

# Physico Chemical and Rheological Properties of Wheat Flour Bun Supplemented with Orange Peel Powder

Aastha Raj<sup>1</sup>, Dorcus Masih<sup>2</sup>

<sup>1</sup>M.Tech. Food Engineering, Department of Food Process Engineering, Vaugh School of Agriculture Engineering and Technology, Sam Higginbottom Institute of Agriculture, Technology and Sciences, SHIATS University P.O Naini, Allahabad, U.P-211007, India

<sup>2</sup>Assistant professor, Department of Food Process Engineering, Vaugh School of Agriculture Engineering and Technology Sam Higginbottom Institute of Agriculture, Technology and Sciences, SHIATS University P.O Naini, Allahabad, U.P-211007, India

**Abstract:** *This study aimed to find out the effects of supplementation of wheat bread with food industry by-products, orange peels, at 5%, 7% and 10% levels. The results shows that orange peels contained 3.5%,2.67%,6.69%,2.0%,2.35%,85.37% moisture protein, ash ,fat,fiber,and carbohydrates, respectively. The proximate composition of bun fortified with 5% orange peel powder moisture 2.3%, carbohydrate 56.8%, protein32.65%, fat 1.9% and ash 2.3%.The rheological analysis showed that maximum resistance to extension was found to be increasing from 496 in wheat flour to 527 mm in wheat flour containing 5% orange peels powder, while increasing the addition of orange peels to 7% caused an increase in dough resistance to extension was 528 and at 10% dough resistance to extension was 403 B.U. The results also indicated that addition of orange peels to wheat flour caused an increase in arrived time and a decrease in dough stability. The bun samples prepared by adding orange peels have lead to increase in the water absorption while the arrival time and dough stability were decreased. So fiber as a food industry by product is recommended to be used as food additives to gain nutritional and healthy benefit.*

**Keywords:** Orange peel Rheological Properties, Extensibility, Farinogram

## 1. Introduction

An orange is a type of citrus fruit which people often eat. Oranges are a very good source of vitamins, especially vitamin C **Romero and Rodriguez (1992)**. Food processing by products have become an important sanitary problem material to be studied. Such efforts have been made for converting these refused materials into valuable products **Tresca (2012)**.

There are some nutritional wastes such as orange peels that are considered important factors of therapeutic diets and nutrient effect supplying essential nutrient elements such as fiber, vitamin, and mineral to human body. Orange peels are a waste product of orange fruits used for processing. They represent <5% of fresh fruit and have a hard horny shell containing an oily kernel. **Khalifa(1998)**

Citrus is the most abundant crop in the world, 63.95 and 12.53 million tons of orange and lemon products were produced during 2004, respectively **Laufenberg(2003)**. Brazil is the world's leading orange producer, with an output almost as high as that of the next three countries combined (the United States, India, and China).

Dried citrus peels are rich in cellulose, hemicelluloses, proteins and pectin, the fat content is however low **Dhillon and Gill (2004)**. In the citrus processing industry citrus peels is the major solid by-product and comprises around 50% of the fresh fruit weight. Orange peel contains many nutrients like essential oil, protein, fiber, vitamin C etc. The citrus waste can be used as raw material for pectin extraction or in pelletized form for animal feeding. However, the citrus waste

has to be dried first, and none of these processes has been found to be very profitable. The aim of the study is to find out the effect of supplementation of wheat bun with various levels of orange peel powder.

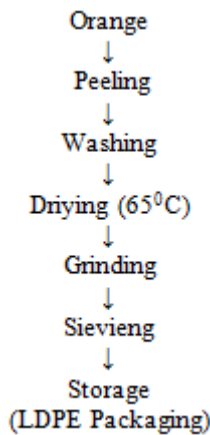
## 2. Material and Method

### 2.1 Procurement of Material

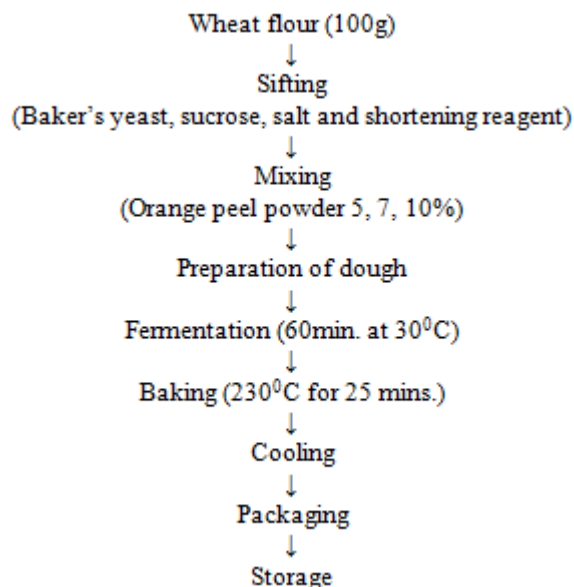
The materials such as orange, orange peel, wheat flour and packaging material will be procured from the local market of Allahabad.

### 2.2 Preparation of Samples

The materials used in the present study were brought from the local market. These materials were food industry by-products, orange (*Citrus sinensis*) peels. Orange peels were well washed and dried at 63°C using a hot air oven. A laboratory grinder was used to give powder. The ingredients which were used in bun making were bought from local market. These ingredients included: wheat flour, compressed baker's yeast, sucrose, salt and shortening.



**Figure 1:** Flow chart of Orange peel powder (Source Babiker *et. al.*2013)



**Figure 2:** Flow Chart for Preparation of Orange peel supplemented Bun (Source Pomorenze *et.al* 1977)

### 2.3 Physio Chemical Composition

The chemical composition of the different samples was determined. These analyses included the contents of moisture, protein, ash and crude fibre using AOAC,1990 methods, while fat contents was determined using AOAC,2000 method and carbohydrates content was determined according to FAO,1982.

### 2.4 Rheological Analysis of Bun Dough

Citrus by-products blends at 0, 5, 7 and 10% levels were prepared by replacing wheat flour. The effect of citrus by-products (orange peel and pulp) on the mixing profile of the dough was studied by two methods Farinograph and Extensograph which were carried in CFTRI, Mysore.

#### 2.4.1. Farinograph Test

Water absorption (amount of water required for the dough to have consistency of 500 Brabender units line), arrival time (the time in minutes required for the curve to reach the 500 Brabender unit line after the mixer will be started and water will be added, mixing time (the time in minutes from the first addition of the water to development of dough's maximum

consistency), stability (the time in minutes elapsing when the top of the curve intersects first 500 B.U. line leaves that line) and softening of wheat flour dough and its blends with orange peel was determined according to AACC (2000) methods using a Farinograph type (PL) (Brabender Farinograph, Germany). 250 grams of tested samples (14% moisture basis) were used.

#### 2.4.2. Extensograph Test

Extensograph test was carried out according to the method described by AACC (2000) to measure the following data:

- dough extensibility (E) (the total length of the base of the extensogram measured in millimeters).
- dough resistance to extension (R) ( the height of the extensograph curve was measured in Brabender units after 5 minutes from the start.
- dough energy (represented by the area in Cm<sup>2</sup> out lined the curve) and the peak height ( the maximum height of the extensograph curve measured in Brabender units).

### 2.5 Bun Making

Bread was made using the 100 - g straight dough method. The basic formula included 100 g of flour, 2 g of compressed baker's yeast 1 g of sucrose , 2 g of salt, 1 g of shortening , water as needed, and different concentrations of orange peel, which has been added at 5, 7 and 10 % concentration on a flour replacement basis. The dough was fermented for 60 min. at 30 °C followed proof period for 15 min. Breads were baked at 230 °C for 25 min.

**Table 1:** Treatment combinations used for the preparation of bun

S.No.	Treatments	Refined flour(g)	Orange peel powder(%)
1	Control	100	0
2	T1	95	5
3	T2	93	7
4	T3	90	10

## 3. Result and Discussion

### 3.1. Physicochemical Analysis of Orange Peel powder and Incorporated Bun

The physico-chemical composition of sample was determined. The physico-chemical composition of sample was determined. The analysis included the contents of moisture, protein, ash, fiber, fat and carbohydrate was determined. The orange peel powder contained 3.5% moisture, 2.67% protein, 6.69% ash, 2% fat, 2.35% fibre and 85.37% carbohydrate. As shown in table 2. Similar observations were observed by (Nassar 2008).

The moisture ,protein, ash, fiber, fat and carbohydrates were determined for the control bun (100% wheat flour) and the bun supplemented with different levels(5,7and10%) of orange peel as indicated in table 2. It could be noticed that supplementation of bun with orange peel powder associated with the increasing of moisture, protein, ash, fiber, fat and carbohydrate. This increase in moisture, protein ash, fiber and fat due to relative increase of these nutrients in orange peel powder. The protein content increase in orange peel powder resulted in increased levels of fiber and ash which

were significant at ( $P < 0.05$ ). Protein content contribute to the ability of dough to rise and maintain its shape as it baked. Increases in the proportion of glutenin in the blend generally increased mixing time. Ash content is an indication of the level of minerals present in a food material. This suggests that orange peels can help in boosting the mineral content of wheat bread. Fiber has been reported to have a high water binding capacity, therefore increase in fiber content. The carbohydrate decrease due to orange peel powder has less sugar. Similar results were obtained by Babiker (2013).

**Table 2:** Chemical Composition of Orange peel powder and Control bun and bun supplemented with Orange Peel powder

Parameters	Orange peel powder	Bun supplemented with Orange peel powder			
	Values	T0	T1	T2	T3
Moisture	3.5	2.04	2.31	2.4	2.6
Protein	2.67	31.7	32.65	33.90	34.5
Ash	6.69	2.1	2.3	2.6	2.7
Fat	2.0	9.51	9.39	9.47	9.50
Fiber	2.35	1.8	1.9	1.98	2.0

### 3.2 Rheological Properties

#### 3.2.1 Farinograph Characteristics

The results in Table 3 showed the effect of addition of orange peels to wheat flour on farinograph readings. From these results it could be noticed that, addition of orange peels, to wheat flour increased dough water absorption, from 49.2, 53.6, 59.3 and 63.0%, for wheat flour and with addition of 0, 5, 7 and 10% of orange peels, respectively. The results also indicated that addition of orange peels to wheat flour caused an increase in arrived time and a decrease in dough stability. Arrived time was found to be 4.8, 4.2, 3.0 and 3.5 min, dough stability was found to be 5.3, 4.2, 4.1, 2.7 min at the levels 0%, 5%, 7% and 10%, respectively. However, mixing tolerance was found to be 52, 76, 52, and 96, at different levels of orange peel addition.

**Table 3:** Farinogram parameters for dough prepared from wheat flour and wheat flour containing orange peel

Dough type	Water absorption (%)	Dough development (arrived) time (min)	Dough stability (min)	Mixing tolerance index (BU)
T <sub>0</sub>	49.2	4.8	5.3	52
T <sub>1</sub>	53.6	4.2	4.2	76
T <sub>2</sub>	59.3	3.0	4.1	52
T <sub>3</sub>	63.0	3.5	2.7	96

#### 3.2.2 Extensograph Characteristics

From the results presented in Table 4. It could be noticed that, extensibility of the dough decreased from 137 min in wheat flour to 100 min in wheat flour containing 5%, 7%, 10% orange peels powder, respectively. Maximum resistance to extension was found to be increasing from 496 in wheat flour to 527 mm in wheat flour containing 5% orange peels powder, while increases 528 mm the addition of orange peels to 7% and at 10% decrease in dough resistance to extension to 403 B.U., respectively. The extensibility of the dough decreased and maximum resistance to extension increased by increasing the levels of nutritional wastes in all samples. Similar results were observed by Singh (2013).

**Table 4:** Extensogram properties of dough prepared from control wheat flour, and dough supplemented with orange peels (DOP) at different levels

Dough type	Resistance to extension-R (BU)	Extensibility-E (min)	Ratio figure	Energy (cm <sup>2</sup> )
T <sub>0</sub>	496	137	3.6	88
T <sub>1</sub>	527	111	4.7	78
T <sub>2</sub>	528	106	5.0	75
T <sub>3</sub>	403	100	4.0	55

### 4. Sensory Analysis

Data indicated that the score of bun containing 5% orange peel flour were found to be most acceptable. At 5% level of incorporation, all the attributes scored highest score level. The colour scores of bun with 5% orange peel flour reached maximum than to rest of the proportions. Thus, incorporation of orange peel flour 5% level improved the sensory attributes namely texture, flavor, color, and over all acceptability. The nutritional quality of the developed bun was enhanced due to the addition of orange peel flour. Thus, the sensory evaluation depicts that highest amount of orange peel powder that can be incorporated to develop acceptable bun was 5% i.e., sample T<sub>1</sub> was the best regarding all sensory attributes. The results were in conformity with Femenia (1997). The analysis of variance of the data obtained was done completely Randomized Design (CRD) for different treatments as per the methods given by Panse and Sukhatme (1967). Data were assessed by analysis of variance (ANOVA)

### 5. Conclusion

It is concluded that highly nutritious bun may be prepared by incorporating a level of 5% orange peel powder without adversely affecting the overall acceptability of the product. Among four treatments the first treatment i.e., 100:5 sample was found to be the best depending upon different sensory attributes like color, texture, flavor, and over all acceptability. This was so because the values for all sensory attribute were maximum. The texture parameters are having acceptable results at 5% incorporation of orange peel powder. The results in rheological analysis indicated that addition of orange peels to wheat flour caused an increase in arrived time and a decrease in dough stability in Farinograph and in Extensograph the extensibility of the dough decreased and maximum resistance to extension increased by increasing the levels of nutritional waste in all samples.

### 6. Acknowledgement

The authors would like to express their sincere gratitude to all who helped the execution of this work. I would like to acknowledge gratitude to all the teachers of Department of Food Process Engineering, SHIATS who helped and guided me during course of study and in this work.

### Reference

- [1] A.A.C.C. (1987). Approved Methods of the American Association of Cereal Chemists . Published by American

- Association of cereal Chemists, Ins. St. Paul, Minnesota, U. S. A.
- [2] A.O.A.C. (1990). Official Methods of Analysis, 14th ed. Association of Official Analytical Chemists. Washington, D.C., USA.
- [3] AACC (2000) 10<sup>th</sup> Edn. St. Paul. Minnesota (No.54-21).
- [4] AOAC. (2000). Association of Official Analytical Chemists, Official Methods of Analysis (17th Ed.). Arlington, VA. USA.
- [5] Babiker W.A.M., Abdel Moneim E. Sulieman, Sirekhatim B. Elhardallou, Elamin A. Khalifa 2013. Physicochemical Properties of Wheat Bread Supplemented with Orange Peel By-Products, *International Journal of Nutrition and Food Sciences*. Vol. 2, No. 1, 2013, pp. 1-4.
- [6] Braddock, R. J. & Graumlich, T. R. (1981). Composition of fiber from citrus peel, membranes, juice vesicles and seeds. *Lebensm.-Wiss. u. Technol.*, 14, 229-31.
- [7] Braddock, R. J. & Graumlich, T. R. (1999). Composition of fiber from citrus peel, membranes, juice vesicles and seeds. *Lebensm.-Wiss. u. Technol.*, 14, 229-31
- [8] Chau, C. F., & Huang, Y. L. (2003). Comparison of the chemical composition and physicochemical properties of different fibers prepared from the peel of *Citrus sinensis* L. cv. Liucheng. *Journal of Agricultural and Food Chemistry*, 51, 2615e 2618.
- [9] Collins, J. L.; Kalantari, S. M. and Post A. R., (1982). Peanut hull flour as dietary fiber in wheat bread. *J. food Sci.* 47:1899.
- [10] Dhillon S.S., Gill R.K., Gill S.S. and Singh M. (2004). Studies on the utilization of citrus peel for pectinase production using *Aspergillus niger*. *Inter. J. Environ.*, 61:199 – 210. Dis. 5, 621–627
- [11] El-Badrawy. A. K. (1994). Utilization of refused bread in Egyptian Bread Making. M.Sc., Thesis. Faculty of Agric. Cairo University. Egypt.
- [12] FAO. (1982) : Natural additives from industrial wastes. *Research Continues*, Ain Chams University , 31(1) : 567- 577 .
- [13] Femenia, A., C. Lefebvre, Y. Thebaudin, J. Robertson and C. Bourg, (1997). Physical and sensory properties of model food supplemented with cauliflower fiber. *J. Food Sci.*, 62: 635-639. fermentation with mixed ruminal microorganisms in vitro. *Food borne Pathogen*.
- [14] Khalifa, A.H.; EL-Dengawy, R.A. and Ramadan, B.R. (1998): Chemical composition of pomegranate peel, *Assiut Journal of Agricultural Sciences*, 29(3): 11-18.
- [15] Laufenberg, G., K. Kunz and M. Nystroem, 2003. Transformation of vegetable waste into value added products: (A) the upgrading concept; (B) practical implementation. *Biores. Technol.*, 87: 167-198.
- [16] Nassar A.G., A.A. AbdEl-Hamied and E.A. El-Naggar Food Science and Technology Department, AL-Azhar University, Assuit, Egypt.
- [17] Pomorenze, I., Shogren, M.D., Finney, K.F., and Bechtel, D.B. (1977). Fiber in Bread-making- Effects on Functional properties. *Cereal chem-* 54: 25-41. Pomorenze, I., Shogren, M.D., Finney, K.F., and Bechtel, D.B. (1977). Fiber in Bread-making- Effects on Functional properties. *Cereal chem-* 54: 25-41.
- [18] Singh N, Rajini PS 2013 Studies on the biological activity of potato waste (peel) components for their possible applications. PhD thesis, Mysore, University of Mysore, India; 2002. p. 258.
- [19] Tresca J. Amber (2012). About.com Guide. About.com Health's Disease and Condition. <http://ibdcrohns.about.com/od/dietandnutrition/g/fiber.htm>.
- [20] Wilkins, M.R., Widmer, W.W., Grohmann, K., 2007. Simultaneous saccharification and fermentation of citrus peel waste by *Saccharomyces cerevisiae* to produce ethanol. *Proc. Biochem.* 42, 1614–1619.