Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-7: 4554-4561

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-7 pp. 4554-4561**
Journal homepage: http://www.ijcmas.com

Original Research Article

Standardize the Baking Time for Rice Cookies and Color Values for Celiac Disease

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A B S T R A C T

Bakery products are the most popular food consumed by all age groups in all over the world. Among all bakery products, cookies are predominant, with vast combinations of texture and taste giving them a universal appeal. The per capita consumption of biscuit in India is 8 Kg per annum in comparison to 15 Kg per annum in developing countries. Biscuits or cookies are considered as the lowest cost processed foods in the country, when compared to Indian sweet meats, salted snacks, wafers and savoury items. Gluten is an essential structure-building protein used through white wheat flour in bakery products, which affect the appearance, mouthfeel, colour and texture final products. Celiac disease is an important disease associated with the allergic reactions and intolerances to gluten consumption. Therefore, in the present investigation attempts have been made on the development of gluten-free rice based cookies using hydrocolloid (guar gum) as binding material. In preliminary optimization the baking time of 12 to 14 minutes was found suitable for rice cookies under the condition of 170 ± 5°C upper and 185 ± 5°C as lower burner temperature to provide the similar objective colour (L, a, b and ΔE) characteristics of cookies in respect with white wheat flour (maida) cookies. The optimized composition as 162.27 gm rice flour and 11.97 gm Corn starch with the other fixed non varied ingredients was found suitable to get characteristic cookies. Further studies may be explored with the use of other hydrocolloids to develop functional gluten-free processed products in different combinations to make the baked product suitable for automatic process line with low cost, nutritious, organoleptic acceptable so as to provide the products range to the patient having limited product options and suffering from celiac diseases.

Keywords

Bakery product, celiac diseases, rice cookies, wheat flour, color value

Introduction

Bakery products are the most popular food consumed by all age groups in all over the world. In India bakery products are increasingly becoming popular as indicated by over 2.5 fold increase in their production during last two decades [1]. The production of bakery product in India is 3 million tones [2]. Among all bakery products, cookies are predominant, with vast combinations of texture and taste giving them a universal appeal. Biscuits in India is accounting for more than 30% of total bakery products production. The per capita consumption of biscuit in India is 8 Kg per annum in comparison to 15 Kg per annum in developing countries [3]. Cookies are considered as the lowest cost processed foods in the country, when compared to Indian sweet meats, salted snacks, wafers and savoury items. Apart from offering

nutrition and taste, they can be packed in a variety of sizes. Gluten is an essential structure-building protein used through white wheat flour in bakery products, which affect the appearance, mouthfeel, colour and texture final products. In contrast to bread, in cookies the gluten network is restricted to develop for the dough to be cohesive without being too elastic [4]. Cohesive dough with low elasticity can also be formed from gluten-free composite flours.

Celiac disease is an important disease, which is associated with the allergic reactions and intolerances to gluten consumption. The chronic inflammation of mucosa in the proximal small intestine causing the progressive disappearance of the villi, which leads to the malabsorption of several important nutrients including iron, folic acid, calcium and fat-soluble vitamins.

The only effective treatment for celiac disease is a strict adherence to a gluten-free diet throughout the patient's lifetime which, in time, results in clinical and mucosal recovery [5].

In recent years there has been increasing interest on gluten-free bakery products, mainly involving the approach of incorporation of starches, dairy proteins and hydrocolloids. The application of gums to dough has been reported to give increased yields as well as give the dough a greater resilience with less flabby appearance. The baked products were also said to have a better texture as well as longer shelf life. A well mixed dough containing guar gum has excellent sheeting properties. Rolls and bread augmented with guar gum had a soft texture and improved shelf life [6].

During the early part of the 18th century North Americans began to use the word "cookie" to define a small, sweet, flat or slightly raised confection. The term cookie is derived from the Dutch word "koekje or koekie", meaning to a small cake. Cookies as they are called in the USA (Semi-sweet short dough biscuits) are made from soft wheat flour and are characterized by a formula high in sugar and shortening and relatively low in water [7, 8]. Alternatively, Biscuits are small baked products made principally from flour, sugar and fat having moisture content of less than 5 % and when packed in moisture proof containers have long shelf lives, perhaps six months or more [9].

Bakery products, particularly biscuits are wide popular in rural as well as urban areas among all the age groups [10] and as an important food product used as snacks by children and adult in the world. The production of biscuit was estimated at the level of 7 lakh tones with annual turnover of about 15 billion Indian Rupees [11]. The production of biscuit with bread have increased from 5 to 19 lakh tones from 1975 to 1990 and 19 to 30 lakh tones during 1990 to 1999, respectively, recording six fold increase in a quarter of a century [3]. In India, total number of units producing biscuit and bread belong to medium and small scale sector and their number is estimated at about 4800. The per capita consumption of biscuit in India is 8 kg per annum as against 15 kg per annum in developed countries, which is increasing gradually [3].

There is no literature available for the development of cookies from the mixture of gluten-free rice based composite flour. Therefore it was considered desirable to replace the wheat flour by broken rice and corn starch composite flour and develop cookies which would be similar in sensory characteristics as those based on wheat flour alone.

Materials and Methods

Preparation of rice flour

Cleaned broken rice grains were tempered at 14 % moisture by following the procedure of AACC [14]. Tempered broken rice grains were milled in dry grinder in the Department of Food Technology, Sant Longowal Institute of Engineering and Technology, Longowal, Punjab. The flour sample thus obtained was sieve through standard mesh Size sieve (100µ) and the obtained sieved flour was stored in an airtight container under refrigerated condition (4 ± 2ºC) prior to their use in the actual experiment.

Isolation and purification of starch from broken rice grains

Starch was isolated from broken rice grains by a little modified method described by Ai Bayati *et al.*, [15] and Grant, L. A. [16]. Cleaned broken rice grains were steeped in distilled water (1:2, w/v) for 12 hours. The steeped grains were washed thoroughly with distilled water and then subjected to ground in a wet grinder to make slurry. The resultant slurry thus obtained was filtered through muslin cloth followed by sieving through standard mesh sieve (100µ). Then, supernatant was mixed well using shaker for 5 minute with eight times volume of distilled water and kept under refrigerated condition (4 ± 2ºC) for 8 hour.

After that, the water containing water-soluble protein was removed by removing the supernatant carefully. The starch paste prepared by mixing residue with the remaining water was then mixed with eight times volume of sodium hydroxide solution (0.25g/100g) containing sodium sulphate (0.12g/100g) and kept under refrigerated condition (4 ± 2ºC) for 8 h. The supernatant was decanted off after the soaking time was completed. The isolation step was repeated three times. Then, the paste was neutralized with 0.5 (N) HCl. Then, the starch solution was filtered through Buckner funnel under vacuum to remove the washed water during each step of washing. The filtered cake (starch) was dried at 50ºC to less than 12 % moisture content, ground, passed through 100µ sieve and stored in gip-type plastic bag.

Preparation of cookies

The process of cookie preparation either from maida or rice flour is presented in Fig. 2. The production process consisted of dough mixing, dough sheeting, dough relaxation, and cookie.

Results and Discussion

Standardization of baking time for cookies

Colour is an important parameter in judging the acceptability of cookies. The objective colour values for plain and rice cookies were evaluated using Hunter Colour lab for L, a, b values during entire baking up to 15 minutes (Table 2). The lightness (L value) decreased from 76.21 to 48.57 and 74.61 to 48.65 in plain cookies and rice cookies, respectively during baking (Fig 2). Change in the ’a value ‘ was found increasing in cookies from 0.51 to 11.37 and -1.13 to 10.49 for plain and rice cookies, respectively (Table 2), which is also evident from Fig 3. The ‘b value ‘, which is an indication of change in the yellowness increased from 18.00 to 23.64 during initial baking up to 12 minutes and further decreased to 18.39 for plain cookies (Table 2). The similar trend was observed for rice cookies where the b value increased from 16.17 to 21.89 till 12 minutes baking and further decreases to 17.87 (Fig 4).

Fig.1 Flow diagram for the preparation of rice flour

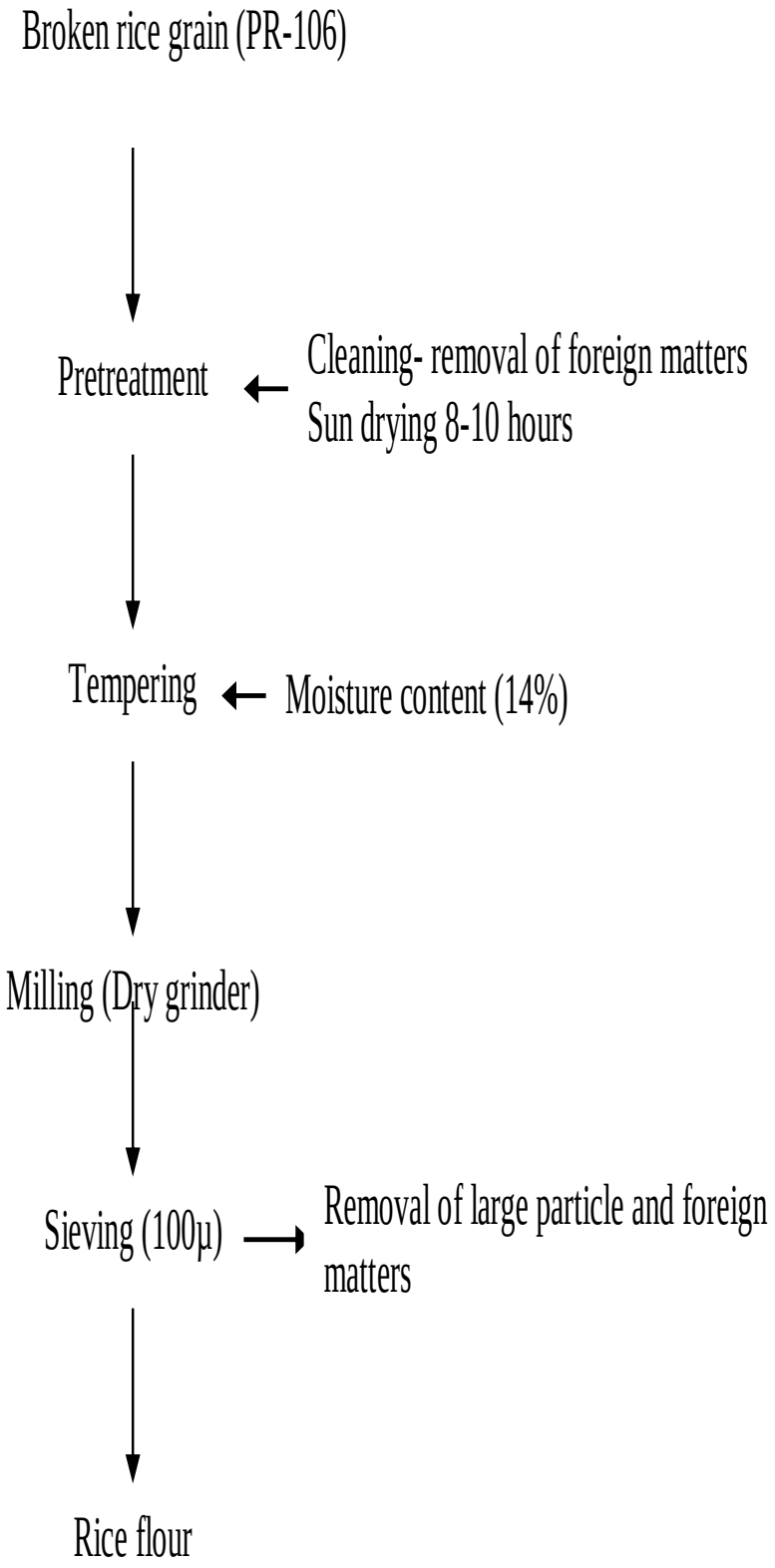
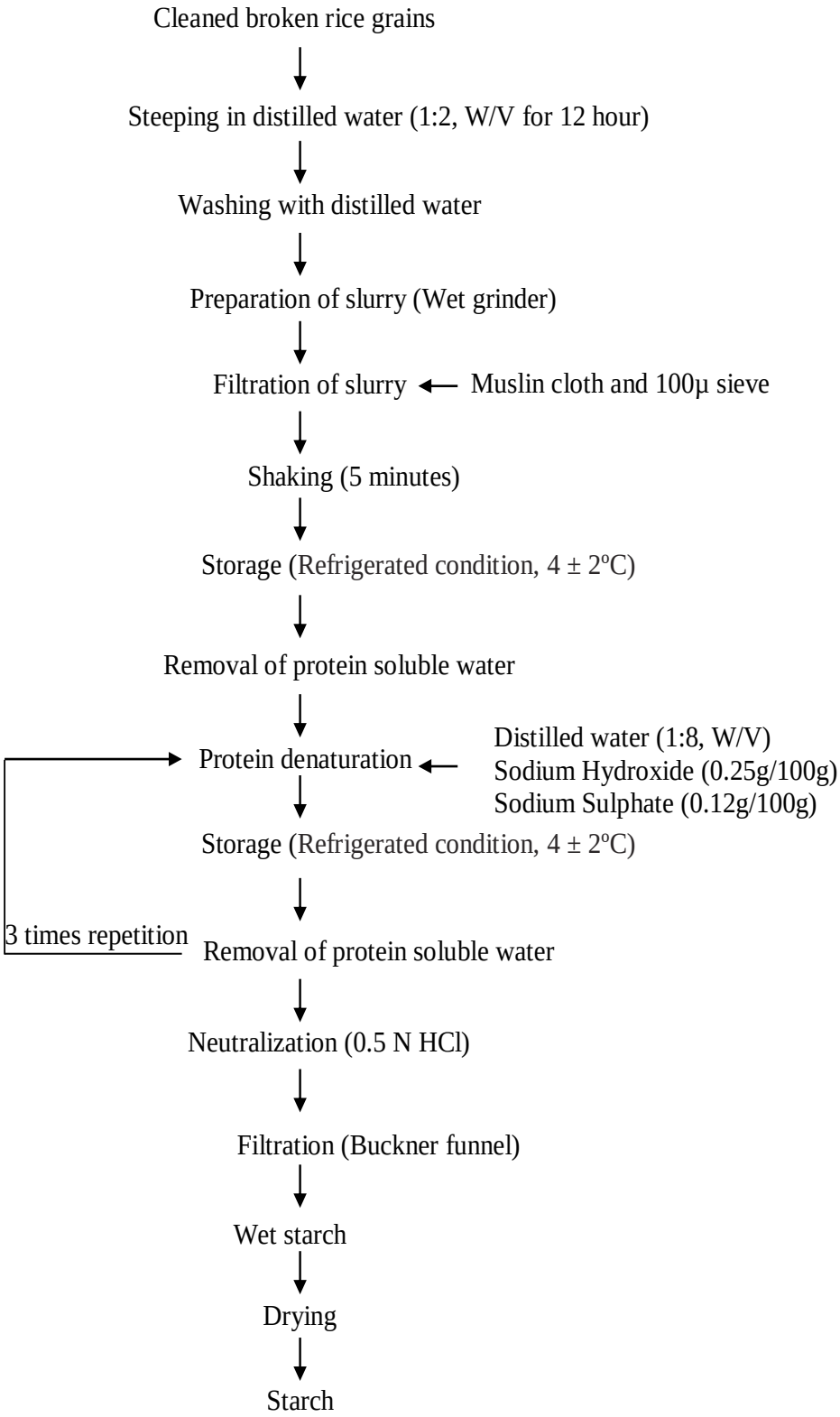


Fig.2 Flow diagram for isolation and purification of starch from broken rice grains



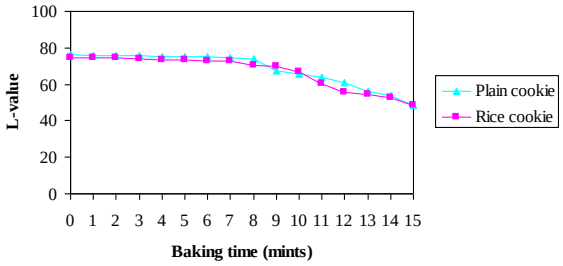


Fig. 2. Effect of L-value for the baking kinetics of cookies dough as a function of corn starch and rice flour

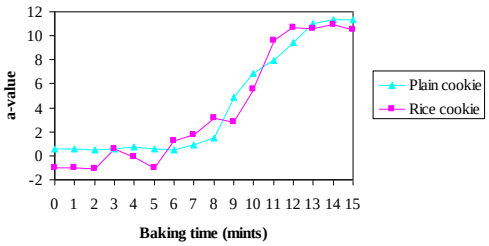


Fig. 3. Effect of a-value for the baking kinetics of cookies dough as a function of corn starch and rice flour

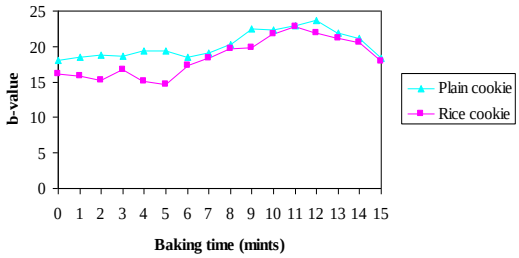


Fig. 4. Effect of b-value for the baking kinetics of cookies dough as a function of corn starch and rice flour

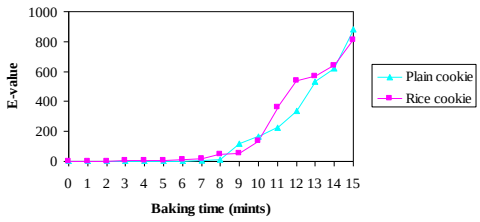


Fig. 5. Effect of ◁E-value for the baking kinetics of cookies dough as a function of corn starch and rice flour

Table.1 Central composite rotatable design for preparation of cookies

Exp. No.	Coded values		Un-coded values	
	Corn starch	Rice flour	Corn starch	Rice flour
	---	---	(gm)	(gm)
1	-1	-1	7.32	157.32
2	1	-1	42.68	157.32
3	-1	1	7.32	192.68
4	1	1	42.68	192.68
5	-1.414	0	0	175
6	1.414	0	50	175
7	0	-1.414	25	150
8	0	1.414	25	200
9	0	0	25	175
10	0	0	25	175
11	0	0	25	175
12	0	0	25	175
13	0	0	25	175

Table.2 Effect of baking time on colour of plain and rice cookies

Baking state of cookies dough	Baking time	Plain cookies				Rice cookies			
		L	a	b	ΔE	L	a	b	ΔE
	(min)	-	-	-	-	-	-	-	-
Unbaked	0	76.21	0.57	18.00	0.00	74.61	-1.00	16.17	0.00
	1	75.82	0.56	18.44	0.59	74.56	-1.04	15.78	0.40
	2	75.68	0.52	18.72	0.90	74.5	-1.13	15.26	0.93
	3	75.47	0.54	18.66	0.99	73.98	0.56	16.65	1.75
	4	75.44	0.76	19.33	1.55	73.42	-0.09	15.09	1.85
	5	75.30	0.58	19.45	1.71	73.33	-1.03	14.58	2.04
	6	75.29	0.51	18.51	1.05	72.77	1.23	17.36	3.13
	7	74.37	0.87	19.04	2.13	72.58	1.69	18.38	4.03
	8	74.00	1.48	20.28	3.30	70.56	3.10	19.66	6.74
	9	67.19	4.84	22.43	10.92	69.68	2.81	19.76	7.19
Partially baked	10	65.91	6.89	22.27	12.82	66.72	5.57	21.79	11.70
	11	64.11	7.92	22.97	15.00	60.29	9.62	22.74	19.00
Baked	12	61.23	9.43	23.64	18.30	55.34	10.69	21.89	23.25
	13	55.98	10.98	21.85	23.07	54.47	10.62	21.18	23.79
	14	54.02	11.37	21.16	24.88	52.71	10.96	20.51	25.33
Over baked	15	48.57	11.31	18.39	29.66	48.65	10.49	17.87	28.44

The total colour difference (ΔE) value increased from 0.00 to 29.66 and 28.44 for the plain and rice cookies, respectively (Table 2), which revealed that there is no significant ($P \leq 0.05$) difference at 13 minutes and 14 minutes baking time (Fig 5). Thus, on the basis of baking state cookies were classified as unbaked (0-9 minutes), partially baked (10-11minutes), baked (12-14 minutes) and over baked (15 minutes) (Table 2).

The present investigation entitled "Studies on the formulation of the rice (Oryza Sativa) based gluten-free composite flour cookies" was carried out for the optimization of baking time and ingredient formulation in the preparation of gluten-free rice based cookies. The baking time of 12 to 14 minutes was found suitable for rice cookies under the condition of 170 ± 5° C upper and 185 ± 5°C as lower burner temperature to provide the similar objective colour (L, a, b and ΔE) characteristics of cookies in comparison with white wheat flour (maida) cookies. Further studies may be explored with the use of other hydrocolloids to develop functional gluten-free products in different combinations to make the baked product suitable for automatic process line with low cost, nutritious, organoleptic acceptable so as to provide the products range to the patient having limited product options and suffering from celiac diseases.

References

1. Puranik, D. B. (2003). Milk byproducts as functional ingredients in bakery products. *Beverage Food World*, 30:21-22.
2. Samanth, P. (2002). Baking profits. *Times Food Process*. March-April, pp 8-13.

3. Shukla, F. C., Shilpa, M., and Thind, S. S. (2000). Bakery industry in India – present quality control and future scenario – A review. *Beverage and Food World*, 27:11–15.
4. Contamine, A. S., Abecassis, J., Morel, M. H., Vergnes, B. and Verel, A. (1995). Effect of mixing conditions on the quality of dough and biscuits. *Cereal Chemistry*, 72:516–522.
5. Gallagher, E., Gormley, T. R. and Arendt, E. K. (2004). Recent advances in the formulation of gluten-free cereal-based products. *Trends Food Science Technology*, 15:143–152.
6. Cawley, R. V. (1984). The role of wheat flour pentosans in baking. *Journal Science Food Agriculture*, 15:834–841.
7. Wehrle, K., Gallagher, E., Neville, P., Keogh, M. K. and Arendt, E. K. (1999). Microencapsulated high-fat powders in biscuit production. *European Food Research and Technology*, 208:388–393.
8. Gallagher, E., O' Brien, C. M., Scannell, A. G. M. and Arendt, E. K. (2003). Use of response surface methodology to produce functional short dough biscuits. *Journal of Food Engineering*, 56:269–271.
9. Manley, D. (1998) In: Manley D (edition) Biscuit, cookie and cracker manufacturing manuals, Manual 1. *Woodhead Publishing Limited*, Cambridge.
10. Agrawal, S. R. (1990). Prospects for small-scale biscuit industry in the nineties. *Indian Food Industry*, 9:19–21.
11. Alagh, S. K. (1990). Biscuit industry in India future scenario. *Indian Food Industry*, 9:22–23.
12. Hoseny, R. C. (1986). Soft wheat products. In: Principles of cereal science and technology. *American Association of Cereal Chemists, Minnesota*, 282 p
13. Manley, D. J. (1983). Technology of Biscuits, crackers and cookies. *Chichester, U.K., Ellis Horwood Limited*.
14. American Association of Cereal Chemists (2000). Approved methods of the AACC. American Association of Cereal Chemistry, St. Paul, MN.
15. Al Bayati, S. H. and Lorenz, K. (1975) Chemical properties of starches isolated from iraqi rice varities. *Lesbenmittel-Wisseneschaft-und-Technologie* (LWT), 8(4)163-167.
16. Grant, L. A. (1998). Effects of starch isolation, drying, and grinding techniques on its gelataniztion and retrogradation properties. *Cereal Chemistry*, 75(5)590-594.
17. A.O.A.C., (1995). Official Methods of Analysis, *Association of Official Analytical Chemists*, Washington D.C.
18. A.O.A.C., (1975). Association of Official Analytical Chemists. *Association of Official Analytical Chemists*, Washington D.C.
19. Dubois, M., Gilles, K. B., Hamilton, G. K., Rebers, P. A. and Smith, F. (1956). *Analytical Chem*., 28:350-354.
20. Wankhede, D. B. and Tharanathan, R. N. (1976). Sesame (*Sesamum indicum*) *Carbohydrates. Journal of Agri. Food Chem*., 21:655-659.