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ХІМІЧНІ, ФІЗИЧНІ ТА МАТЕМАТИЧНІ МЕТОДИ ДОСЛІДЖЕННЯ ПРОЦЕСІВ ТА АПАРАТІВ

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COMPLEX APPROACH TO QUALITY IMPROVEMENT OF BAKERY PRODUCTS BY USING PHYTO-EXTRACTS

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The important task of food industry is the development of innovative solutions to problems as well as manufacturing the products with currently relevant physiological properties. Wholesome food products with protective and prophylactic properties fortified with vitamins, essential amino acids, mineral substances, and other biologically active compounds continue to gain popularity [1,2]. Additionally, baking industry encounters the product quality problems, especially in straight dough technologies and while processing low quality flour, that are solved by using chemical improvers. However, this fact causes unease among consumers and health professionals. In this regard, the growing interest towards aromatic and medicinal plants as the source of biologically active compounds capable of improving the product quality has been observed. Given their chemical composition, physiological properties, and availability, dogrose and hawthorn berries containing valuable vitamins, major and minor dietary elements, mono- and disaccharides, pectins, amino acids, etc. as well as peppermint and lemon balm leaves known for their antioxidant and antiseptic properties and appealing flavor has been chosen as promising raw materials. These ingredients have distinctive range of pharmacological properties, such as anti-inflammatory, anticarcinogenic, restorative, and protective [3,4].

Considering high reactivity of pectic and phenolic compounds, organic acids, etc., it is advisable to study the possibility of controlling the intensity and direction of colloidal and biochemical processes and the state of biopolymers during bread making in order to improve the quality of intermediate and finished products, despite the quality fluctuations of raw materials. The plant materials containing saccharides, amino acids, vitamins, and wide range of macro- and microelements, often absent or lacking in flour and other traditional ingredients, can be considered as promising components of nutrient mediums for yeast and lactic acid bacteria. Additionally, the presence of compounds with antioxidant and antiseptic properties and appealing flavor allows to consider the possibility of preventing oxidative and microbiological spoilage and decreasing the content of additives, preservatives, and flavoring agents [5].

The determination of rational methods and parameters of plant material preparation in order to form the necessary properties considering the requirements and conditions of baking industry is one of the most important tasks.

The easiest method of plant material preparation is grinding and its further usage in the form of powder, however, its structural and mechanical properties, especially the particle size, noticeably differ from the properties of flour, which leads to degradation of sensory qualities of finished products.

Extraction is an effective method of separating the complex of technologically valuable compounds and removing the undesirable fractions. Water was chosen as an extractant traditional for bread industry with the material to extractant ratio of 1:10 for dogrose and hawthorn berries, and 1:20 for peppermint and lemon balm leaves. The rational temperature and duration of extraction was determined experimentally, monitoring the content of total soluble

solids and the effect on rising power of yeast and gluten elasticity for dogrose and hawthorn extracts and biological activity for peppermint and lemon balm extracts.

It was determined that most compounds used as nutrients by yeast and lactic acid bacteria (mono- and disaccharides, amino acids, vitamins, organic acids, etc.) were retrieved from dogrose and hawthorn berries during the first 30 minutes of extraction at 100 °C, thus such extracts positively affected the rising power of yeast, reducing the time a dough pellet submerged in water needed to break surface by 18-29 %. Increasing the duration of extraction to 60 minutes led to increased content of pectins and tannins capable of affecting the protein-proteinase complex of wheat flour and increasing gluten elasticity by 12-24 %. Further study had shown the positive impact of phyto-extracts on rheological properties of dough, fermentation process, and physico-chemical properties of finished products.

Biological activity (indicator of antioxidant properties) of peppermint and lemon balm extracts reached its maximum after 30 minutes of extraction at 90 °C; increasing the temperature and duration evidently led to destruction of necessary biologically active compounds. Those extracts had no apparent impact on fermentation process and rheological properties of wheat dough; however, they displayed noticeable antimicrobial properties, such as the ability to inhibit the growth of hay bacillus (*Bacillus subtilis*) and mold of *Aspergillus* and *Penicillium* genus. Furthermore, after the addition of extracts into the dough, the finished product retained the appealing flavor of peppermint and lemon balm.

In order to achieve the multidirectional improvement of physico-chemical, microbiological, and physiological properties of bakery products, it was necessary to study the phytocomplexes of berry (dogrose and hawthorn) extracts combined with aromatic (peppermint and lemon balm) extracts.

It was determined that the usage of phytocomplexes allowed to increase loaf specific volume by 9-12 % and shape stability by 9-11 %, improve sensory properties of finished products, slow down their staling and microbiological spoilage. Furthermore, the biological activity of bakery products increased from 12 (control sample) to 30-50 (samples with extracts) to 68-84 (samples with phytocomplexes).

Thus the results of studying the extracts of dogrose and hawthorn berries and peppermint and lemon balm leaves separately and combined into phytocomplexes show the merits of their usage in baking industry in order to improve consumer qualities, safety, and physiological properties of finished products as well as control the fermentation process of dough.

Scientific Supervisor – PhD. (Tech.), Associate Professor Lebedenko T.

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