

ANALYSIS OF THE ROLE OF CHEMICAL IMPROVEMENTS IN BREAD PRODUCTS PRODUCTION TECHNOLOGY AND THEIR IMPACT ON CONSUMER SAFETY

TSTU PhD student,

Mustafaev O.Sh

TCTI, Ph.D., Assoc.

Ravshanov S.S

TCTI, master,

Karimov D.

TCTI, master,

Safarov S.S

TCTI

Abdullayeva F.B

Abstract: *In this article, chemical improvers play an important role in improving the technological and organoleptic quality of bakery products. In particular, emulsifiers, hydrocolloids, oxidizing agents (e.g. ascorbic acid) and leavening agents significantly improve the stability, volume, structure and shelf life of dough. These substances increase technological efficiency by controlling the fermentation process, strengthening the gluten framework and retaining moisture. However, their safety for consumption depends on proper use and strict regulatory control, and in some cases it has been reported that harmful substances, such as acrylamide or 3-MCPD (3-monochloropropane-1,2-diol), may be formed during the baking process [1].*

During the kneading process, the (-SS-) bonds in the flour proteins are converted to (-SH-) bonds under the influence of mechanical forces [2], which reduces the strength of the gluten and its ability to hold gas. The (-SH) and (-SS-) bases in the dough determine its strength, and the more (-SH) bases are converted to (-SS-) bases, the stronger the dough will be [3].

Oxidizing agents, including potassium bromate, potassium iodate, ascorbic acid, and azodicarbonamide, are widely used to improve dough strength [4]. Potassium bromate is less effective during the mixing process and becomes active during the fermentation period, with a maximum addition rate of 0.03 g/kg [4]. By introducing air and molecular oxygen (O₂) into the dough, it participates in enzymatic reactions, causing the oxidation of free sulfhydryl groups and an increase in bread volume [5].

The addition of ascorbic acid was found to reduce the GI and GL values of bread made with 90% flour compared to bread made with 72% flour, which may be due to the high dietary fiber content in the flour. When compared with lipase enzymes and the emulsifier DATEM, differences were found in bread volume and oven rise, with

Lipopan 50-BG significantly increasing bread volume [6].

The addition of soy lecithin, salt, and reducing agents (l-cysteine and glutathione) to the dough affects the formation of 3-MCPD and glycidyl esters during the baking process [7]. Therefore, it is important to consider consumer safety when adding chemical additives.

Synthetic ingredients – oxidants, preservatives, antioxidants and colourants – are used in bakery products to improve technological quality and extend shelf life. They are subject to regulatory control through international and national standards, with acceptable daily intakes (ADIs) and sanitary and hygienic standards [7].

An analysis of synthetic ingredients used in bakery products and their safety for consumption is presented (Table 1). For example, potassium bromate poses a risk of carcinogenicity, ascorbic acid is generally safe, potassium iodate may affect the thyroid gland in excess consumption, sorbates and benzoates are moderately safe, but there is a possibility of allergy [8].

Table 1

Synthetic ingredients added to bakery products and their impact on consumer safety

Synth etic ingredient	The role of bakery products	Consu mer safety	Potential health effects	Existing norms / recommenda tions
Potas sium bromate (KBrO ₃)	An oxidant in the dough, it improves the volume and structure of the bread	It can become a dangerous, carcinogenic substance	Negative effect on height growth, carcinogen, effect on kidney and liver	Banned in many countries
Ascor bic acid (vitamin C)	Improve s the quality of dough, oxidizing	Usually safe	Excess amounts can affect blood sugar levels	ADI: 0– 2 mg/kg 5 mg/kg body weight
Potas sium iodate (KIO ₃)	It affects the dough structure and color	Safe in moderation	An excess amount has an effect on the activity of the thyroid gland	≤50 mg/kg flour
Sorbat es (sorbic acid)	Preserva tive stops the development	Safe in moderation	Allergy, itchy skin	ADI: 25 mg/kg 5 mg/kg body

	of microorganisms			weight
Benzoates (sodium benzoate)	Preservative	Safe in moderation	Allergy, hepatotoxic effects are possible	ADI: 5 mg/kg 5 mg/kg body weight
Azodicarbonamide (ADA)	Oxidizing, increases the volume of bread	Excessive consumption is dangerous	In some cases, there is a threat of allergy, carcinogenicity	Limited availability in the US
Synthetic colors (E102, E110)	Improves appearance and organoleptic properties	Safe in moderation	It can cause hyperactivity and allergies in children	In the European Economic Union, the maximum amount of use is set

Also, the formation of bread aroma depends on the composition of the ingredients and the fermentation process, and the main aroma compounds are 2-acetyl-1-pyrroline, (E)-2-nonenal, 3-methylbutanal, and others [9].

The above analyses demonstrate the impact of bread improvers on human health and the environment, and demonstrate the need for their safe and environmentally friendly use [10]. Since natural improvers (derived from plant or animal tissues) are also widely used, it is important to continue research to improve the quality of the finished product and assess its safety.

Conclusion: Chemical improvers play an important role in improving the technological and organoleptic quality of bread products, but the lack of consideration of consumption safety, dosage and regulatory control can have a negative impact on health. Also, the use of natural improvers makes it possible to produce high-quality, environmentally friendly and safe bread products.

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