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РОЗДІЛ 1

АКТУАЛЬНІ ПИТАННЯ ЗБЕРІГАННЯ ТА ТЕХНОЛОГІЇ ПЕРЕРОБКИ ЗЕРНА, ОВОЧІВ ТА ФРУКТІВ

WHOLEMEAL FLOUR - NEW TREND IN WORLD WHEAT PROCESSING

V. Pokarinina
Odessa National Academy of Food Technologies, Odessa

The processing of grain into WGF is carried out by different technologies, which differ in the type of grinding equipment and the number of grinding systems. Roller mills, crushers or millstones can be used as grinding equipment. There is also the practice of using combined technological schemes, where roller mills are used as the main grinding equipment, and millstones or crushers are involved on the latest grinding stages. WGF obtained by different manufacturing technologies differs significantly by quality indicators. Local Ukrainian state quality standards (DSTU) for wheat WGF are absent today. DSTU 46.004-99 «Wheat flour. Specifications» apply only to high-grade flour and dark flour. Research of quality indicators of Ukrainian wheat WGF showed that some manufacturers use DSTU 46.004-99 [10] in the WGF production, other manufacturers control the quality of the flour according to their own specifications.

Due to the lack of unified manufacturing technology, the quality indicators of Ukrainian WGF presented on the local market fluctuates greatly. Therefore, **the purpose** of the work is to substantiate the principle of the technological scheme and optimal grinding modes of production of wheat WGF.

The object of the study was the technology of wheat' and spelta's WGF production. The subject of the study is WGF from common wheat and from spelta wheat that were obtained in the laboratory due to various technological schemes.

According to the quality indexes, wheat grain of 4^{th} class (test weight 780 g/l, vitreous 53%, protein content 10,4 %, gluten content 17,0%), and spelta grain (test weight 670 g/l, vitreous 64%, protein content 13,5%, gluten content 37,0 %) were used for laboratory grain processing into WGF.

WGF was obtained from two variants of technological schemes with different modes of grinding systems. The technological scheme according to option No. 1 included four break grinding systems (B1, B2, B3, B4) on roller machines and one grinding system (St1) on a millstone. The technological scheme according to option No. 2 included three break grinding systems (B1, B2, B3) on roller machines (whereby I and II break grinding systems were carried out without intermediate sieving) and two grinding systems (St1, St2) on a millstone.

According to the scheme option No. 1 at each of technological system the WGF was obtained by the using of sieves No. 1,0; 090; 080; 067; 063; 056. The overt ail products, after the sieving of the flour, were directed for further grinding at subsequent systems. The final grinding of the bran obtained at the last roller mill system (B4) took place on a millstone (St1). In laboratory grinding No. 1.1 the following operative system modes (sieve release) were maintained: SR_{I} = 34 %, SR_{II} = 58 %, SR_{III} = 57 %. At the final grinding system the maximum amount of flour was selected. During the laboratory grinding No. 1.2 the operative modes at B3 and B4 were slightly higher than at the previous grinding: SR_{III} = 41 %, SR_{IV} = 21%. The load on millstone system (St1) at grinding No. 1.2 was 13.8 %. During laboratory grinding No. 1.3 low operating modes of the systems were maintained: SR_{I} = 36 %, SR_{II} = 76 %, SR_{III} = 74%, SR_{IV} = 86 %. The load at St1 at this grinding was the lowest and equal 0.6 %. Laboratory grinding No. 1.4 is characterized by the following operation modes of the grinding systems: SR_{I} = 26 %, SR_{II} = 53%, SR_{III} = 36 %, SR_{IV} = 23 %. In this grinding operation mode of B1 was the highest comparing to other grindings. The load on St1 at grinding No. 1.4 was the highest comparing to other similar laboratory grindings and equal 17,3 %.

In the next stage, the laboratory grinding of common wheat and spelta wheat grains into WGF according to the scheme option No. 2. It consisted of three roller mill grinding systems and two millstone grinding systems, and based on gradual-parallel grain grinding. On the roller mill grinding systems, WGF was selected by passage of flour sieves No. 38, which provided separation of pure flour. Larger fraction with bran's in its composition was sent for further grinding. For laboratory grindings the sieve release on the first two systems SR_{I+II} was gradually reduced: 54.6%, 48.8%, and 39.8% for grindings No. 2.1, 2.2, 2.3, respectively. As a result, the load on the millstone systems increased and the amount of flour obtained from the abrasion deformation also increased. There were no significant difference in moisture content, ash content and gluten content between the obtained WGF samples (Table 1).

Table 1 – Quality indicators of WGF

No. grindings	Moisture, W %	Ash content, Z %	Crude gluten		Granulatory, %		Physiochemical indicators of bread		
			content, %	gluten deformation index, units	top on sieveNo. 067, %	passage through sieveNo. 38, %	bread volume, cm^3	porosity, %	Specific bread volume, cm^3/g
1.1	12,9	1,68	17,1	71	4,3	44,3	350	75	1,5
1.2	12,5	1,68	17,0	70	4,9	40,8	350	75	1,5
1.3	12,8	1,67	17,1	71	1,5	55,0	360	77	1,6
1.4	13,0	1,68	17,2	72	11,0	36,0	330	75	1,4
2.1	12,8	1,68	17,4	70	1,3	64,3	430	79	2,0
2.2	12,6	1,68	17,2	68	3,4	60,1	400	79	1,9
2.3	11,3	1,81	39,6	106	1,6	50,3	380	67	1,8

Analyzing the obtained data it can be noted that the best sample for quality indicators and baking properties in the grinding scheme option No. 1 was a sample of WGF from laboratory grinding No. 1.3. This is connected directly to the particle size of the flour: passage through the sieve No. 38 was 55 %, and the top of sieve No. 067 – 1.5%, which indicates a more balanced particle size distribution. Bread volume for samples No.1.1-1.4 fluctuated within 330-360 cm3, the porosity of the studied bread samples varied within 76-77%. The worst quality had the sample of flour obtained as a result of laboratory grinding No1.4, which is also related to its particle size.

The quality indicators of the common wheat WGF obtained according to the scheme option No. 2 differed with a smaller particle size of the flour: the top on sieve No. 067 was 1,3 and 3,4 %, respectively. The passage through sieve No. 38 had 64,3 % and 60,1%, respectively. The obtained bread from these samples was characterized by good baking properties, a larger bread volume of 430 and 400 cm3, and a high porosity that corresponds with similar indicator from bread made of high-grade flours.

Particle size of spelta WGF was characterized by top on sieve No. 067 – 1.56% and sieve No. 38 passage –50.3 %. The content of crude gluten in the sample was 39.6%, gluten deformation index (GDI) = 106 units. The high value of GDI resulted in worse baking properties compared to wheat flour obtained in the same scheme.

Conclusion. Wheat and spelta WGF is popular among the population of many countries in the world. Ukrainian state standards for wheat WGF are absent for this moment. DSTU 46.004-99 «Wheat flour. Specifications» apply only to high-grade flour and dark flour.

The research of technological, baking quality indicators of wheat and spelta WGF and the indicators of baked bread showed completely different end-results, due to different technological approaches for its production and lack of general normative documentation. For the production of WGF, it is most appropriate to use combined technological schemes with the usage of roller machines as grinding equipment on the main systems of the technological process and millstones at the ending systems for the final grinding of intermediate products. Based on the conducted researches it is advisable to use the scheme, which consists of 3-4 roller mill grinding systems and 1-2 millstone grinding systems with sequentially grinding. The following operative modes of systems (passage through sieve No. 067) are recommended: SRII = 30-40%, SRIII = 60-70%. The operation mode of other systems must be such as to ensure maximum extraction of WGF. It was found that the particle size of wheat WGF, which is controlled by the top on sieve No. 067,must be not more than 2.0%,while the passage through sieve No. 38 must be not less than 50%.

Scientific supervisor – Candidate of Technical Science,
Associate Professor O. Voloshenko.

STABILIZATION OF CURCUMIN BY POLYSACCHARIDE MANNAN FROM COFFEE SLURRY

Yershova K.
Odessa National Academy of Food Technologies, Odessa

Curcumin is a phenolic compound produced by some plants, among which *Curcuma longa* is the reachest in this principal curcuminoid [1]. Curcumin is one of the very few promising natural products that has been extensively investigated by researchers from both the biological and chemical point of view [2]. Curcumin and turmeric's other two curcuminoids, desmethoxycurcumin and bisdesmethoxycurcumin are natural phenols responsible for the yellow color of turmeric. Indeed, because of its bright-yellow color, curcumin is used as a food coloring as well as food additive [3].

Curcumin is now regarded as a "new drug" with great potential and is being used as a supplement in several countries. For example, in India, turmeric containing curcumin has been used in curries; in Japan, it is popularly served in tea; in Thailand, it is used in cosmetics; in China, it is used as a colorant; in Korea, it is served in drinks; in Malaysia, it is used as an antiseptic; in Pakistan, people use it as an anti-inflammatory agent to get relief from gastrointestinal discomfort; and in the United States, it is used in mustard sauce, cheese, butter, and chips, as a preservative and a coloring agent. Curcumin is marketed in several forms including capsules, tablets, ointments, energy drinks, soaps, and cosmetics [4].

Curcumin is a symmetric molecule, also known as diferuloyl methane. The IUPAC name of curcumin is (1E,6E)-1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione, with chemical formula $C_{21}H_{20}O_6$, and molecular weight of 368.38. The diketo group exhibits keto-enol tautomerism, which can exist in different types of conformers depending on the environment. Curcumin can exist in several tautomeric forms, however, the enol form is more stable in the solid phase and in solution [2, 3].

The spice turmeric is used in Indian and Chinese medicine since ancient times for wide range of diseases. Extensive scientific research on this molecule performed over the last decades has proved its potential as an important pharmacological agent.

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Наукове видання

Збірник наукових праць молодих учених, аспірантів та студентів

Головний редактор, д-р техн. наук, проф. Б.В. Єгоров
Заст. головного редактора, канд. техн. наук, доц. Н.М. Поварова
Відповідальний редактор, д-р техн. наук, проф. Г.М. Станкевич
Технічні редактори А.В. Коваль, Т.Л. Дьяченко

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