

**Impact of Redox Agents in the Baking Industry****Food Science**

**Keywords:** wheat, flour, redox factors, oxidants, pastry, hectoliter weight, proteins.

<b>Albulena Xhurkaj</b>	<b>University "Haxhi Zeka", Peja, Republic of Kosovo.</b>
<b>Nexhdet Shala</b>	<b>University "Haxhi Zeka", Peja, Republic of Kosovo.</b>

**Abstract**

The object of the study is the impact of redox agents in the baking industry. Redox factors used more by millers, bakeries and baking industry to improve the qualities of the dough and bread. Using redox factors in baking shows technological advantages that are needed mainly by the demand for economic production in modern process of bread making. In today's production process, which is automated and controlled additives used to adjust the characteristics of flour for the process to improve product quality and reduce prices. Among additive, redox factors are an important group; their influence is mainly driven by the system SS / HS of flour and dough. The latter relates primarily to oxidation, and subsequently with the reducing factors to modify the structure of the protein gluten. Oxidants have a dual action. First, accelerate the maturation which is obtained by attitude of flour saving from 1 to 2 months. Some oxidants (ext., acetone peroxide) also have a bleaching effect in flour from the oxidation of the pigment. Secondly, oxidants can improve rheological qualities and gas qualities dough holder. Use of acid L-ascorbic acid and L-cysteine, combined together, improves the quality of the bread better than using them alone. Optimal ratio of acid Lascorbic and L-cysteine is 60:40 ppm. With this report, the bread has maximum specific volume and other parameters very good.

**Introduction**

Studies in the field of redox additive submit interest in scientific research. Their influence is mainly driven by the system SS / HS of flour and dough. The latter relates primarily to oxidation, and subsequently with the reducing factors to modify the structure of the protein gluten. Redox factors are used more by millers, bakeries and baking industry to improve the qualities of the dough and bread. Using redox factors in baking shows technological advantages that are needed mainly by the demand for economic production in modern process of bread making. In ancient times bakers adapt the time of the fermentation and mixture, also the baking conditions by types of qualities of flour and yeast action to obtain the required quality of baked products. In today's production process, which is automated and controlled additives are used to adjust the characteristics of flour for the process to improve product quality and reduce prices. Shortened time mixing reduces inputs energy mixing dough, and the time required by the dough to come together with the quality of the bread rise with greater volume in the mold of bread and improved crumb structure. Rheological qualities of dough are related to baking quality. Gluten proteins are responsible for changes in the quality of baking, besides that, it is insoluble particles of high molecular weight (HMW) polymer of gluten which is closely linked to changes in the strength of the dough and baking quality between different types of grain. Rheological measurements are used to measure how fast, sensitive indicator of polymerase molecular structure changes and qualitative features. His use of redox agents in bakery products industry is necessary, especially in cases where we are unable to harmonize with different quality of wheat. Use of acid L-ascorbic and L-cysteine, combined together, improves the quality of the bread better than using them alone. Report of optimal of acid Lascorbic and L-cysteine is 60:40 ppm. With this report, the bread has maximum specific volume and other parameters too good. From the comparative data of extensor graph, of flour reference to those with supplements, have a significant improvement of increase energy (cm<sup>2</sup>).

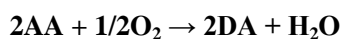
**Material and Methods**

In the grain industry the most important experimental measurements to determine the rheological qualities are: Penetrometer, Texture meter, Consist meter, Amyl graph, Farina graph, Micrograph, Oleograph, different viscometer of flow, equipment of recording and fermentation. Experimental tests are simple to perform and are used often in practical situations on site, to obtain data that are useful in the evolution of execution

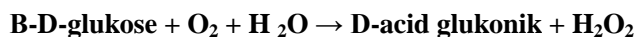
during the process of quality control. Redox agents are widely used by millers, bakeries and baking industry to improve the quality of dough and bread. The use of redox agents in baking shows technological advantages that are needed mainly by the demand for economic production in modern process of bread making. In ancient times bakers adapt the time of the fermentation and mixture, also the baking conditions by types of qualities of flour and yeast action to obtain the required quality of baked products. Among additives redox agents are an important group, their influence is mainly driven by the system SS / HS of flour and dough. The latter relates primarily to oxidation, and subsequently with the reducing of the factors to modify the structure of the protein gluten.

Oxidants have a dual action. First, accelerate the maturation of flour which is obtained from attitude of flour during of storage from 1 to 2 months. Some oxidants (e.g., acetone peroxide) also have a bleaching effect in flour from the pigment oxidation. Secondly, oxidants can improve rheological qualities and gas qualities pulp holder. Shortened time of mixing reduces energy inputs in mixing dough, and the time required by the dough to come together with the quality of the bread rise with greater volume in the mold of bread and improved crumb structure. Air oxygen affects the flour during milling and storage, and is largely responsible for its natural maturity; SH content of flour falls significantly during the storage. Atmospheric oxygen introduced into the dough during mixing and affects the qualities of dough. Changes can be observed immediately after mixing, resistance from the increasing rise and release falls. Oxygen mixed into the dough is leaved during processing and is consumed from the fermentation of yeast. Therefore, a fermented dough is mainly an aerobic system. Enzyme of glucose oxidase is an enzyme that comes from the mold of *Aspergillum* and sometimes from Penicillin.

In the long fermentation and pasta that will be made noodles, glucose oxidase is more effective in long exposures in atmospheric oxygen. Halogenate used for bread making include iodates and bromate and their potassium salts. The biggest difference between iodates and bromine is quick action of iodates and the slow action of bromate. In normal conditions, potassium bromate has no effect during mixing and about half of bromate increase is still present after mixing and the break of 4 hours. The bromate operate in rheology of dough during fermentation and baking. AA is oxidized in dough by oxygen in the atmosphere under the influence of heat unstable enzyme (oxidase ascorbic acid) and catalase with heat stable (heavy metal ions). D-ascorbic acid and oxidized combined number of links are oxidized in the same way. AA oxidation rate depends on the amount of oxygen mixed into the dough, e.g. increases significantly with increasing rotation of frying dough.



Firstly, the AA is oxidized in DA by oxygen present in the dough. Channeled reaction enzymatically and non-enzymatically and depends on the amount of oxygen mixed into the dough. Hydrogen peroxide is the active ingredient produced for improving the quality of dough. The use of enzymes instead of chemical oxidants is an interesting option for improving the performance of baking the dough. Glucose-oxidase is known to strengthen the dough and to improve the mold volume of bread, it has a wide use in flour improvement factors. Replacing successful oxidants as bromate, need combination with other enzymes, for example xylenes. Glucose oxidase catalyzes the oxidation of glucose by consummation of atmospheric oxygen and produces glycolic acid. In contrast to calcium peroxide, glucose-oxidase is soluble in water and is stable for at least one year when stored at 2-4 °C.

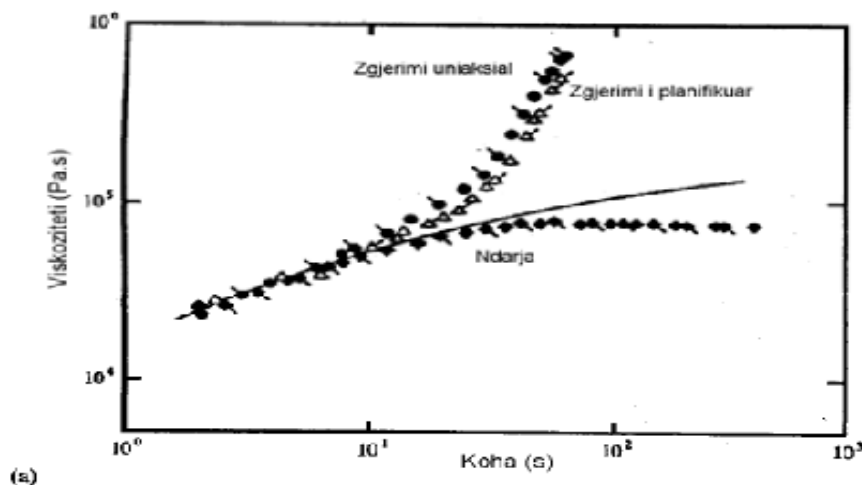


The wheat is important culture in cereal of bread. According to botanical classification is part of monocotyledons class, of Gramineae family and gender *Triticum*.

Rheological qualities of dough are related to baking quality, mainly due to an early tradition manual rheology subjective assessment of the dough before baking. Gluten is the largest protein's of wheat flour, responsible for bringing his single long VISKO-elastic deformation. Gluten proteins are responsible for changes in the quality of baking, besides that, it is insoluble particles of high molecular weight (HMW) polymer gluten which is closely linked to changes in the strength of the dough and baking quality between different types of grain. Rheological measurements are used to measure how fast, sensitive indicator of molecular structure changes polymerase and qualitative features. While gluten seen as a polymer, wherein the rheological qualities of gluten in relation to its molecular structure and functional behavior throughout the process of making bread is very convenient in relation to understanding the physical mechanisms responsible for changes in quality of bread making.

Annealing is related to the growth and sustainability of the bubbles, their size, expansion, growth and cleavage during the baking process, which will have a greater impact on the quality of the final bread, as by the appearance as well as by volume. It is considered as the limit of the expansion of these bubbles which is directly related to their sustainability, thanks to the merger and the eventual loss of gas when bubbles fail. Rheological qualities of the walls of the bubbles are important in maintaining the resilience to snap cleavage during the baking and also in terms of regulation and content of gas during fermentation and baking, and, consequently, the structure and volume of the final product.

Experimental tests are used to determine the behavior of dough of bread during the process, such as Farina graph and Micrograph. Many food materials are viscoelastic and therefore their qualities depend on the speed of the test. This is important in many aspects of pulp processing: if the dough is deformed quickly, as in the mix or in distribution, then rheological qualities of dough will be very different if they are measured in typical slow measures of deformation found in testing machines. In contrast, during the processing of dough will undergo various attraction in size and in kind, which differ in rheological test.



**Img.1. Viscosity of separation**

This shows that a wide spread of the break process is responsible for the break process inside of dough, which is associated with high molecular weight of the spread gluten. The qualities of the rest of pulp are closely related to the distribution MW and especially with the implications of the polymers of glutamines and are available as a quick way to describe the changes in the distribution MW between cultivars that vary in the quality of baking.

## Results and Discussion

Hectoliter weight of the grain and other seed crops depend on a number of factors, such as chemical composition, humidity, the amount of the envelope and the impurities, etc. Hectoliter weight has a little value when is increased the grain humidity over 16% (so that the increase of moisture for 1% weight hectoliter down to 0.5 kg). In measuring cylinder placed knives in which is placed a cylindrical body and cylinder filling. From the third cylinder which is held at a distance of 4 cm from the entrance of the cylinder for filling stream so ¼ cylinder filled for 8 seconds. Then is removed the knife and the grains with the cylinder body fall into measuring cylinder. Knife inserted again so that excessive measures grains fall off, removed from the cylinder to cylinder filling for measurement and measuring cylinder is placed on the scales and weighed. Weighted measure is the measure of a quarter of a liter or 1 liter and it can then be multiplied by 400, respectively 100 to gain importance of 1 hl. Hectoliter weight of grain varies:

- Wheat 61-88 kg / hl;
- Oats 35 to 66 kg / hl;
- Barley 45-81 kg / hl, etc.

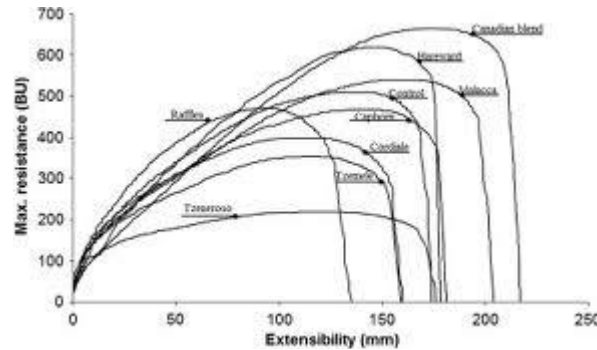
Measure of 1000 grains represents full extent of cereal grains expressed in dry matter. Are used the following tools: separator samples; counting device (counter with photo lamp), but in case of absence can also manually; Technical scales; tweezers. From the sample for analysis, in the numerator or manually is counted twice by 500 full grains without impurities, with a precision of 0.1 g and the values are collected.

The method of determining the amount of ash is based on burning of material (flour) at temperatures of 900° C and the weighing of the residue. Ash or the mineral resources that remain after the burning make a very important indicator for determining the value of their food. In the technology of grain processing, the ash content is determined by the type of flour. According to many authors it determined that the ash content in the grain cleaned of impurities and expressed as a percentage of dry matter, is about 1.97%.

Laboratory milling, container for firewood (china) electric slab heating, Expiator, analytical scales with accuracy of 0.0001g, Kindle thermo resistant, oven muffle with regulatory temperature and air circulation, 96% Ethanol. Farina graph room has a capacity of 300 g (Farina graph of Branberder). Tools needed: Farina graph apparatus; scales; Special by rete; plastic shovel; thermometer up to 500 ° C; paper chart; glass. Registration mechanism during the test, creates a diagram leaving trace on a paper rolls, which is called farina gram, which can vary in form and in length. In the letter in abscissa is written the time expressed in minutes, while the Y-axis is indicated the consistency of pulp expressed in units farina graphic (UB- Brabender units, but other than the Farina graph of brabender now are used many other types farina graphs), with a value of 0 to 1000 UB dough maker that is released for work, leave it to work one minute, then placed 300 g of flour which is mixed first one minute and then will be given 50 to 60% water depending on the flour. When dough is formed, the interior walls of dough maker are cleaned with plastic shovel. If the middle of the curve reaches its maximum and it is less than 490 UF or more than 510 UF, the blending is terminated. The new flour is given the correct amount of water according to the table of Tibor it, during which if we consistency under 490 NJF then water should be removed, while the 510 UF We give water. When consistency is reached 490-510 U.F. blending continues and lasts 15 minutes from the time of issuance of water in dough maker. With extensor graph are analyzed the physical qualities of dough, respectively the dough which is processed before in farina graph, is placed in extensor graph where is measured its resistance. With the usage of constant power during the same speed and in the same side, dough is deformed above the stretch and its break. The resistance that makes the dough against the power is recorded in form diagrams – Extensor gram (Fig. 2).

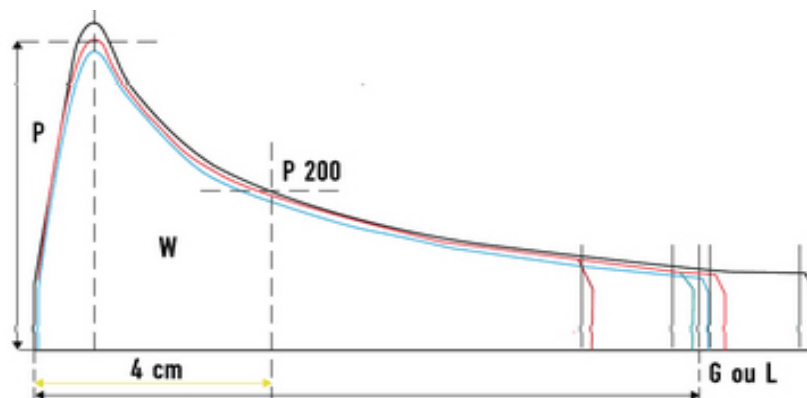
Tools needed: Farina graph and Extensor graph of Brabender; scales; plastic shovel; Laboratory glass of 250 ml; thermometer; plan meter; scissors for cutting

The dough. The work of the enumerators should stay in the zero point. Este no graph room temperature is 29-30 °C. Thermometer and circulating pumps are released an hour before work on purpose that Farina graph and ester no graph can reach optimal working temperature. In the Farina graph mixing is placed 300 g flour, 6 g of salt and water (right amount of water is placed on the glass where the salt and gained 2% salt solution is). Mid-curve should be at 500 U.F. +/- 10 U.F. (Within 5 minutes after delivering of the solution). If is not achieved the right consistency will be repeated the evidence where will be done the correction of the amount of water.



**Img.2. Estensograma flour with different quality**

Oleograph Shopping is another type device similar to steno graph, where the dough is divided into small pieces in the form of circular disk, which placed flat on a plate with air pressure and forced to swell until they crack. The main parts of an oleograph are; 1) water tank, which when is moved to the vessel creates pressure on inflated bubble; 2) collects water bubbles, which runs from the reserve. This bubble is calibrated in mm and with the amount of water that is needed to burst bubble can be measured (the speed of water flow right bubble collection regulated through a tube that enters in action); 3) tiles holder that holds the dough when inflated the bubbles. This plate has a removable lid to provide the dough desired thickness; 4) a control manometer, which records the air pressure required to bubble inflated. Thermostat locks before starting work, and temperature Mixer and apparatus is  $25 \pm 0.2$  0C. Before starting top work the flour temperature is regulated at 20 ° C. By biretta in the Erlenmeyer container is placed the solution of NaCl - in the amount which corresponds to the equivalent of 50 ml per 100 g flour with a moisture content of 15%.



**Figure 3. Curve aerogrammes.**

## Conclusions

The use of redox agents in bakery products industry is necessary, especially in cases where we are unable to harmonize with different quality of wheat. The use of the acid of L-ascorbic and L-cysteine, combined together, improves the quality of the bread better than using them alone. The report of acid of L-ascorbic optimal and L-cysteine is 60:40 ppm. With this report, the bread has maximum specific volume and other parameters very good. From the comparative data of extensor graph, of the reference flour to those supplements, have a significant improvement to increase energy (cm<sup>2</sup>).

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