Таблица 1

Режимы и параметры приготовления ржаных заквасок

Наименование параметров	Густые закваски	Жидкие закваски
Влажность, %	55…60	68…72
Температура, °С	26…28	28…30
Продолжительность брожения, час	3,0…3,5	3,0…4,0
Конечная кислотность, град	11…13	9…12
Подъемная сила, мин	20…24	23…28
Количество закваски на возобновление, %	60,0	50,0
Количество закваски в тесто, %	40,0	50,0

такое же количество из муки и воды для воспроизводства новой порции [3].

Следует отметить, что производственные закваски накапливали в необходимых соотношениях кислотообразующие бактерии, дрожжевые клетки и органические кислоты [2]. В непрерывно освежаемых ржаных заквасках было обнаружено определенное количество разнообразных бактерий вносимых с сырьем, в том числе культуры дикой микрофлоры. Но в процессе брожения значительная часть этой микрофлоры подавлялись кислотообразующими бактериями. На основании этого можно заключить, что закваски выведенные путем спонтанного брожения можно использовать в производственном процессе вместо заквасок, выведенных по разводосному циклу с применением чистых культур дрожжей и молочнокислых бактерий.

На основе закваски, полученной путем спонтанного брожения, была произведена пробная выпечка ржаного хлеба. Качество готовых образцов было определено путем органолептической оценки. Полученные результаты показали, что опытные образцы хлеба имели правильную форму, характерный цвет мякиша, разрыхленную структуру пористости, а также вкус и запах, свойственные ржаному хлебу без посторонних привкусов.

На основании вышеизложенного можно рекомендовать использование заквасок, полученных путем спонтанного брожения, вместо разводочного цикла в небольших пекарнях. Приготовление теста на густых и жидких заквасках проще осуществлять по двухстадийному циклу: закваска, тесто, так как он является менее трудоемким и менее длительным для предприятий малой мощности. В случае необходимости с учетом возможностей предприятия можно подобрать оптимальную технологию выведения заквасок.

На основании проведенных исследований можно сделать следующие выводы:

1. Изучено использование заквасок, полученных путем спонтанного брожения.
2. Показана возможность использования густых и жидких заквасок, полученных при спонтанном брожении в производственном процессе.
3. Отмечено, что хлеб, выпеченный на спонтанно забродивших заквасках, по органолептической оценке отвечал предъявляемым требованиям для ржаного хлеба.
4. Рекомендовано использование заквасок, полученных на основе спонтанного брожения, на предприятиях малой мощности.

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PRIMITIVE WHEAT (POLBA) IN UKRAINE

Data are presented in the analytical review on growing and application of the primitive wheat (polba) in Ukraine. It is shown that the history of polba in Ukraine numbers several centuries. After considerable decay and neglecting, there is some revival of interest to the culture. Properties of Ukrainian polba are reviewed, as well as several recipes of polba porridge are given.

Keywords: polba, hulled wheat, primitive wheat

В аналитическом обзоре представлены данные по выращиванию и применению примитивной пшеницы (полбы) в Украине. Показано, что история полбы в Украине насчитывает несколько столетий. После значительного спада и пренебрежения, наблюдается некоторое возрождение интереса к этой культуре. Рассматриваются свойства украинской полбы, а также приводятся несколько рецептов приготовления каши из полбы.

Ключевые слова: полба, пшеница, примитивная пшеница

Introduction

Wheat was the main crop of Ukraine in the 19th century and the most important exported food. In 1913, the sowing area of wheat in Ukraine occupied 8.9 million hectares (5.8 million hectares of barley, 4.5 million hectares of rye) or 31.8 % of the total crop acreage and 36.0% of grain, including winter wheat was 3.1 and 5.8 million hectares of spring wheat. The total crop of winter wheat was 3.6, spring one – 4.3 million tons. On the Right Bank and Western Ukraine almost exclusively winter wheat was distributed, on the Left Bank and in the steppe dominated spring wheat, while winter wheat was the main culture in the Crimea [1].

Since 1925 wheat area has experienced increase due to decreasing the acreage of barley, and more or less productive rye. Spring wheat crops almost disappeared, because of growing new varieties of winter wheat resistible to frost.

Wheat species grown in Ukraine are as follows: Soft or regular wheat (*Triticum aestivum Linn.*) is the main component of bread products. Hard wheat (*Triticum durum Desf.*) is used for making macaroni dough and to improve conventional bread products. Also the following wheats are grown in Ukraine in limited amounts, such as polba (*Triticum dicoccum* - used for production of cereals), spelta (*Triticum spelta*), Polish wheat (*Triticum polonicum*), English wheat, or mast (*Triticum turgidum*) [1].

In recent years interest has raised to natural, environmentally friendly products including primitive wheat called «polba» in Ukraine and Russia. It became so theoretically popular that it even obtained the name of «caviar of cereals» [2-5]. The current interest to polba is related to the development of organic farming. This culture grows on various soils without fertilization and is extremely economical and resistant to diseases and pest damage. The current rush in polba demand in Western Europe is due to extremely useful and even therapeutic features of polba. It has high content of protein, amino acids, vitamins and iron.

Development of organic agriculture in Ukraine has just started. Polba is cultivated now only in Cherkassy, Zhitomir, and Volyn regions [6, 7]. Private Company Haleks-Agro, village Stryyeva, Novograd-Volyn district, Zhytomyr region cultivates polba since 2008 [6, 18]. It has concluded over 300 contracts for leasing the land (shares), and received a certificate program in organic farming in Dutch by the Control Union and the Swiss organization «IMO». In the north of Ukraine there are 10 000 hectares under polba and in 2010 there was the first harvest. Seeds (the German variety) were bought at a price of 1000 EUR per ton and imported from Europe [18]. Productivity of polba in Ukraine is from 1.5 to 4 tons of grain per hectare. There is also a «Live Earth of Potutory « small company at Berezhanskiy district, Ternopilska region where they grow up polba [19].

In Russia polba is not very popular. It seems, that only two farmers grow polba there [3, 5, 20, 21]. V. F. Timofeev [20] grows polba at a small private enterprise in Kukmor settlement, Republic of Tatarstan. In the 90s he saved 100 kg of polba in the same experimental farm where grain could abyss, and then the story of polba in Russia threatened to break off. There is a small private enterprise «Chahar» in Kasumkente village, Suleiman Stalskiy district, Dagestan where M. Ahmad revived the primitive variety of polba called «Lezgi Chahar» [21].

Some history of polba

Cultural polba (*Tritikum dicoccum Schrank*) and spelta (*Tritikum spelta L.*) are ancient wheats known from prehistoric times. They formed an epoch in the development of agriculture from early Neolithic to the 1st century BC. These two species are closely related in their history. In the first half of the XIX and XX century cultural polba was called the «usual polba» and spelta - the «real polba». This has caused some confusion in the names of the cultures that differ substantially in quality characteristics of grains as raw materials for bread and cereals. The more interesting of these two types of cultural polba is T. *dicoccum* [8].

Herodotus (V millennium before Christ), who visited Egypt about 450 before Christ, wrote about the bread «olura» (polba) as the only bread of Egyptians: «The ancients consume wheat and barley, but the Egyptians considered shameful to take them in the food; they prepared their food from «olura» [9].

Primitive wheat (polba) as a culture is also known from ancient times in the North Caucasus, Europe (former Soviet Union), as evidenced by archaeological remains of this culture dating back to III-V millennium BC. Scientists believe that the center of polba origin is the Eastern Mediterranean, Caucasus, and Abyssinia [10, 11]. The first mentioning of the polba cultivation in Ukraine, as well as in Russia was in the 15th century. The main crops were focused at Crimea, Middle Volga, and Astrakhan province [12].

In Ukraine polba as a cereal culture has ancient traditions. The oldest polba was found in the Chernivtsi region and belongs to 4th century BC. In Ternopilska region finding refers to the bronze century. In the Carpathian region polba was cultivated to mid-50's of the 20th century (under the names «orkish» and «lusknytsya»), and in the Slovak Carpathians - even to the 80's.

In the tsarist Russia, including Ukraine, polba was the main type of wheat till the end of 18th century. It was appreciated for ease of cultivation and unpretentiousness. In Ukraine wheat appeared in culture at 4 - 3 century BC (hard wheat and widely used type of wheat - hulled wheat called in Ukraine «polba»). Porridge from polba until XVIII-XIX centuries was very common among eastern Slavs. Polba had immense popularity primarily due to its excellent agricultural characteristics. Since XIX century the sharp decline in crop of polba was observed against expanding production of more fertile soft wheat. In Crimea polba was found at the Kerch Peninsula near Feodosia. Polba was formerly grown in Tatar villages near Bakhchisarai, but the 1933 survey of the Crimean peninsula has not revealed any traces of polba. Known historical events and social upheavals in mid twentieth century, mass deportations of the population adversely affected the lifestyle of the population in Ukraine, destroyed here many cultural traditions, including traditions of farming. The disappearance of polba was one of the outcomes of these events [13]. Nowadays polba is preserved mainly in areas where the population retains elements of national culture. For example, in Armenia and Dagestan polba is not only saved by people, but also its crops increase [14]. The problem of polba's revival as a culture in Ukraine is relevant for today:

Properties of Ukrainian polba

Cereal crop of polba has several valuable features. This plant differs by resistance to adverse soil and climatic conditions. It is characterized by rapid ripening; it is well growing on black soil, on clay, in taiga and peat bogs. Polba is more resistant to cold and drought than wheat, less damaged by pests and diseases. The negative economic qualities include rough neural films that are snug against the grain and cover it [15]. Polba is a cereal containing 17-23% of protein, and 38-40% of gluten [17]. Size of grain is small (mass of 1000 grains in average is 29-35 g, unlike wheat with the mass of 1000 seeds of 40-50 g).

Cereal grains made of polba are known by their good taste and nutritional benefits. For taste and nutrition polba porridge is not inferior to buckwheat one. Output of cereals grain from polba is 61-85%, while the barley - 56%, buckwheat - 69%, millet - 77%. Groats from polba are glassy and do not create mucus during cooking, so it is indispensable in preparation of many national dishes [14]. So, in the Caucasus and Dagestan they prepare polba pilau, which local people value above the rice one. According to researchers [14], porridge made of various samples of polba has pleasant smell, crumbly structure, soft texture, and good taste. The coefficient of soft boiling in different samples of polba is from 6.6 to 8.0. Data on the chemical composition of polba flour [9] are shown in Table. 1.

Table 1
Data on the chemical composition of flour polba with two types of *Tr. dicoccum* and *Tr. Spelta* [9]

Quality Score	Composition of flour	
	Tr. dicoccum	*Tr. Spelta*
Moisture, %	11.2	11.0
Ash, %	0.783	0.555
Protein, %	13.79	12.5

Data on trial for bakery properties of polba flour [10] show that dough during the kneading is sticky, elastic, and smooth. During maturation, it darkens. Yield of dough from 100 g of flour is 157 grams. Yield of bread from 100 g of flour is 146-148 g.

Ready bread is dark brown with smooth crust. Color of crumb is grayish. Taste is sweet, not like wheat or rye bread. Index of porosity varies from 94 to 96%.

Current data [16] show that the amino acid composition of flour obtained from polba species *Tr. dicoccum* (Emmerich) and *Tr. Spelta* (Spelta) is very close to the amino acid composition of wheat flour used as a reference sample (Table 2).

Analysis of Table. 2 data shows that in the flour with species *Tr. dicoccum* and *Tr. Spelta*, as in wheat, lysine is the limiting amino acid. However, the lysine content in flour from these types of polba is higher compared with wheat flour respectively by

Table 2

Amino acid content (g/100 g protein) in flour obtained from *Tr. dicoccum* and *Tr. Spelta*

Amino acid	FAO Scale (1985)	Wheat		*Tr. dicoccum*		*Tr. Spelta*	
		Content	Score protein,%	Content	Score protein,%	Content	Score protein,%
Threonine	3.40	2.75	81	2.95	87	2.63	77
Valine	3.50	3.92	112	4.36	125	4.16	119
Methionine		1.51		1.40		1.58	
Cysteine	2.50	2.34	94	2.25	90	2.03	81
Leucine	6.60	6.68	101	6.91	105	6.76	102
Isoleucine	2.80	3.32	119	3.66	131	3.54	126
Tyrosine		3.07		2.54		2.94	
Phenylalanine	6.30	4.82	77	4.59	73	4.78	76
Lysine	5.80	2.09	36	2.47	43	2.25	39
Aspartic Acid		4.26		4.72		4.57	
Serine		4.85		4.65		4.57	
Glutamic Acid		34.20		31.05		34.37	
Proline		10.86		11.06		10.92	
Glycine		3.29		3.30		3.08	
Alanine		2.96		2.99		2.78	
Arginine		3.78		4.92		3.98	
Histidine		2.00		2.47		2.04	

18.2% and 7.7%. Data [16] on the study of rheological properties of dough from flour *Tr. dicoccum* and *Tr. Spelta* are shown in Table. 3. Job of strain (W) for flour with Tr. Spelta is higher than for the reference sample by 4.6%, and the formation time of dough with flour from Tr. Spelta more than in reference by 3.8 times. This suggests that «force of flour» from Tr. Spelta is higher than that of wheat flour.

Bread obtained from flour *Tr. dicoccum* and *Tr. Spelta*, has a higher ratio of specific volume compared to the reference wheat sample, correct form, pulp color from cream (*Tr. Spelta*) to grayish (*Tr. Dicoccum*), pleasant taste and aroma. Crumb is characterized by granular and rough structure compared with the control sample [16]. Perhaps this bread can be recommended for prophylactic or therapeutic nutrition. Thus, polba is a perspective culture that would be appropriate to use in bakery and pastry products to develop competitive products and improve functional technological properties of flour.

Table 3

Rheological properties of dough

Parameter	Wheat flour	Flour from *Tr. dicoccum*	Flour from *Tr. Spelta*
Index of extension (G)	23.0	21.9	34.3
Job of strain (W)	173	118	181
The ratio of dough elasticity to elasticity (P / L)	0.38	0.95	0.25
Absorption of water,%	49.4	58.0	54.0
Time of dough formation, min	1.30	1.30	5.0
Resistance, min	10.0	4.0	6.3

Recipes of polba porridge

There are several recipes for preparing foods from polba. One of the polba porridge recipes was given by Dr. E. Serebryanskaya, an expert in healthy living, absolute Olympic gold medalist in rhythmic gymnastics, 8-time World Champion, nine-time European Champion [17].

Recipe no. 1 [20]. A glass of whole or crushed polba; Clabber - 0.5 cups; Milk - 0.5 cups; Salt, sugar, butter - to taste. Mix yogurt with a glass of cold water, soak polba in this mixture for 5-6 hours. Then rinse groats and put them in a pan, pour in half a cup, which had previously been half a cup of water and milk. Mix everything and put to boil on low heat until all the liquid boils away. Then add salt in the ready porridge to taste, sugar and butter and let stand covered for an hour after the cereal is ready to eat. Taste of the finished dish is amazing - a light shade of walnut with bright wheat taste. Very nutritious, perfectly satisfies hunger. Grains do not boil soft, remaining intact, have a beautiful yellow-pink color. Polba porridge with butter substitute meat, since polba contains up to 26% of protein and 18 essential amino acids.

Recipe no. 2 [3]. Polba porridge is cooked this way: well-washed polba is soaked in water for 20-30 minutes (like rice), water is drained, pour water (1:1.5) and cook in no enamelware on medium heat for about half an hour at the end of lid closure hold for another five minutes, turn off the heat and still keep the lid for steaming. Cooking it, basically mix it with different fillings. And cook it in a pure form of salt in water and then add either honey, or milk, or butter. It is very well kept after cooking in the fridge, and the ingredients that are added just before eating, introduce diversity. In addition, it is good to combine polba porridge with meat in pilaf, as cereal does not stick together and absorbs flavor and fat. It is a good alternative to rice. Porridge turns fragrant, nourishing and easily digested.

Recipe no. 3 [17]. Ingredients: 1 cup of polba, 0.5 liters of yoghurt, ½ cup water, 0.5 liters of milk, 100 grams of butter. Soak polba overnight or at least 5-6 hours in a mixture of yogurt (or sour milk) with spring water. After this, rinse the seeds in cold water and boil milk over low heat. After boiling the liquid, wrap in a blanket or something warm and let stand for 30-40 minutes. Serve filled with oil.

Conclusion

Due to high content of protein, amino acids, vitamins and iron, polba has extremely useful and even therapeutic features. The problem of polba's revival as a culture in Ukraine is relevant for today.

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ПЕРСПЕКТИВНОСТЬ ИСПОЛЬЗОВАНИЯ АТОМИЗАТОРА «ГРАФИТОВАЯ ВТУЛКА-ФИЛЬТР» ПРИ АТОМНО-АБСОРБЦИОННОМ ОПРЕДЕЛЕНИИ ТЯЖЕЛЫХ МЕТАЛЛОВ

В статье приведены аналитические характеристики и возможности атомизатора «графитовая втулка-фильтр» при атомно-абсорбционном определении некоторых компонентов в различных природных водах и пищевой продукции. Сформулированы рекомендации по применению.

Ключевые слова: атомизатор «графитовая втулка-фильтр», тяжелые металлы, атомно-абсорбционная спектроскопия, матричные влияния.

In the article analytical descriptions and possibilities of sprayer are resulted «graphite hob-filter» at atomic-absorbing determination of some components in different natural waters and food products. Recommendations are formulated on application.

Keywords: sprayer are resulted «graphite box- filter», hard metals, atomic-absorption spectroscopy, matrix effects.

Контроль содержания микроколичеств тяжелых металлов, таких как свинец, кадмий, мышьяк и селен важен в связи с их высокой токсичностью и, вследствие этого, низких ПДК. Атомно-абсорбционная спектроскопия, в частности в ее электротермическом варианте, благодаря хорошим аналитическим характеристикам: экспрессности, простоте, высокой чувствительности, часто применяется для их определения. Однако при этом зачастую возникают помехи, связанные с матричными эффектами при высоких содержаниях солей и органического вещества. Традиционно для их устранения применяется ряд способов и приемов – отделение мешающих компонентов от определяемых, так называемая SPTF-техника, а также применение некоммерческих атомизаторов. Последние обладают рядом преимуществ: повышают чувствительность и снижают матричные влияния. Однако вследствие их малой изученности некоммерческие атомизаторы практически не применяются в практике отечественных лабораторий.

Нами были изучены аналитические характеристики и возможности атомизатора «графитовая втулка-фильтр» (рис. 1) при атомно-абсорбционном определении свинца, кадмия, мышьяка и селена в различных природных водах и пищевой продукции. Атомизатор изготовлен из пористого графита и вкладывается в обычную пиролитическую печь. Через отверстие для дозирования проба подается на поверхность фильтра и распространяется по его объему. При атомизации аналит и матрица испаряются и диффундируют с разной скоростью через пористый графит. При высоких температурах соединения щелочных металлов, из которых состоит, в основном, матрица природных вод образуют интеркалаты с графитом. Данный эффект удерживает пик их испарения по сравнению с пиком, характерным для определяемых компонентов (рис.2).

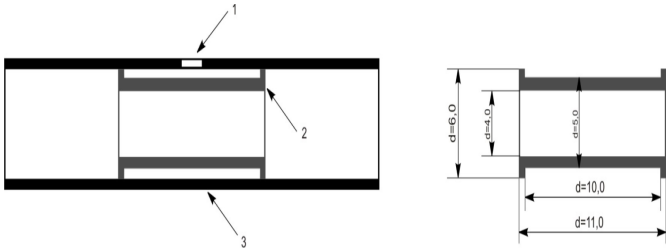

Рис. 1. Общий вид электротермической графитовой трубчатой печи с «графитовой втулкой-фильтром»: 1 - отверстие для дозирования, 2 - «втулка-фильтр», 3 - трубчатая печь

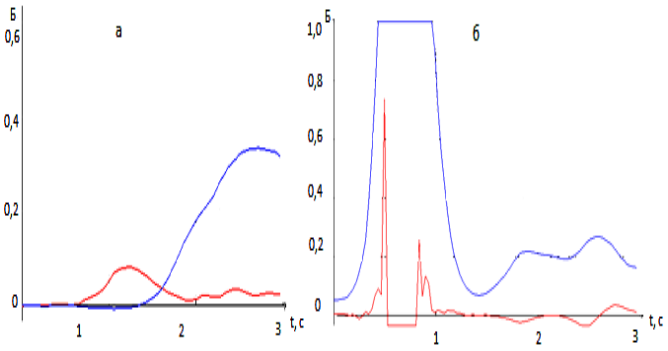

Рис. 2. Регистрограмма атомного (красная линия) и неселективного испарения (синяя линия) микроколичеств Pb при его испарении с «графитовой втулки-фильтра» (а) и стенки печи (б)

В отличие от техники испарения микроколичеств металлов с платформы Львова, при работе с «графитовой втулкой-фильтром» время их полного испарения, а также амплитуда пиковых значений абсорбционности атомов возрастает. Повышение амплитуды можно объяснить снижением неэффективных