



Improve Flour Quality by use Oxidized Agent during Tempering of Local Wheat

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Abstract

The Objective of this study was examined the effect of Oxidized Agent (hydrogen peroxide) added to temper water in order modify the quality of the local wheat flour. Chemical properties (protein, ash) and wet, dry gluten, gluten index and color. Rheological properties were measured by the farinograph, amylograph. Bread quality (Specific volume, Sensory evaluation). The hydrogen peroxide was added at three different levels (0, 0.01, 0.03%) to temper water wheat. Addition of hydrogen peroxide during tempering water wheat led to no significant increase in protein, ash, color and wet, dry gluten contained, but led to significant increase in gluten index. Addition hydrogen peroxide led to no significant increase on farinograph parameters. No significant effect on begin of gelatinization and viscosity temperature but there is significant positive effect on peak of viscosity curve. Significant positive effect on dough and bread quality, improved dough process Specific volume, crust color, symmetry of form, taste and chew ability. The optimal dose of hydrogen peroxide is (0.03%).

Keywords: *Hydrogen peroxide, Tempering, Local wheat, Dough rheology, Gluten, bread.*

Introduction

Tempering is the approach of adding water to wheat before milling to tighten the bran and freed the endosperm of the kernel and thus improve the efficiency of flour extraction [1,2] reported that wheat flour treated with hydrogen peroxide improves influence in a different way texture and color of wheat bread crumb respectively the finished products obtained from them. Hydrogen peroxide present in wheat-flour dough about 1 μ mol of hydrogen peroxide per gram flour, hydrogen peroxide can oxidize sulfhydryl groups to disulfide bonds [3].

According to World Health Organization there is no proof that hydrogen peroxide has obvious carcinogenic effect [4]. Enzymes are usually added to the flour during the dough making. However, this could sometimes cause some problems due to over dosage and non uniform mixing.

Recently [5] who reported the addition of glucose oxidase or transglutaminase to the tempering solution led to a wheat flour with improved gluten-forming strength. The addition of hydrogen peroxide to the

tempering water of wheat may improve new properties of the wheat flour. The objective of this study was to determine the effect of hydrogen peroxide tempering water of wheat on the chemical, physical and rheological characteristics of the produced wheat flour and bread quality.

Materials and Methods

Materials

In this study were used wheat from General Grain Trading Company of Babylon, which is grown in middle Iraq. Wheat properties were as follows: Moisture content, 8.11% test weight, 73 kg/hL, thousand kernel weight, 26 g. protein content, 10.23% Hydrogen peroxide (50%) two dosage were used (0.01, 0.03) based on flour. Were addition as water solution.

Wheat Milling

The amount of water and hydrogen peroxide were calculated to be added to the wheat (5 kg) was calculated after its initial moisture content was measured (8.11%) and the amount of water needed to be tempered was

added to reach 16% moisture using distilled water, tempering process continued through 20 hours at 20C°. Then grinded the Buhler mill, which belongs to the General Company for the manufacture of Baghdad grain, and then the flour was passed through the silk fabric triangular and grade 8 xxx for one degree of flour and bran, the flour samples then stored in polyethylene bags at 4 C ° for necessary tests.

Chemical Determination for Wheat and Flour

Moisture Determination

Moisture were Determine According to standard [6].

Protein Determination

Protein were Determine depending on Kjeldahl method According to standard [6].

Ash Determination

Ash ratio were Determine using a device InFramatic Supplied by the German company Pertin.

Physical Determination for Flour

Color Test

Color were determined using a Color Grader Series IV (Satake UK, Stockport, UK), according to Flour Testing Panel Method No. 007/4 (2000).

Wet and Dry Gluten and Gluten Index

The method used in [7] and numbered (38-12), and using Glutomatic 2200 System which contains a unit for washing the gluten.

Amylograph Test

The amylograph test was performed according to [7].

Farinograph Test

The Farinograph test was performed according to the method mentioned in [7] numbered (54-21) using 300 gm flour based on 14% moisture content.

Baking Test

Bread Processing

The Straight dough method was used according to the method mentioned in [7] and numbered (10-10). The dough mixture consisted of (100 g) flour, (2 g) yeast, (1.5 g)

salt 5g sugar, (3g) fat and (4g) dry milk (Nido). The amount of water for each treatment was added according to the absorbance recorded in the farinograph at 30 C°. Specific volume was measured at one hour after baking by the rapeseed displacement method, described by [7] Method 10-05.01. Calculated the specific volume (volume / weight) (cm³/g).

Sensory Evaluation

Sensory evaluation of the external characteristics (volume, crust color, shred and symmetry of form and crust characteristics) and for internal characteristics (grain, crumb color, aroma and Taste, chew ability and crumb texture) of the baked goods was carried out in accordance with the evaluation system of the American Institute of Bakeries (Dalby and Hill, (1960)). The total score of 100 degrees was distributed according to the API form. These scores was converted into a global concept determined as: very good (>90), good (80–90), regular (70–80) and detestable (< 70)[8].

Statistical Analysis

The data were analyzed according to the Complete Randomized Design (CRD) and using the completed statistical program [9]. The Duncan Multivariate Test was used to determine the significance of the differences between the averages at the probability level of 0.01.

Results and Discussion

Effect of Hydrogen Peroxide Tempering on Chemical and Physical Properties of Wheat Flour

The local wheat was used in this study which was showed that the extraction rate was 72%, which is not different from the extraction rate of tempering wheat with hydrogen peroxide solution 72.5%, protein percent before milling wheat was 10.11%.

Test weight of the grains was low 71 kg/hL; this could be the Cereals was affected by insect infection or due to adverse of climatic conditions that give low weight values, reducing the amount of produced flour [10].The chemical and physical properties of wheat flour were studied and summarized in Table 1.

Table 1: Effect of the hydrogen peroxide tempering on chemical and physical properties of wheat flour

Parameters	Control	H ₂ O ₂ Dose 0.01%	H ₂ O ₂ Dose 0.03%
Protein	9.56 ^a	9.62 ^a	9.68 ^a
Ash	0.73 ^a	0.67 ^a	0.59 ^a
Color	7.5 ^a	5.9 ^a	5.1 ^a
Wet gluten	27.22 ^a	28.60 ^a	29.46 ^a
Dry gluten	9.10 ^a	9.54 ^a	9.62 ^a
Gluten index	4 ^c	20.20 ^B	30.50 ^a

Means with the same letter are not significantly different

Compared with the control, hydrogen peroxide addition to the tempering water wheat slightly increased in protein contained but it is still low for bread making where the appropriate rate for the baking industry is 12% [11]. Were showed all doses of added hydrogen peroxide during tempering water wheat no significant decrease in ash content, on the other hand addition hydrogen peroxide improve flour color.

The effect of the addition hydrogens peroxide during tempering wheat on the gluten quality resulted no significant increases in wet and dry gluten, The gluten quality determined by the gluten index values, all doses of hydrogens peroxide treatment resulted in a significant increase in the gluten index from 4 to 30.50% from dose (0.03%hydrogen peroxide). This finding was agreement with [3] who reported hydrogen peroxide can oxidize sulfhydryl groups to disulfide bonded which strength gluten.

Effect of Hydrogen Peroxide Added to Tempered Water Wheat on Farinograph Properties of Flour

Farinograph have been used in milling and baking industries to evaluate the dough properties of the flours to be used in bread making, Farinograph parameters from wheat flour dough were shown in Table (2). Addition of hydrogen peroxide to the tempering water wheat showed that no significant increased in water absorption. Similar results were found in the [12].

The addition Enzyme to the tempering water barely modified the water absorption capacity of the resulting treated wheat flours from 55.4 % for control to the 55.8% for glucose oxidase. The Dough development time (DDT) and stability were slightly increased [13]Who reported when hydrogen peroxide added to wheat flour increase in DDT But decrease in dough stability.

Table 2: Effect of hydrogen peroxide tempering on farinograph properties of flour

parameters	control	H ₂ O ₂ Dose 0.01%	H ₂ O ₂ Dose 0.03%
water absorption %	57.5 ^a	58 ^a	58.3 ^a
development time (min)	2.1 ^a	3.3 ^a	3.7 ^a
Dough stability	1.7 ^a	2.4 ^a	2.9 ^a

Means with the same letter are not significantly different

Effect of the hydrogen peroxide tempering on Amylograph properties of flour

Results of using Amylograph characteristics with and without addition hydrogen Peroxide during tempering was presented in Table (3). This results showed that there is no significant differences in begin gelatinization

and viscosity temperature between samples significant positive effects were observed in peak viscosity compared to control Peak viscosity of wheat flour slurry depends on hydrogen bonds through which the starch molecules are associated with each other. If these hydrogen bonds are disrupted or hindered, than reduction in Peak viscosity occurs [14].

Table 3: Effect of the hydrogen peroxide tempering on Amylograph properties of flour

Parameters	Control	H ₂ O ₂ Dose 0.01%	H ₂ O ₂ Dose 0.03%
Begin of gelatinization (°C)	62 ^a	62.4 ^a	62.8 ^a
Peak viscosity (BU)	680 ^a	565 ^b	526 ^c
viscosity temperature (°C)	89.3 ^a	89.5 ^a	89.8 ^a

Means with the same letter are not significantly different

Effect of the Hydrogen Peroxide Tempering Water Wheat on the Specific Volume of Bread

The treatment with hydrogen peroxide during tempering produced something sticky dough while untreated samples were produced sticky and difficult to process dough moreover. The specific volume of bread was improved with hydrogen peroxide treatment during tempering wheat was shown in Table (4). Hydrogen peroxide addition to the tempering water there were no significant increased in bread weight but significantly

increased in volume and specific volume of bread comparing to the control. [15] reported there were significant differences in proof height and bread weight, but these differences did not result in differences in final bread volume. The increase in specific volume is also consistent with the findings of [2] who reported that hydrogen peroxide added directly to the wheat flour increase of specific volume. The results obtained indicated that hydrogen peroxide improved the specific volume.

Table 4: Effect of the hydrogen peroxide tempering water wheat on bread the specific volume

parameters	Control	H ₂ O ₂ Dose 0.01%	H ₂ O ₂ Dose 0.03%
Weight (gm)	148.58 ^a	142.66 ^a	138.5 ^a
Volume (Cm ³)	250 ^c	300 ^b	350 ^a
Specific volume (cm ³ /g)	1.65 ^c	2.10 ^b	1.15 ^a

Means with the same letter are not significantly different

Effect of the Hydrogen Peroxide Tempering Water Wheat on the Sensory Evaluation

Food quality is usually associated with sensory evaluation, these tests were done by eight trained judges of the food science college, and the Sensory evaluation results was shown in Table (5). Addition hydrogen peroxide during tempering improved Sensory evaluation of bread, there were significant differences in volume, crust color, chewiness, symmetry of form and Texture. All evaluations for bread from assays in these

tests were determined as better those of the control. The best total scores (76) regular according to [8] were obtained for bread treatment with 0.03% hydrogen peroxide during tempering [12]. Reported that the addition of enzymes in the tempering solution improved the quality parameters of the resulting fresh bread. According to [16] the oxidative improvers cause a significant increase in bread volume and optimization of all bread sensory quality characteristics that a customer takes into account in order to select an product.

Table 5: Effect of the hydrogen peroxide tempering water wheat on the Sensory evaluation

	10	8	3	3	3	3	10	10	10	20	10	10	100
PARAMETERS	External characteristics						Internal characteristics					crumb texture	total score
	volume	crust color	crust characteristics	Bread characteristics	symmetry of form	shred	Grain	crumb color	aroma	taste	chew ability		
Control	4 ^b	3 ^b	1 ^a	1 ^a	1 ^b	1 ^a	4 ^a	2 ^b	5 ^a	8 ^b	4 ^b	4 ^b	38 ^a
H ₂ O ₂ Dose 0.01%	6 ^a	7 ^a	2 ^a	2 ^a	2 ^a	2 ^a	6 ^a	7 ^a	7 ^a	13 ^a	6 ^{Ab}	8 ^a	68 ^b
H ₂ O ₂ Dose 0.03%	7 ^a	6 ^a	2 ^a	2 ^a	2 ^a	3 ^a	7 ^a	8 ^a	7 ^a	15 ^a	7 ^a	10 ^a	76 ^b

Means with the same letter are not significantly different

Conclusion

Results of this study showed that Addition of hydrogen peroxide during tempering water local wheat led to

- Positive effects on rheological properties of dough flours.
- Improve gluten index, dough handling and process.

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- Improves the specific volume of bread.
- Positive effects on Sensory evaluation like improves volume, test, crust color, chew ability and texture.
- The optimal dose of hydrogen peroxide is 0.03%.

