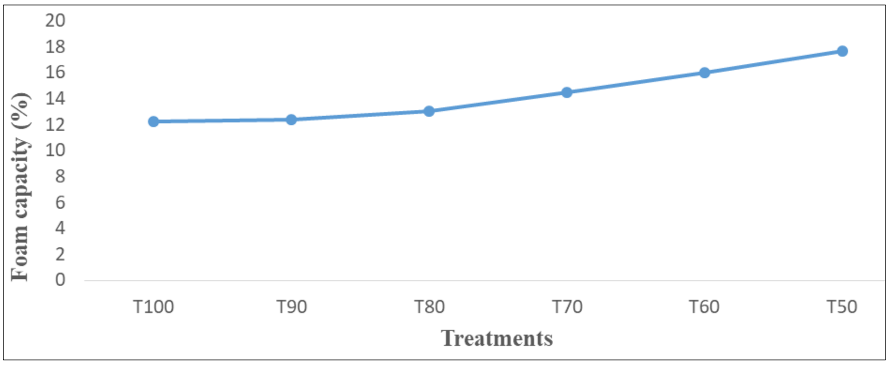

Fig 1.5: Foam capacity (%) of composite flours

Gelatinization temperature of composite flours ranged from 60.75ºC to 72.16ºC. The highest gelatinization temperature was observed for T_{50} (72.16ºC) and lowest control treatments T_{100} (60.75ºC). In the composite flour, the gelatinization temperature was increased with increase in the incorporation of soy bean, carrot, mushroom and apple pomace powder with wheat flour. The gelatinization temperature was found for T_{50} flour (72.16ºC) followed by T_{60} (70.16ºC), T_{70} (63.25ºC), T_{80} (63.16ºC), T_{90} (61.50ºC) and T_{100} (60.75ºC) respectively. Sahay and Singh (1996) [17] were reported the temperature at which gelatinization of starch take place is known as the gelatinization temperature.

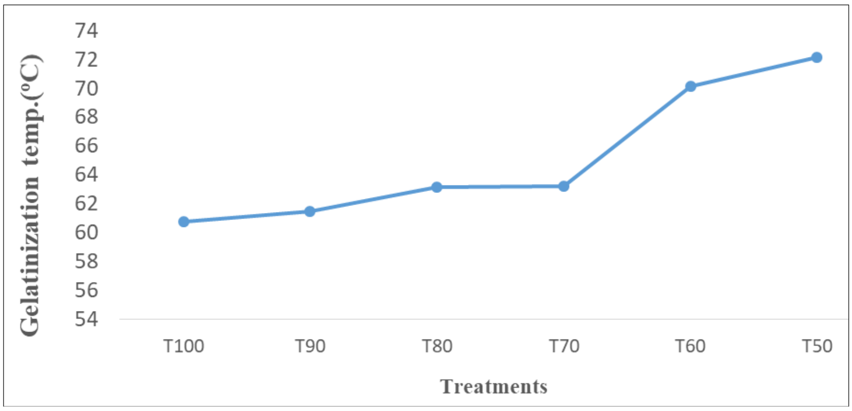

Fig 1.6: Gelatinization temp. (ºC) of composite flours

Conclusions

In this research the functional properties of composite flours such as swelling capacity, water absorption capacity, emulsion activity, emulsion stability, foam capacity, gelatinization temperature were increased with increase in the incorporation of other flours with wheat flour.

The result showed that the T_{50} has highest functional properties of composite flours compared to others.

References

1. Chandra S, Samsher. Assessment of functional properties of different flours. African Journal of Agricultural Research. 2013; 8(38):4849-4852.
2. Fennama RO. Food Chemistry (3rd eds) Basel, Hong Kong: Marcel Dekker Inc. New York, 1996, 36-39.
3. Fu BX. Asian noodles: History, classification, raw materials and processing. J. Food Research International. 2008; 41:888-890.
4. Graham DE, Phillips MC. The conformation of proteins at air-water interface and their role in stabilizing foam. London Academic journal, 1980.
5. Grajek W. Stres oksydacyjny jako przyczyna chorób. in: Przeciwutleniacze wżywności. Aspects zdrowotne, technologize, molecular ianalityczne. WNT, 2007, 69-89.
6. Hou G, Kruk M. Asian Noodle Technology. Technical Bulletin. 1998; 20(12):1-10.
7. Kaur M, Singh N. Relationships between selected properties of seeds, flours, and starches from different chickpea cultivars. Int. J. Food Prop. 2006; (9):597-608.
8. Kaushal P, Kumar V, Sharma HK. Comparative study of physico-chemical, functional, antinutritional and pasting properties of taro (Colocasia esculenta), rice (*Oryza sativa*), pegion pea (*Cajanus cajan*) flour and their blends. LWT-Food Sci. Technology. 2012; 48:59-68.
9. Kinsella JE. Functional properties of protein in food- A survey Crit. Rev. Food Sci. Nutr. 1976; 5:219.
10. Kulkarni SS, Desai AD, Ranveer RC, Sahoo AK. Development of nutrient rich noodles by supplementation with malted ragi flour. International Food Research Journal. 2012; 19(1):309-313.
11. Kumari S, Grewal RB. Nutritional evaluation and utilization of carrot pomace powder for preparation of high Fibre biscuits. Journal of Food Science & Technology. 2007; 44(1):56-58.
12. LIU K. Expanding soybean food utilization. J. Food Technol. 2000; 54(7):46-47.
13. Narayana K, Narsinga RMS. Functional properties of raw and heat processed winged bean (Psophocarpus tetragonolobus) flour. J. Food Sci. 1982; 42:534-538.
14. Oberoi DPS, Sogi DS, Gill BS. Noodle Processing Technology. Bev. Food World. 2007; 34(10):68-70.

15. Okaka JC, Potter NN. Functional and storage properties of cow pea-wheat flour blends in bread making. J. Food Sci. 1977; 42:828-833.
16. Ratman DV, Ankola DD, Bhardwaj V, Sahana DK, Ravi Kumar MNV. Role of antioxidants in prophylaxis and therapy: A pharmaceutical perspective. J. Control. Release. 2006; 113:189-207.
17. Sahay KM, Sing KK. Unit operations of Agricultural Processing. Vikas Publishing House Pvt. Ltd. New Delhi, 1996, 237.
18. Singh U. Functional properties of grain legume flours. J. Food Sci. Technol. 2001; 38:191-199.
19. Shinde BG. Isolation and characteristics of starch horse grain. Unpublished M.Sc. Thesis. Mahatma Phule Krishi Vidyapeeth, Rahuri (India), 2001, 16-17.
20. Siddiq M, Nasir M, Ravi R, Dolan KD, Butt MS. Effect of defatted maize germ addition on the functional and textural properties of wheat flour. Int. J. Food Prop. 2009; 12:860-870.
21. Sosulski FW, Garatt MO, Slinkard AE. Functional properties of ten legume flours. Int. J. Food Sci. Technol. 1976; 9:66-69.
22. Upadhyay A, Sharma HK, Sarkar BC. Characterization and Dehydration Kinetics of Carrot Pomace‖. Agricultural Engineering International: The CIGR Ejournal. Manuscript FP. 2008; 35(l):10.
23. Walde SG, Math RG, Chakkarvarthi A, Rao DG. Preservation of carrots by dehydration techniques—A review. Indian Food Packer. 1992; 46:37-42.
24. Wang HJ, Thomas RL. Direct Use of Apple Pomace in Bakery Products. Journal of Food Science. 1989; 54:618-620.
25. Yadav S, Gupta KR. Formulation of noodles using apple pomace and evaluation of its phytochemicals and antioxidant activity. Journal of pharmacognosy and photochemistry. 2015; 4(1):99-106.
26. Yasumatsu K, Sawada K, Maritaka S, Toda J, Wada T, Ishi K. Whipping and emulsifying properties of soy bean products. Agri. Biol. Chem. 1972; 36:719-727.