ADDITIONS FOR CORRECTING THE TECHNOLOGICAL PROPERTIES OF FLOUR AND FOR IMPROVING THE NUTRITIVE VALUE OF BREAD

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Abstract: The producers' attention is channeled towards ensuring the high and constant quality of the bread production. The sum of requirements such as: inoculation, energy value, organoleptic and physicochemical proprieties, and the appearance is translated by one word, and that is quality. There are many factors responsible for achieving the proper quality value of the bread. Among these factors, one may include, first of all, the quality of the raw material, the equipment used and the human factor. The classic technology of bread fabrication is based on the biological proprieties of the wheat and the technological characteristics of the flour. For improving the flaws of the bread, the dough is enriched with biogenic substances, reducing or oxidizing substances, or substances for increasing the dough acidity. Making these additions efficient is done by adding the multienzymatic systems. For increasing the nutritive value of the bread, the dough is strengthened with micronutrients, proteins from different sources or other additions belonging to the vegetal reign, such as soy flour and alimentary fibres.

Keywords: dough, enzymes, reducing substances, soy less oxidizing substances, alimentary fibres, organic acids, multienzymatic systems.

Cereals and almost all their derivates lie at the basis of human alimentation (Banu, 2000). The bread and the bread industry products belong to the human alimentary behaviour throughout all the stages of his life. To satisfy the consumer's taste, the producers have approached an array of products. The various products range is obtained either by auxiliary variants or by altering the value of the operational parameters. All the choices adopted are related to the classic traditional technology.

Is traditionalism a mark, an obstacle to evolution or a landmark of quality? The quality of the raw material – the flour – may be improved but not very much. There are kinds of bread with additions which have the mission to complete its nutritive value and of reducing its energy value. Thus it is intended to apply a social treatment, meaning a discrete alimentation with microelements and fibres to the population where a general absence is

observed. However, the consumer, in his traditionalism, desires that bread should remain bread, and one with very good taste qualities, with a good aroma, smooth and uniform porosity, large volume, which could complete a rich menu of every meal.
The classic technology has suffered alterations when it comes to preparing the dough. There are substances which are added in very small quantities as compared to the raw material, which are called additives and substances which are added in larger quantities and which are considered to be auxiliary materials.
By refining the raw material – the wheat – the flour, depending on the extraction degree, is deprived of certain elements of high biological value. This deficit can be made good by different additions. In order to make good the deficits related to the technological characteristics of the flour, such as a low capacity to form gases, a low capacity to retain these gases, medium and low power, low hydrating capacity, low productivity load, the dough is supplemented with different enzymatic mixtures, reducing or oxidizing substances. In order to improve the productivity load, to extend the duration of the newness of the bread, to modify the biological balance, auxiliary materials of different sources, especially vegetal, are added to the dough.

ADDITIVES USED FOR IMPROVING THE FLOUR QUALITY

The additions in the bread manufacture are generically called "ameliorators". According to the Codex Alimentarius Commission FAO-OMS are defined as any substance, even microbiological, which is not consumed normally as food and it is not used as a typical ingredient even if it has or it has not nutritive value. Adding it to the food product has a technological purpose connected to the fabrication, wrapping and storing the food products with certain effect or with convenient direct or indirect expected effects on their proprieties.

Adding biogenetic substances to the dough

Enzymes are used in the bread manufacture, from different sources, as enzymatic products for standardizing the flours and conditioning the dough. The exogenous enzymes come from vegetal tissues (seeds, germinal cereals) and microorganisms (bacteria, yeasts and moulds) (Banu, 2000, Cherejir et al., 2004).
The amylases are the most hydrolases used in bread manufacture. The enzymatic products contain as an active substance especially the α-enzyme, the glucosidal chains attack enzyme (Duboi, et al., 1995, Boder, 1998, 2000).

Amylases are the key to „gas production" in dough (Auerman 1960). They have a catalytic action, contributing to the transformation of starch into fermenting sugars, which are the source of carbon of the microorganisms during the fermentation process.

α-amylase (α-1,4 glucan 4-glucanohydrolase E.C. 3.2.1.1.) is one of the most frequently used enzymes. The influence on the glucanic chains of amylase and amylopectin is randomly. The glucosic chains α-1,4 are hydrolyzed and fragments of oxides are released up to the final dextrin (Auerman, 1960, Leihninger, 1987). Thus the macromolecular structure of the hydrated starch is destroyed, having as a result its liquefaction (Bordei, 1998).

β-amylase (α-1,4 glucanmaltohydrolase E.C. 3.2.1.2) activates at the nonreducing ends, on the α-1,4 chains, as glucose and maltose producer. The α- and β-amylases are enzymes found in the wheat as well and the addition corrects the deficit of the amylotic activity of the flours.

Pullulanase is the enzyme that hydrolyses the α-1,6 glucosic chains in a maltose polymer. The izoamylase contributes to breaking the α-1,6 glucosic chains within the amylopectine and can partially react with α-amylase (Bordei, Teodorescu, 2000).

The enzyme which attack both the α-1,4 and the α-1,6 glucosic chains is the amiloglucosidase – AMG (called also glucoamylase) having fungal origin (*Aspergillus niger* or *Rhizopus delemar*). It is added to the dough because of its antistaling properties. It is recommended to use AMG in the technology of frozen doughs (Klup, 1995, Bordei, 1998).

The state of starch grains aggregation, the degree of starch hydration, the temperature and the concentration of the hydrogen ions, and the medium make-up influence the activity of amylases in dough (Duboi, 1995, Cărăban et al., 2003). The most frequently used sources of amylolitic enzymes are the microbial ones. They are added to the dough in order to improve the capacity of flour to form gases, to reduce the fermentation time, to improve the baking and the values of the bread quality indices – porosity, aroma, taste, colour, elasticity – are much improved. It is recommended to use them for processing the flours with a Hagberg index value bigger than 280s (Voicu, 1995).

The proteases are hydrolases which break the peptidic connections and are used for improving the processing qualities of the dough. According to their action, they are divided into sulfhidril proteases and serine proteases. If a gluten hydrolyses is necessary, the serine proteases of bacteriological origin are used. If the purpose is that of reducing the fermentation time, then the neutral proteases and the sulfhidril proteases are used (Lee, C.C.).

The source of the proteolitic enzymes are the vegetables with the lowest activity and the microorganisms (moulds and bacteria). The best choice for the bread manufacture is the fungal protease. The dosage is done according to the enzymatic activity of the mixture and to the values of the quality indices of flour. The enzymatic mixtures which are actually used are fixed on a starch foundation and can be powder, liquid or pills. By adding the proteolitic enzymatic mixtures, the kneading time is reduced, the creed proprieties of the dough are improved and the rheological proprieties of the colloidal mixture are regulated according to the technological requirements, the extensibility and the capacity of the dough to retain gases are also improved. It is recommended that these enzymes to be added to flours with low proteolitic activity. If the flour has a small amount of gluten, but which is "powerful", the enzyme addition is smaller than for processing the flour with a medium amount of gluten, but more in quantity (Iorga, 2002). The volume of the bread is increased and the structure, texture and smoothness of the crump are improved (Belc, 2000).

The endo- and exo-hydrolases which are added to the dough hydrolyse the dissoluble and indissoluble pentosans (Roman et al., 1994). The endoxilanases hydrolyze the β-1,4 chains within the main chain of xylans, forming oligomers of different molecular mass (Courtin et al., 2002). The exoamylases activate at the ends of the chain releasing much simpler products. The xylanase sources are the moulds (*Aspergillus orizae*, *Aspergillus niger*). The positive action of xylanase in dough can be correlated to the decrease of the content of indissoluble pentosans. More water is available, which contributes to the gluten forming. The viscosity of the dough is reduced, the stability, the tolerance to fermentation, the capacity to retain gases are improved, thus increasing the bread volume (Banu, 2000, Bordei, 2000, Giurea, 2001). The crumb structure is smoother and the duration of the newness is improved (Maat, et al., 1992, Diaconescu, 1998). An amelioration of the bread quality is obtained if xylanase mixed with α-amylase and cellulose for preparing the dough is used (Diaconescu, 1998). This combination may be used for processing a flour with strong gluten, low extensibility and with no fibre addition (Diaconescu, 1998), but also with fibres addition (Diaconescu, 1998). For the bread with fibre addition, it is recommended to use xylanase without other combination. The xylanase used in combination with the transglutaminaze improves the value of the bread volume, as compared to the blank test and to the test where we only added transglutaminase (Kokser, 2001, Diez, 2002, Georgescu, 2003, Giurea, 2003). The fungal hemicellulase (*Aspergillus orizae*) reduces the tackiness of

the dough with or without bran, and the volume of the test as compared to the blank test increases dramatically (Diaconescu, 1998, Courtin, 2002).
Oxidoreductases act for accelerating the process of forming the sulfhidril connections within the peptidic chains, for obtaining a flexible dough. The lipoxigenase is a dioxigenase that catalyses the oxidizing of the polyunsaturated fat acids at the hydroperoxides. It was proven that apart from the free fat acids, it also has an influence over the monoglicerides. It is made inactive by the metallic ions Cu^{2+} and Hg^{2+} and by the temperature of 69°C (Banu, 2000). The lipoxigenase acts in dough for lightering the crumb colour, thus whitening the dough and it contributes to the improvement of its rheological characteristics. The main cause for the whitening is the pigments oxidizing. It has been proven experimentally that for the lipoxigenase of different sources, the whitening activity varies. It appears that in the whitening process the free radicals of the fat acids resulted from the peroxidation reactions are involved. All these are influenced by the duration, the speed and the way of dough kneading. The lipoxigenase is involved in a system of oxidizing and reducing reactions where catalase and peroxidase are present. The catalase decomposes the oxidized water which is a stopping agent of the lipoxigenase. By the lipoxigenase, the dough tolerance to kneading is increased, same as its stability, its resistance to deflation after the elapse of the forming time (Bordei, 1995, Toma, Teodorescu, 2000). The sources of lipoxigenase are especially the vegetal ones (soy, flax, lucerne, peas, corn) and more recently the animal tissue. The lipoxigenase added to the dough comes from combined sources which make up the liquid phase of oxidizing, such as “FLO” which contains 0,3% soy flour, 1‰ flax flour, 0,25-0,5% vegetal oil and 20-25% wheat flour.
The lipoxidase which catalyses the oxidizing reaction of the polyunsaturated fat acids leads to altering the aroma of the bread and forming the volatile compound resulted after the breaking of the hydroperoxides. As nutritional repercussions, the loss of polyunsaturated fat acids and the appearance of toxic products of the oxidized lipids can be observed. The combined oxidizing of carotenes leads to the whitening of the crump and losses of provitamine A. The combined oxidizing of the tiol groups from the glutenic proteins leads to the release of lipids, the improvement of the dough rheological proprieties in terms of increasing its tolerance to moulding. The bread volume increases and the crumb have a better porosity. By the combined oxidation of other molecules, the technological and sensorial effects are insignificant. The loss of tocopherols constitutes the main sensorial repercussion.

The glucoxidase (GOX) is a flavic aerobe enzyme, which catalyses the reaction of oxidizing glucose at gluconic acid, forming H_2O_2 (oxygenated water) which is the most efficient catalyst of the pentosans oxidized coating of wheat flour (Izydorezy et al., 1990). The oxygenated water produced by GOX acts on the SH groups, oxidizing them. This effect is similar to that of the potassium bromide. GOX acts for the decrease of the SH groups. By using GOX in the bread manufacture, a drier, more flexible and dough more tolerant to allegation, fermentation and moulding, is obtained (Vermulapali, 1998). The influence of the addition of glucozoxidase on the bread volume is positive (Diaconescu, 1998). The ameliorations of the bread characteristics are evident is when a flour of lower quality is used (Wikistron, Eliason, 1998, Diaconescu, 2002). It is not recommended to use it together with other enzymes such as the α-amylase and the amyloglucisidase. For optimizing the activity of glucozidase, it is added glucose in the dough. In the bread manufacture the glucosidase added to the dough comes from microbial sources, especially moulds.

A similar effect to that of the GOX has HOX, the hexozoxidase, E:C:1.1.35, with the difference that by the action of the HOX the values of the parameters in question are much higher. This happens because the group specificity of HOX is higher than that of GOX (Poulsen, et al., 1998).

Catalase (E.C.1.11.1.6.) and peroxidase (E.C.1.11.1.7) catalyze the decomposing reactions of the oxygenated water. The oxygen resulted from the reaction is an important source of oxygen in dough. The activity of catalase and peroxidase is established at the maturation of flour. During allegation, the action is also stable. It is recommended that catalase and peroxidase should be added to the dough with high fibre content. These enzymes are involved in an extremely complex system of reactions of oxidoreduction, together with the ascorbic acid, the polyfenolaxidases and the lipoxigenase (Qi Si et al., 1997, Wikstrom, 1998). The effect of these reactions is establishes at technological and nutritional level. The yeast and the salt decrease the activity of catalase. The frozen dough has a catalase and peroxidase activity equal to that of fresh dough, and the lyophilized dough is lower with approximately 30% (Van de Plaat et al., 1988).

The action of the multienzimatic systems in the bread manufacture

The treatment of the dough with enzymes “controls” the quality of the final product. By the action of the multienzimatic system, the phases of the technological process are influenced, which in their turn influence the characteristics of the dough and of the bread (Toma 1997, Takano, 2000).

The proteins form films like thin surfaces and the starch grains are distributed on these surfaces. It appears that where the starch grains "get attached", there are breaches in the proteic films. This action was visualized by the electronic microscopy SEM. The rheological properties of the dough are highly related to its microstructure *Letang et al., 1999, Takano et al., 2002). By adding to the dough the amiolitic, proteolitic, glucozoxidase, xilanase and exogenous enzymes of bacterial fungal origin, the capacity of absorption pharinographically established, is modified. The time of dough making decreases if the fungal α-amylase and the fungal protease are used and it increases if fungal xilanase and glycosidase are used. The dough stability decreases when α-amylase and protease after 8 minutes are added and increases after 5.5 minutes when xilanase and glycosidaseare added (Indirani et al., 2003). The used enzymes have the same source. They are fungal, coming from the same type of microorganisms, Aspergillus niger. So, there are techniques of obtaining enzymes with different action from microorganisms of the same type. The α-amylase-protease combination improves the capacity of forming gases and their retention to the dough. By the protease-xilanase combination, the flexibility of the dough is increased and due to the redistribution of the water, the quantity of gluten is increased (Diaconescu, 2002, Indirani et al., 2003). The glucozoxidase catalyses the reaction of forming the gluconolactose and the molecular oxygen is transformed to hydrogen peroxide. The glucozoxidase is an enemy of the microorganisms in their fight for substratum. The oxygenated water, in the presence of the galactozidase acts on the galactose or another hexozoxidase (Poulsen et al., 1998).

The addition of reducing substances

They are added during the preparation of the dough and have the mission of transforming the bisulfuric connections into sulfhidril ones. These substances act for reducing the power of the flour and decreasing the maximum resistance of the dough. The resistance of the gluten and its tenacity are reduced. The reducing substances used are: the cysteine, the cystine, the sulphite and the sodium bisulphate, the reduced glutathione and the odorless garlic (Bordei, 2000). They are added to the dough in calculated doses as a result of numerous experiments. The overdosage leads to contrary effects. The cysteine acts in the allegation phase. The cystine, which connects directly to the gluten fibers, oxidizes it, thus replacing the bisulphuric bridges in the structure of the gluten causing its weakening and that is why, for example in the United States and Canada, it is used for reducing the

kneading time when processing flour made from tough grains. The dosage is done according to the power of the flour and it is recommended to be done when preparing the fluid leaven. Due to the liquid medium, there is a stronger contact between the cysteine and the protein. The sulphite and the sodium bisulphate act for reducing the time of kneading the dough but these substances are not accepted by the Romanian legislation (Bordei, 2000).The odorless garlic is not available in our country, only on the international market, and if it is correctly used does not cause flaws to the final product. The reduced glutathione contains the L-cysteine and has the same effect as the pure substance. It is obtained from the dead yeast cells. It is a tripeptide of the γ glutamil cysteine.

The addition of oxidizing substances

These belong to the category of the chemical ameliorators and are used during the flour processing with low gluten with the purpose of improving the technological characteristics. It increases the dough capacity to retain gases and also its tolerance to following processings. Its capacity of be processed is increased, the volume of bread is larger and the textural characteristics of the crumb are definitely better. The crumb colour is lighter.

The action of the oxidizing substances is the forming of the –S-S- links between two –SH links that come from two different protein molecules. The dough rheological proprieties are due to the proteins and to the intermolecular action or the interchange sulphidril-bisulphide, and by the action of the oxidizing agent, The –SS- links are established.

The used oxidizing agents are: the ascorbic acid, the potassium iodine, the potassium bromide, the benzoperoxide, the ammonium and sodium persulphide. The ascorbic acid is the most frequently used oxidizing agent. It is also called the C vitamin but in the dough and in the bread it looses its functionality as a vitamin. The ascorbic acid is oxidized by the bihydroascorbic acid in the presence of the oxygen, and the reaction is catalyzed by the ascorbotoxidase enzyme. The bihydroascorbat reductase is anaerobic and acts in the presence of a hydrogen provider which is the reduced glutathione. By the system reduced glutathione-oxidized glutathione and the gluthahtionreductase enzyme, the –SH groups are transformed into –SS- groups, when a specific NADH-dependent bihydrogenase is present (Giurca, 1998). In this oxyreducing system, an intermediate component appears, which is involved in the oxidizing effect and namely, an acid ion, the intermediate monobihydroascorbic acid. The latter gives up an electron to the ascorbic acid. The superoxyde acid ion O^{2+} is reduced to oxygenated

water by dismutation. The OOH hyperoxide oxidizes the tiolated chemical group RS, forming the bisulphuric link (Nakamura et al., 1997). It is recommended to use the ascorbic acid during kneading because at that moment the proteic molecule has the most exposed reactive groups. There is no danger of over dosage. The more the flour is of low quality, the more is the dose up to maximum 100 ppm. When preparing the dough by intensive kneading, we use a dose of 75 ppm of ascorbic acid. This oxidizing agent has a medium speed of action. The potassium bromide and the potassium iodine are not accepted by the Romanian legislation. The calcium peroxide is an oxidizing agent which decomposes in the presence of water and forms the oxygenated water around the calcium hydroxide. This activates the catalase and the peroxidase. The sulphidril groups are oxidized for the –SS- groups (busulphuric). It is recommended to use the mixed with other ameliorators and additions such as the whey and the amilolitic enzymes. The moment of adding is at the end of the kneading because it is good that the calcium peroxide should not be dissolved into water. By adding calcium peroxide in a dose of maximum 75 ppm of dough, the dough gets a better texture and it enfolds better. Its elasticity and the resistance are much improved and the quality of the final product is much ameliorated (Tieckelmann, 1991).
In order to substitute the action of an oxidizing agent such as the potassium bromide and of some additions such as the emulators, the transglutaminase is added to the dough. This is a germ enzyme which improves the viscosity and extensibility of the dough acting for increasing the degree of veining of the proteins that form gluten and, by increasing the quantity of absorbed water (Gerrald et al. 2000, Koskel et al., 2001).

ADDITIONS WHICH AMELIORATE THE FLOUR CHARACTERISTICS AND STRENGT THE BREAD

The performances of processing the dough, the increase of the duration of freshness of the final product, the improvement of the nutritive value, the creation of diet and new types, are also possible by using some additions.
“The vital gluten” improves the rheological characteristics of the dough and the nutritive value of the bread by increasing its proteic content (Belc, 2000). It is added in doses of 0.5-2%, to the diet products sucha s: high fibre content bread, whole bread, bread with non-wheat flour additions (Bordei, Teodorescu, 2000, Sanchez et al., 2002). The quantity of “vital gluten” which is added is calculated according to the total protein content of the product, the protein content of the vital gluten, that of the flour and the

quantity of flour where it is added. The over dosage has negative effects. "The vital gluten" is a powder that contains 70-80% protein, u = 105 starch, 1.5-2.5% fats, 0.9-1.5% mineral salts. For each percentage of gluten added, the hydrating capacity of the flour increases by 1.5-2%, the glutenin network formed is better developed and it better comprises the other composing elements. The time of making the dough is slightly increased (Teodorescu, 2003). The sources of "vital gluten" are the starch factories which have as raw material the wheat and not any other cereal. It is called "vital gluten" because the drying parameters are chosen as to maintain the technological principles of the mixture. For other uses, such as proteic supplement, the devitalized gluten is used, for which the drying parameters are different than those of the "vital gluten", meaning, they are not so spared (Bordei, 2000).

The emulgators are active, surface substances, tensionactive, with hydrophilic and hydrophobic proprieties. The dough as a poliphasic system is influenced by the addition of the surfactants because supplementary transversal links are formed between the polar and non-polar zones. The surfactants are ionic, nonionic and ampholyte. The most important characteristic of the surfactants is the HLB (hydrophil-lipophyl-balance). The absorbed emulator forms on the surface gas, liquid or solid films. In the bread manufacture, the strengthening of the dough with an emulator is described as being the connection between it and the gluten. The protein-emulator complex is formed by direct interaction with the proteins of the gluten (the gliadine and the glutenine), forming the hydrophilic and hydrophobic links. The interaction with other components of the flour appears, such as the lipides and the starch (Giurca and Sava, 1998). The type and the level of usage of the emulators in the bread manufacture is: DATEM – diaceyl tartaric esters of monoglicerides and biglicerides (0.3-0.5%), EMG – mono and bi ethoxided glycerides (0.3-0.5%), SSL- sodium lactic stearoil (0.3-0.5%), lecithin – LC (0.2-0.5%) (Metter et al., 1996, Bordei, 2000).

Lecithine is the most frequently used emulator. A variant altered with HLB=12 is used. The extensibility of the dough is increased, its capacity to be processed and the volume of the bread. The sodium lactic stearoil used in bread manufacture has a value of the HLB of 9-11. this emulator interacts with the polar lipids, the proteins and the starch (Giurca, 1998, Bordei, 2000). During baking the links of the lipids with the emulators are broken, but those with the starch are intensified. The amylose-emulgator complex is dissoluble in water even in this complex form. The quantity of free amylose decreases, which can form intermolecular associations when the bread cools down, is preventing "the reducing of starch". Due to the helical configuration

of the amylose, the emulgator is absorbed inside the propeller. It has this effect only in the anhydride form, since in hydrated form; the laminated layers are separated by layers of water. According to the toxicity analyses FAO/OMS, SSL releases lactic acid through hydrolyses.
The mono- and diglycerides are used in many European countries and in the United States. These antistaling agents are more efficient if they have in their make-up α-monoglycerides, if the iodine index is between 1 and 120 and if the melting point is between 40-70°C. The most frequently used are the glycerin monostearate and the glycerine monopalmitate. DATEM, diaceyl tartaric esters of monoglicerides and biglicerides are widely used in Europe. The dough with emulgator additions is more easily processed and its tolerance to the variations of the flour quality is improved. The capacity to retain gases is also improved. The bread made of such dough has a larger volume as compared to the blank test; the crumb is more elastic, tendered and less coarse. The freshness lasts longer and the bread capacity to be sliced is improved (Metter, 1996).

The combined force of the complex ameliorators

In order to improve the flour characteristics, it has been observed that using complex ameliorators which contain enzymes with different specific action, oxidizing or reducing agents and surfactants, is a more efficient method than using them individually. There are numerous combinations, such as for example commercial products on starch base. These complex ameliorators contribute to the flour and bread quality, the adjustment of the technological process and the correction of the flaws of the traditional technologies of making the bread.
The dough acidity increasing agents are used for processing the low quality flours, made of germinated grain or those attacked by pest. The agents increase the acidity and reduce the pH of the dough. In order to improve the proprieties of the gluten, to prevent the disease of stretching of the bread, to accentuate the maturing of the dough, we add lactic acid, acetic acid, citric acid, whey and butter milk. These are natural products which reach the human body from other alimentary sources as well. The action of these agents is orientated to the change of the ionization of the substratum, to the alteration of the active center. The steric conformation of the protein carrying active groups from the enzyme and the substratum is altered. The reactive groups of the substratum protein become active or are masked. The formed acidity inhibits the activity of the α-amylase and the proteolitic enzymes (Colar, 1992, 1994, Banu, 2000, Bantea, 2003). The final product has a

larger volume, a better taste, and an aroma more resistant to the diseases. The farinographic characteristics of the dough are much improved (Bantea, 2003). One cannot say that the lactic and acetic acids form the complete aroma of the bread, but they guarantee it (Levesque et al., 1991, Molnar-Richard, 1994).

The dry acid dough is used in a ration of 1-4% for the making of the dough for different types of acid bread, tasting of milk, yogurt or butter. This dough is prepared from wheat flour and this one has an acidity of 30-60 degrees, rye flour, with an obtained acidity of 100-110 degrees, insulin or butter. It is a powder with 8% humidity, white, if it comes from wheat flour and slightly brown if it comes from rye flour. The fermentation of the mixture of flour and water is done in more phases on the basis of the micro flora typical for the flour. Using this dough in bread manufacture has benefic effects on the body because it contains prebiotics which stimulate the development of the bifid bacteria. From a technological point of view, the fermentation time is reduced by eliminating the leaven phase and therefore, only the direct method if employed. As compared to the bread obtained with the classical method, the one with acid dough addition has a specific aroma, good volume and elasticity, greater viability, so a superior quality according to the type (Belc et al., 2002).

Hydrocolloids in the bread manufacture

The most frequently used are the gum guar, GG, (0.5-10%), the carboxy methylcellulose, CMC (0.5-0.7%) and the hydroxypropilmethyl cellulose, HPMC. The main function of the CMC is to tie the water inside the systems and to instate, in the watery phase of the system, the stability of the other ingredients, namely preventing the synaeress (Banu, Bordei, 2000). The guar gum reduces the final fermentation time and increases the stability of the dough. Combined with the CMC, the decreasing effect of the elasticity of the dough is potentated. HPMC, the hydroxypropilmethylcellulose, is used in combination with the CMC, the fungal α-amylase and the DATEM. It has been proven by farinographical determinations that the absorption of the water increases by 2-3% (Leonte, 2000). The hydrocolloids added to the dough reduce the fermentation time by 8 minutes (CMC), 7 minutes (HPMC), (Metter, Seibel, 1996, Leonte, 2000).

Fortifying the flours

The micronutrients are used for making bread for preventing the alimentary unbalances, for a maximum protection of the body and a nutritional synergy

physiologically adapted (Costin et al., 2001). These fortifying products must be added to the most suited aliments, such as the bread, following the scientific establishing of the appropriateness of the operation. The addition is done on the basis of a logistics suited to the control of the operation. It is recommended to use efficient and stable sources of active biological compounds which would not influence the price and would not modify the sensorial characteristics. The strengthening is a very refined operation, as far as the dosage is concerned (Costin, Segal, 2001).

Enriching the flours with milk proteins
The milk proteins have the best influence on the rheological characteristics of the dough and on the nutritive value of the bread. The PER indicator, the efficiency of the proteic ration increases, which proves a better equilibrium of the nutritive structure of the proteic amino-acids. The proteins coming from other sources have poorer results as compared to the milk ones (Leonte, 2000, Belc, 2000).

Fortifying with beer yeast proteins in a proportion of 1-3% of the flour ensures an improvement of the hydrating capacity of the flour. The stability of the dough decreases, so does the power of the flour, the PER indices of the bread increases, therefore the consuming organism uses more effectively the bread with a protein addition.

Fortifying the flour with soy proteins
80% of the total world protein production is vegetal. The daily ration of a person is of 100 grams. It has been observed that a person only consumes 60% of the necessary quantity every day. One method to compensate this deficit would be the addition of soy proteins to the bread. These are added for their biological value. They have the capacity to retain water, emulating proprieties, foaming capacity and at the temperature of approximately 70°C, they form gels. The soya proteins are embedded in the proteic matrix of the dough. The addition of EMG (ethoxilated mono- and diglycerides) and SSL (the sodium lactic stearoil) potentates this embedding effect. Hydrophilic and hydrophobic links are made between the soy proteins and the polar lipids and between the sodium lactic steraoil and the soy proteins. The optimum addition is between 2-8% (Purice, 1999, 2000, Cosciug, 2002).

Fortifying the bread with amino-acids has as a purpose to compensate the lysine deficit which is an amino-acid which limits the flours, the tryptophan

and treonine deficit. The wheat flour is supplemented with 0.2% lysine, especially for the products intended for children. It is apparently more efficient to compensate the lysine deficit by adding soy proteins than by using the pure amino-acid (Costin, 2001). It has been experimentally studied the addition of sunflower protein and of fish flour, for the fortifying with amino-acids, but the characteristics of the final product are not appropriate (Leonte, 2000).

Fortifying the bread with micronutrients

The wheat flour is ideal for giving micronutrients (vitamins and minerals) to the population. There are added the vitamins B_1, B_2, PP and iron and in some countries calcium and folic acid, the vitamins A, D, B_1, the niacin and the iron are added in direct ration with the quantities lost during the crushing. They are added as premix.

Fortifying with calcium is done by additions of powder skim milk, calcium lactate (0.5-1.5%), whey, milk caseinates and co-precipitates (10%) which increase the biological value of the proteins in the bread by 40%. From a nutritional point of view, the level of the calcium in the bread depends on the type of lour (Deseatnikov, 2002). The high extraction flour contains phitic acid which links the calcium in inaccessible compounds (Simac, Bordei, 2003). Supplementing the content of vitamins in the bread is done adding premixtures which contain the B_1, B_2, PP vitamins, folic acid, optional iron, addition substances encapsulated in alimentary permeable membranes, which decay in the dough (Buchsesspanner et al., 2003).

ALTERNATIVES FOR STIMULATING THE FERMENTATIVE ACTIVITY IN THE BREAD MANUFACTURE DOUGH

The malt extract is considered to be another alternative for stimulating and maintaining the fermentative activity, apart from the contribution of the diastatic power. The content of fermentable sugars in the dough at the beginning of the kneading is increased. The enzymes of the malt extract with a certain diastatic power and together with the mineral salts increase the capacity to form gases and reduce the fermentation time. The taste and the aroma of the bread are improved. The volume is larger and the porosity smoother. The malt extract contributes to a better harmonization of the technological characteristics. The nutritive value is improved due to the content of active biological factors such as the B_1, B_2, B_6, PP vitamins, the lipids, the gums, the proteins and reducing glucides. The malt extract ensures

a constant value of the fermentation, contributing to the elimination of "the maltase break" (Voicu 2000). The evolution of the quality indices of the bread is positive around the value of 1% addition of the flour quantity. There are other sources of fermentable sugars such as the addition of glucose and saccharose, but the malt extract has both diastatic power and vitamins (Sava, et al., 1999).

Non traditional additions in the bread manufacture

Some additions have been adapted to the industrial system (the modified starch) while others have remained in the research phase (the nettle, the apple jam, the amaranthus seeds, the potato chips).

The modified starch is used in the United States, in Germany, Slovacia, as oxidized starch, carboximethilate, inflated, extrudated, phosphated, coated. By using modified starch, products with a larger volume and crumb of a lighter colour can be obtained. Many types of starch are used: wheat starch, potato starch, corn starch, extrudated, inflated, acetilated.

The coated starch is a good nutritive material for the yeasts, it increases the gas production in the dough, it reduces the fermentation time and increases the duration of the freshness of the bread with up to 30 hours.

The Amaranthus seeds are added to the flour in order to improve the mixture with proteins, lipids, vitamins and minerals and they have a biological value similar to the oat. The amaranthus flour is used for making some diet products for the persons with gluten intolerance. It is added in a ration of 5-10% of the flour. The bread have taste and aroma similar to the bread with other additions, of oil and sugar, but the colour of the crumb is dark grey and the bread is flat (Voicu, 1998).

The soy flour in the bread manufacture

The FDA (Farmaceutic administration of the Agriculture and Industry Ministry of the United States), one of the most respectable institution worldwide, has expressed its approval regarding the advanced idea related to the benefit effects of the soy products on the human health. Soy has a APP (active protein percent) similar to that of milk. The high biological value of the soy protein is given by the high level of lysine and low level of methionine and cysteine. Its use is justified from an economical point of view, the soy flour being cheaper.

For processing the white flour it is recommended to add low fat soy flour or soy flour with active enzymes, and for specialties, the soy fibres, soy concentrate and low fat soy flour. The main functionality of the soy flour is

to increase the nutritive value of the bread. The capacity of water absorption and the crumb whiteness increase, thus the productivity being increased. The soy flour is added in a maximum ratio of 8%. For a higher addition it is necessary to add ascorbic acid as well, as antioxidizing agent (www.soyaprotein.com, Purice, 2000, Boiacioglu, 2003).

The addition of fibres in the bread manufacture

The sources of alimentary fibres are the branny products of the different cereals like wheat, soy, rye. The Romanian fibre products are exclusively breadstuff. According to the last accepted definition (Giurea, 2001), the alimentary fibres are carbohydrates which are resistant to digestion and absorption inside the human thin intestine, and with partial or complete fermentation inside the thick intestine.

The farinographic research has proven that the stability of the dough and the making duration have increased proportionally to the quantity of bran added (20-40% of the flour) (Gerogescu, 1998). As the fibre proportion increases according to the extensogrames, the extensibility of the dough increases as well. The structural relaxation of the dough and the evolution of the maximum resistance are ascending (Georgescu, 2000). According to the amylogrames, it appears a decrease of the maximum degree of coating of the starch, at the same time with the increase of the addition of branny material (Georgescu, 2000). The technological diet is "prescribed" according to the dough farinographic characteristics. The bread with fibre addition has a smaller volume as the addition of bran increases. The more the quantity of the bran increases, the coarser the porosity of the crumb and the more reduced the elasticity. The crumb feels rough and leaves an unpleasant sensation when masticated. The acidity increases gradually, in direct ratio to the bran addition. The bread has a pleasant aroma.

Different branny materials, with different commercial names and a complex content, are used. It is recommended to add these and other branny products in a ratio of 15-17%. The perhydration is recommended to be done before the kneading, because of the level of water in the dough. Processing the bran is done by hydration, humid heating for the inactivation of the thermolabile enzymes and the humid oxidizing treatment (Simac, 2003). This favours the oxidation of the potentially oxidizing substances, such as the free polyunsaturated acids, the glutathione and the substances that can act as foaming destabilizes and which can reduce the volume of the bread (Georgescu, 1998, Giurea, 1998). The products obtained, apart from the recommendations, are considered to be natural products prepared according

to well established technologies. The scheme of conditioning the bran material is a parallel, auxiliary scheme. It crosses the main one on kneading the dough (Georgescu, 1998).

CONCLUSIONS

The technological characteristics of the flour and the nutritive value of the bread are characterized by the following variables: initial volume, fermentation time, flexibility, the dough condition to fermentation, water retention, maximum resistance, extensibility, final rise to baking, final volume of the bread, nutritive value, and energy value. In order to improve these variables, different additives and substances are used in the bread manufacture, some of these being native components of the flour. All the additions are dosed according to the quality indices of the raw material.
The most frequently used hydrolases are the amylases, the proteases and the xylanases.
The used oxyreducing enzymes are the lipoxigenase, the catalase, the peroxidase, the glucoxidase and the hexozoxidase.
The reducing substances or the oxidizer are the chemical alternative of correcting the flaws of the flour.
Due to the synergy of the multienzymatic systems combined with the emulators, the hydrocolloids, the oxidizing or reducing substances, the deficiencies occurred during each stage of the technological process can be corrected.
Improving the nutritive value of the bread is done by strengthening it with micronutrients, vitamins B_1, B_2, PP, folic acid, the vitamins A and D, calcium and magnesium, proteins of different sources, amino-acids.
In Romania, the fibre products are almost exclusively bread manufacture products. Bran materials are being used, with a complex composition and which undergo treatments prior to being introduced into the dough. The addition is limited by the value of certain variables which characterize the dough and the bread.

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