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Rheological Properties and Texture Analysis of Wheatflour Bun Supplimented with Orange Peel Powder

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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 rheological analysis of orange peel 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 form the local market. These materials were food industry by-products, orange (Citrus sinenis) peels. Organe 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.

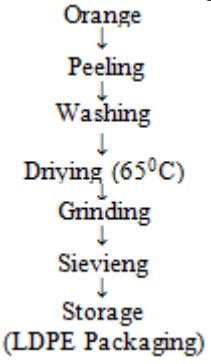

Figure 1: Flow chart of Orange peel powder (Source Babiker*et. al.*2013)

Wheat flour (100g)
↓s
Sifting
(Baker's yeast, sucrose, salt and shortening reagent)
↓
Mixing
(Orange peel powder 5, 7, 10%)
↓
Preparation of dough
↓
Fermentation (60min. at 30^{0}C)
↓
Baking (230^{0}C for 25 mins.)
↓
Cooling
↓
Packaging
↓
Storage

Figure 2: Flow Chart for Preparation of Orange peel supplemented Bun(Source Pomorenz*eet.al* 1977

2.3 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 Extensograh which were carried in CFTRI,Mysore.

2.3.1. 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 developmentof dough's maximum consistency), stability (the time in minutes elapsing when the top of the curve interacts 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) (Barbender Farinograph, Germany). 250 grams of tested samples (14% moisture basis) were used.

2.3.2. ExtensographTest

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 Cm2 out lined the curve) and the peak height (the maximum height of the extensograph curve measured in Brabender units).

2.4. Bun Making

Bread was made using the 100 - g straight dough method. The basic formula included 100 g of flour, 2 g of compressedbaker's yeast 1 g of sucrose , 2 g of salt, 1 g ofshortening , water as needed, and different concentrationsof 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 for15 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 Texture Analysis of Orange Peel Powder Supplemented Bun:

Texture Analysis of Orange Peel Powder Supplemented Bun was done. The product had acceptable quality in the analysis. In texture analysis the force which was applied to the product to check hardness, fraturability, adhesiveness, springiness, cohesiveness, gumminess, chewiness and resilience of the product (bun). Data as shown in fig 4, at 5% level the texture of the product was good.

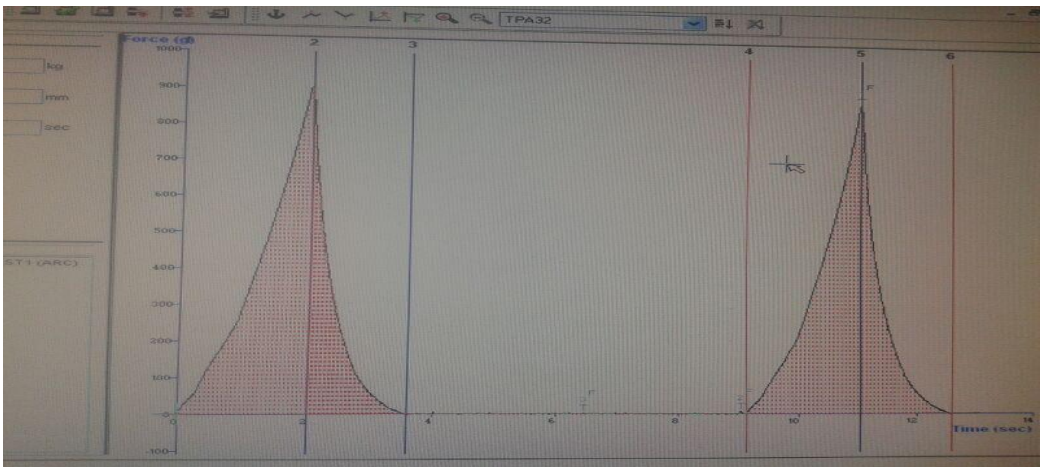

Figure 1: Texture analysis of control Wheat flour bun(T_0)

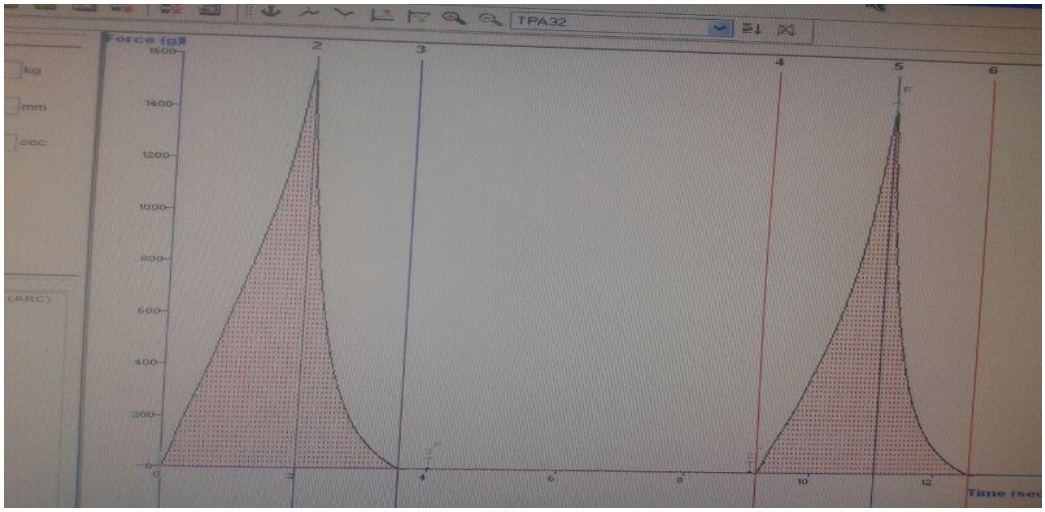

Figure 2: Texture analysis bun supplemented with 5% orange peel powder(T_1)

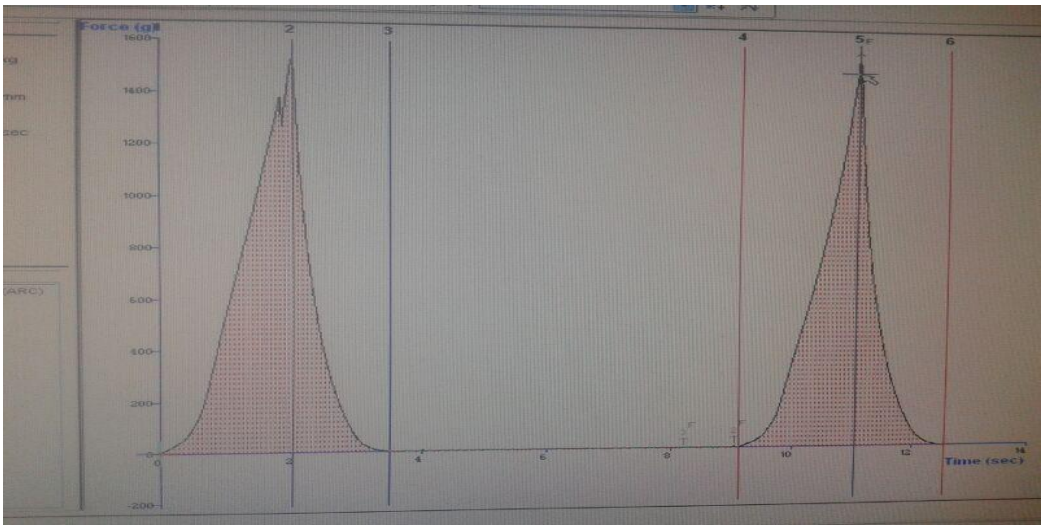

Figure 3: Texture analysis bun supplemeted with 7% orange peel powder (T_2)

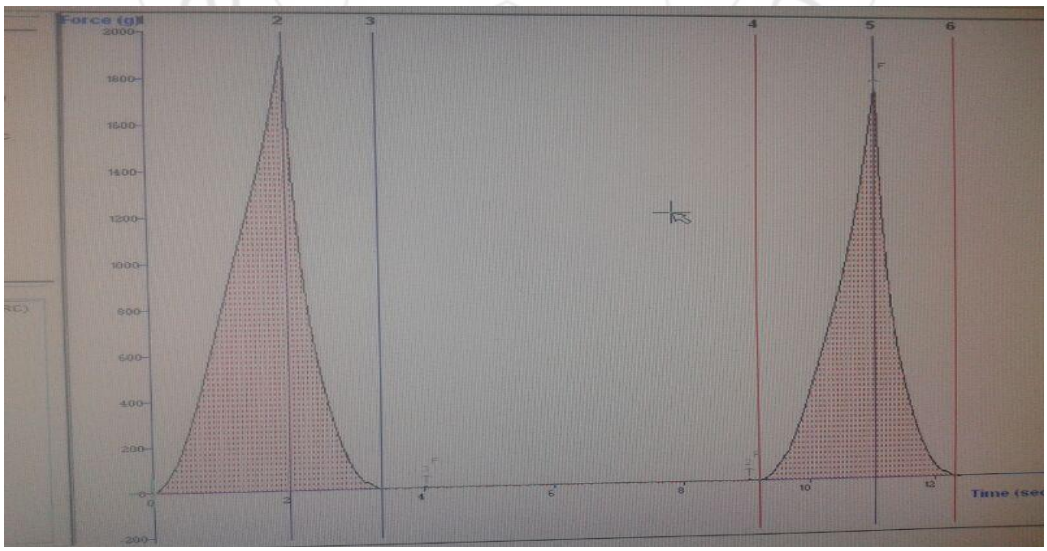

Figure 4: Texture analysis bun supplemeted with 10% orange peel powder (T_3)

Table 2: Texture Analysis of Bun Supplemented with Orange Peel Powder

Test I.D	Batch		Force 1	Area FT 1:2	Time- diff. 1:2	Area- FT 1:3	Area- FT 2:3
			g	gsec	sec	gsec	Gsec
			Force 1	Area FT 1:2	Time- diff. 1:2	Area- FT 1:3	Area- FT 2:3
Start Batch C1	C1						
TPA TEST1	C1		874.542	735.237	2.02	1056.459	321.222
End Batch C1	C1						
Coef. Var.	C1 (F)	STDEV("BATCH")					
S.D	C1 (F)	STDEV("BATCH")					
Avg.	C1 (F)	AVERAGE("BATCH")	874.542	735.237	2.02	1056.459	321.222
Start Batch T1	T1						
TPA TEST2	T1		1463.006	1357.826	2.02	1903.752	545.926
End Batch T1	T1						
Coef. Var.	T1 (F)	STDEV("BATCH")					
S.D	T1 (F)	STDEV("BATCH")					
Avg.	T1 (F)	AVERAGE("BATCH")	1463.006	1357.826	2.02	1903.752	545.926
Start Batch T2	T2						
TPA TEST3	T2		1759.765	1592.872	2.02	2228.769	635.897
End Batch T2	T2						
Coef. Var.	T2 (F)	STDEV("BATCH")					
S.D	T2 (F)	STDEV("BATCH")					
Avg.	T2 (F)	AVERAGE("BATCH")	1759.765	1592.872	2.02	2228.769	635.897
Start Batch T3	T3						
TPA TEST4	T3		1545.694	1221.523	2.02	1724.148	502.625
End BatchT3	T3						
Coef. Var.	T3 (F)	STDEV("BATCH")					
S.D	T3 (F)	STDEV("BATCH")					
Avg.	T3 (F)	AVERAGE("BATCH")	1545.694	1221.523	2.02	1724.148	502.625
End of test data							

Continue.....

Area-FT2:3 gsec Area-FT2:3	Time-diff 4:5 sec Time-diff 4:5	Hardness g Force 2	Fracturability g Force 3	Adhesiveness gsec Variable	Springiness	Cohesiveness	Gumminess	Chewiness	Resilience	Area F-T g sec Area F-T
924.487	1.915	9.647	2.641		0.948	0.875	8.442	8.003	0.437	0.256
924.487	1.915	9.647	2.641		0.948	0.875	8.442	8.003	0.437	0.256
1502.995	1.9	9.877	8.039		0.941	0.789	7.798	7.334	0.402	1.848
1502.995	1.9	9.877	8.039		0.941	0.789	7.798	7.334	0.402	1.848
1675.539	1.945	8.269	8.039	-0.1	0.913	0.752	6.216	5.67	0.399	-0.183
1675.539	1.945	8.269	8.039	-0.183	0.913	0.752	6.216	5.67	0.399	-0.183
1489.828	1.92	6.776	2.641	-0.981	0.95	0.864	5.855	5.565	0.411	0.981
1489.828	1.92	6.776	2.641	-0.981	0.95	0.864	5.855	5.565	0.411	0.981

3.2 Rheological Properties

3.2.1Farinograph 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_0	49.2	4.8	5.3	52
T_1	53.6	4.2	4.2	76
T_2	59.3	3.0	4.1	52
T_3	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^2)
T_0	496	137	3.6	88
T_1	527	111	4.7	78
T_2	528	106	5.0	75
T_3	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_1 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 s

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.

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