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APPLICATION OF PHOSPHATIDE CONCENTRATES FROM LOCAL RAW MATERIALS TO IMPROVE THE QUALITY OF BAKERY PRODUCTS.

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ABSTRACT

It is necessary to develop in practice approaches intensifying chemical-technological processes to ensure production efficiency and competitiveness within the framework of certain clusters in food technologies. As an example of the complex application of physical influences for intensification of chemical-technological processes, the process of obtaining lecithin's as supplementary to the main system of methods of vegetable oil production is considered. Lecithin's, protein products, removal of phospholipids from oils are presented as a stage of technological scheme of lecithin production is considered. Alternative methods are considered to study the influence of different types of phospholipids on baking properties of wheat flour and physical properties of dough to improve the quality of baked goods, and the creation of phosphatide concentrate production.

Introduction

All over the world, bakery products are an important foodstuff, so recently, high demands have been made on the quality that is ensured by the baking advantages of flour, the efficiency of technology and the use of auxiliary materials to expand the range of bakery products.

The quality of flour used in the manufacture of bakery products depends on the type of grain, soil composition on which it grew, as well as climatic conditions and other factors.

Research has shown that the quality of local wheat grains requires the use of baking improvers of various effects, including food emulsifiers. The most effective food surfactants are monoglycerides, their derivatives and phospholipids. Phospholipids are not only emulsifiers, synergists of antioxidants, but also physiologically valuable components.

Firstly Puchkova L.I. and her scientific school conducted scientific research on the influence of phosphatide concentrates on the quality of finished bakery products. (in 50-60s). The analysis of modern scientific and technical literature testifies to several unresolved issues, which are related to the appearance of new commercial forms of phospholipids of various composition and structure, the possibilities of their joint action (synergism) with other surfactants (surfactants), the influence of introduced enzyme preparations on standard forms of lecithins, as well as the possibilities of their use with food fibers (F.F.) [1, 2].

Earlier it was established (L.I. Puchkova, A.P. Nechaev) that fat products containing solid acylglycerols as well as food surfactants (F.S.) contribute significantly to the improvement of bread quality. [3, 4]

For example, the presence of fat components increases the effect of F.S., which in turn contributes to a better distribution of them in the test.

The usefulness of any product is determined by the content of essential vitamins, macro- and micronutrients in its composition. By chemical composition, the product Phosphatide concentrate soy (safflower, sunflower) contains the largest number of the following, necessary for our body, substances:

- Vitamin E (T.E.), which provides 49.3% of the daily quota per 100 g of the product, Vitamin A (RE) - and Vitamin H (biotin) - are distinguished among vitamins with high content;

- among macroelements Phosphorus, Magnesium and Potassium (100 g of the product contains 300%, 24.5% and 24% of the daily requirement of these elements, respectively);

- Iron is the best indicator among microelements, the content of which is 100 grams of the product Phosphatide soy concentrate provides 55.6% of the daily norm. It is very important to know when maintaining certain diets, which imply a certain percentage of carbohydrates, fats and proteins in the diet.

The approximations of the saturated fatty acid compositions of phosphatide concentrate yields are shown in Table 1.

Fatty acids	Soybean oil	Sunflower oil	Safflower oil
Total lipids	99,9	99,9	99,8
Saturated fatty acids in total(g), including:	13,9	11,3	15,75
palmitic	10,3	6,2	12,9
stearin	3,5	4,1	2,5
Monounsaturated (g) fatty acids:	19,8	23,8	66,9
oleic	19,8	23,7	64,9
Polyunsaturated (g) fatty acids:	61,2	59,8	12,1
linoleic	50,9	59,8	12,0
linolenic	10,3	-	traces
Tocopherols (mg)	114,0	67,0	13,0

The valuable product obtained during the cleaning of vegetable oils, as phosphatides, is considered as a by-product and is used in food and feed industries.

Phosphatide concentrates prevent delineation of bakery products, prevent sticking, eliminate spattering of fats during frying, stabilize freezing and thawing processes.

To obtain phospholipids and protein substances is carried out hydration - the process of oil treatment with water and steam. When they are mixed with oil, the volume of phospholipids and protein substances increases, which swell, enlarge and precipitate in the form of flakes. This makes it possible to implement the procedure of obtaining an indispensable valuable product as phospholipids from oils for obtaining lecithin under the following main technological regimes.

Phosphatides - a by-product obtained in the production of vegetable oils from sunflower, safflower, soybean and other oilseeds. They are especially valuable because they contain fatty acids important to the body but not synthesized in it, as well as some fat-soluble vitamins, especially A and E. Due to the emerging trend of increasing demand for phosphatide concentrate and lecithin, the issue of increasing their production is becoming important.

At the same time, it is necessary to note the increased requirements of consumers to quality indicators, which is associated with the import of phosphatide concentrate (lecithin) with high consumer properties.

According to the literature, the phospholipids are lipids, replacing the fatty acid with the phosphate group. During enzymatic action, phospholipases fatty acids contained in phospholipids are released. Arachidonic acid (A.A.) and docosahexaenoic acid (DHA) are both long-chain polyunsaturated fatty acids (LCPUFAs). Consequently, they can be incorporated into or, in other words, form part of a phospholipid or triglyceride.

Lecithin is a collective name for the complex esters of multi-atomic alcohols consisting of phospholipids and triglycerides. The name is derived from the Greek word λέκιθος, meaning yolk.

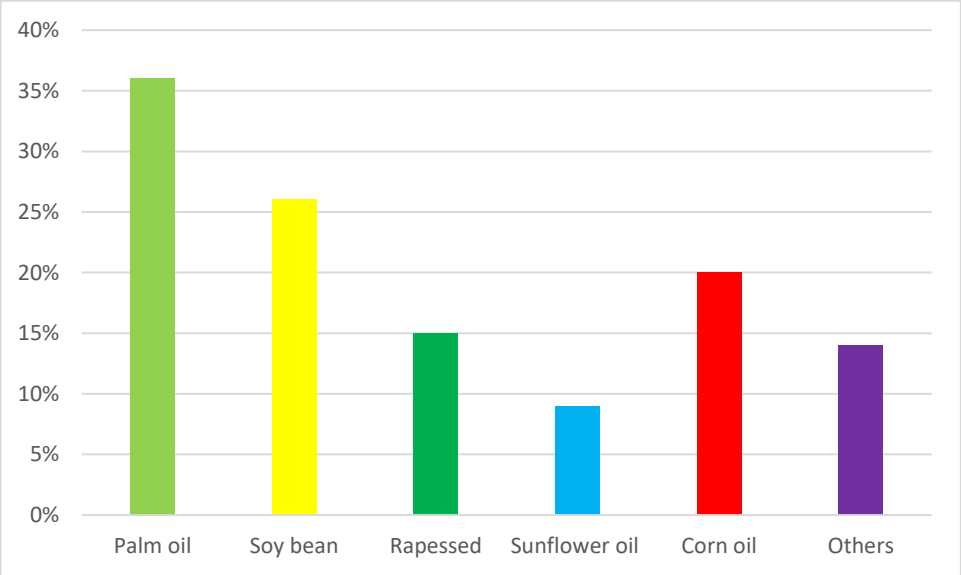
The first lecithin was found in the composition of egg yolk. The substance is also found in some plant products - cotton, soy, sunflower or safflower lecithin is usually used to produce additives.

In the human body, lecithin is one of the main nutrients that are essential for the correct functioning of the nervous system. It is present in all tissues, and the brain consists of about 30% of this substance.

The use of phosphatides in the food industry is based on one of their most important properties - surface activity, which causes high emulsifying, liquefying, foaming and other abilities.

Besides, phosphatides create a real raw material base for the production of food lecithin and biologically active additives on their basis [2-4]. Nowadays, lecithin is used in wide applications. See Table 1.

Table 2.: Worldwide acquisition of lecithin by main food industry sectors in %

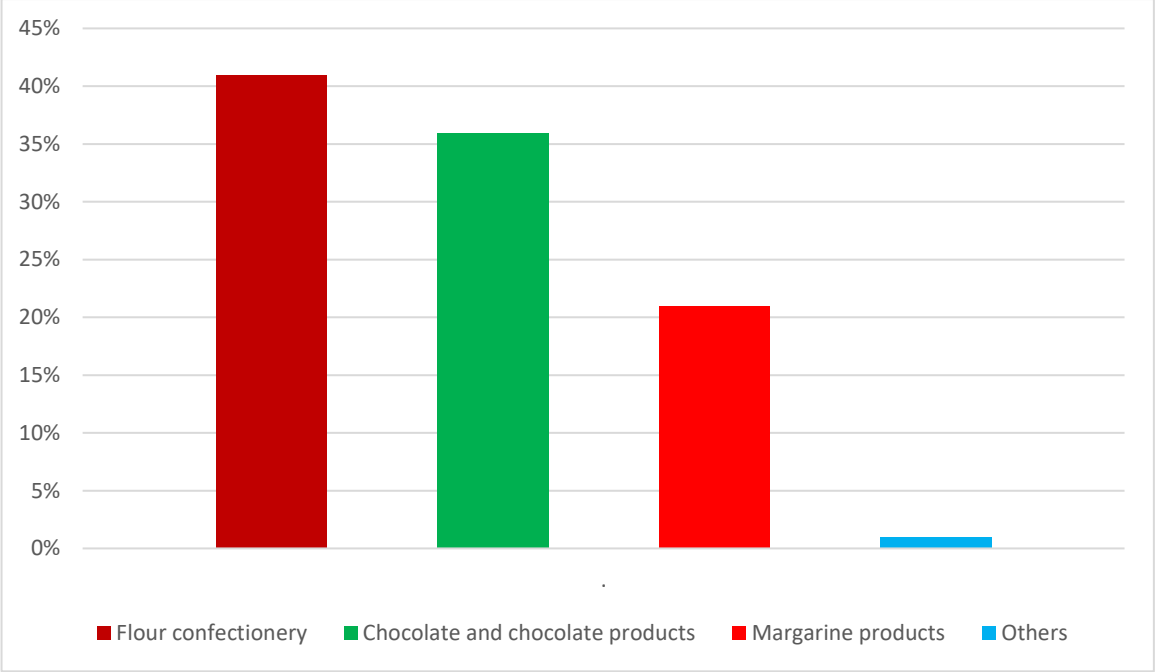


From the Table 1 it is visible, as the most widely used raw objects for reception of lecithin in world scale serve soya beans on which products of primary processing make 26,5 % in structure of world manufacture of vegetative oil, further oil seeds of rape (15,1 %) and sunflower (8,6 %) follow. Cotton, sunflower (71%), followed by soybean (22%) and rapeseed (5%) occupy a globally dominant position in Uzbekistan's oilseeds market.

Researches show that taking soya (safflower sunflower, rapeseed, corn) lecithin reduces the level of bad cholesterol in the blood and also has a positive effect on reducing the production of the stress hormone cortisol.

Due to its unique ability to retain both water and fat, lecithin is used in the food industry as an emulsifier and it is labeled (E322).

Table 3.: Worldwide usage of lecithin in food production, %.



As can be seen from Table 2, flour confectionery - 41%, chocolate and chocolate products - 36%, margarine products - 22% and other approximately - 1% of lecithin consumption in the industry.

For example, in chocolate, chocolate glaze, mayonnaise and margarine, the substance helps to achieve uniform product texture, reduces the sense of viscosity in the mouth and extends shelf life.

Deep processing of soya, sunflower and safflower oil may become one of the profit options for oil producing companies - obtaining phosphatide concentrates, which are a conditional waste in the cleaning of raw vegetable oils at the stage of their hydration and serve as initial raw material for obtaining a full multifunctional product - lecithin (one of the types of emulsifiers).

For example, in extraction, soya and safflower oil contains more non-hydratable phosphatides than in press. This reduces the yield of phosphatides from oils and complicates the processes of its alkaline neutralization and bleaching, which adversely affects the technical and economic performance of refining production. In extraction oils, phosphatides are in the form of their molecules and associates, i.e. micelles, which are destroyed by temperature rise, electromagnetic treatment, mechano-chemical activation (MCA), etc. [2].

We chose the latter method of destruction of phosphatide associates during the hydration of extraction oil. In this case, the hydration process is carried out as follows: extraction oil was loaded into a thermostat, where it was heated 55-60^{o}C. Oil and preheated to the same temperature hydration agent (water or water + citric acid) in the amount of 3% of the mass of the oil pumped to the mechano-chemical activator (MCA), where they were intensely mixed. Further, the mixture was supplied to the exponent, where

the formation of flakes of phospholipids took place at low phase mixing and temperature increase by 10-15ºC. Phase separation was carried out by centrifugation for 5 minutes at a rotational speed of 6000 rpm (facts of separation F.p. = 5500). Hydrated oils were dried under vacuum to a constant mass and then sent to its alkaline neutralization.

The results of hydrated oils analyses are presented in Table 4.

Physical and chemical indicators of hydrating oils

№	Indicator name	U.M.	Soybean oil	Sunflower oil	Safflower oil
1	Total lipids	g	97.9	98,9	97,8
1	Saturated fatty acids: - palmitic - stearin	g	13,8 10,2 3,4	11,2 6,0 4,1	10,3 5,2 3,7
1	Monounsaturated fatty acids - oleinova Polyunsaturated fatty acids - linoleum - linolenic	g	19,7 19,7 50,9 10,2	22,8 22,6 59,7 0	12,2 12,1 56,0 0
	Tocopheroles	mg	114,0	67,0	25,1

Table 3 shows that the extracted phosphatide concentrates comply with the requirements to food products (T.U. 9146-203-00334534-97) and can be used in confectionery, bakery and margarine products. [3]

The oil obtained by pressing and extraction contain small particles of mesma, wax, phospholipids, dyestuffs, free fatty acids, protein substances, so it must be cleaned. Removal of solid suspended impurities and water from the oil is carried out at the stage of its primary purification by sedimentation in settling tanks, dense mechanical traps, with the help of sedimentary centrifuges and during filtering.

Non-dehydrated phosphatide concentrate (P.C.) obtained by water refining of raw soya, sunflower and safflower oils is currently processed to produce lecithin or used as a formulation component for enriched food or feed products. The oils that are part of the P.C. are generally not recovered or processed.

The phosphatide emulsion is dried to prevent the appearance and flow of hydrolytic and bacterial processes in a wet product. The presence of moisture determines the structural and mechanical properties of the phosphatide concentrate.

Only at humidity below 1% does the concentrate have a fluid consistency, which is important and allows for a significant expansion of phosphatide concentrate applications, especially in the confectionery industry.

Further, the joint use of phospholipids, monoglycerides, food fiber and inulin in the production of bakery products is researched. (V.V.Tarasova),

where the positive effect of the composition consisting of phospholipid (STERNCITHIN F-10), the enzyme preparation Lipopan F and food fibers on the rheological properties of the dough and the quality of the finished products was justified taking into account various technological factors: the type of flour, the dosage of the introduced components and the dough preparation method. [5, 6].

We know that an effective method to improve the quality of bakery products is the use of enzyme preparations of directed action. Their use allows us to modify the structural components of flour, dough and introduced ingredients.

Modern technology for processing plant raw materials leads to a reduction in the content of dietary fiber and other physiologically functional ingredients.

Therefore, there is a need for their additional inclusion in mass consumption products, including bakery products.

Considering all aforesaid, development of technologies of joint application of phospholipids, monoglycerides and their derivatives, food fibers, enzyme preparations in the manufacture of bakery products (including functional), taking into account their properties, possible synergy effect, is an actual task having scientific and practical value. Triglycerides are fatty acid ester, which is the main component of vegetable oil and animal fat. Hydrolysis (cleavage) of the triglyceride releases fatty acids, which supply the human body with energy.

As a substitute for standard fat raw materials - used a mixture of blended phosphatide concentrates derived from safflower, soybean, and sunflower oil for baking.

The fatty acid composition of the selected oils was studied by capillary gas chromatography. The selected vegetable oils and palm stearin were blended to achieve an optimal acid ratio of -6/-3 = 10:1.

Results and discussion: Our research aimed to study the effect of PAV on the quality of bakery products, where we used enzyme preparations and physiologically functional ingredients based on local plant raw materials in our formulation.

The research was carried out in the laboratory of the department of "Food Technologies" of the Tashkent Institute of Chemistry and Technology.

Generally accepted and special methods of research of raw materials, semi-finished products and finished products were used in the course of researches.

The composition of fatty acids of lipids was studied by the method of gas capillary chromatography in accordance with GOST 30418-96 on the device MEGA 5600 by "Karlo Erba" with the use of quartz column length of 25 m filled with Silar - 10C at a temperature of 175 ° C. Quantitative determination of individual acids was performed by internal normalization method.

The autolytic activity of wheat flour was determined by the "number of falls" on the Hagberg-Perten device by the rod sinking speed - agitators in flour suspension. The amount of gluten was determined using the tool "IOC." The quality of gluten was characterized by its extensibility (by the ruler) and the value of the total compression strain, determined on the instrument IIK-1M. Flour humidity was determined by the standard method according to GOST 9404-88, flour acidity - by GOST 26839-88. The rheological properties of the test were studied on the device alveograph ("Chopin").

Rheological properties of the crumb when stored by the crumb's ability to swell in water by the Katz method. Bakery products were analyzed 14-16 hours after baking based on physical and chemical indicators (humidity, acidity, porosity, specific volume, total crumb compression deformation) and organoleptic indicators (appearance, crust character, taste and aroma).

We studied the influence of the introduced PAVs in the fat product on the quality of bread made of wheat flour of the highest and first grades.

The multi-component composition for the design of products represents a wide range of opportunities to prevent deficiencies in essential fatty acids, vitamins and other physiologically functional ingredients.

Local first grade wheat flour was used to study the effect of phospholipids on dough properties. The control was a sample of dough prepared without additives.

When lecithin of different degrees of hydrolysis was added to the dough, the amount of washed gluten increased concerning the control sample, and the gluten GDM value increased depending on the degree of hydrolysis (Table 1).

Table 5: The influence of phospholipids of different degrees of hydrolysis on raw gluten quality

Indicator Name	Extracted gluten quality values of dough, cooked				
	Control (no additives)	Dough sample with phospholipids of different degrees of hydrolysis			
		+F-10 (1,0%)	+E-40 (1,5%)	+E-60 (0,5%)	+E-80 (1,5%)
Gluten yield, %:	33,4±0,1	35,7±0,3	39,6±0,3	36,4±0,2	34,0±0,4
Hydration capability, %	163	146	151	148	149
Deformation load resistance H_{def}^{GDM}, unit	78±1	69±2	73±1	72±1	72±1
Elasticity, sm.	14,0	10,8	11,5	11,8	11,5

This is associated with the active participation of flour's lipids and introduced phospholipids in the formation of gluten skeleton in the process

of dough mixing, which leads to an increase in the specific volume of bread, improving the structure of porosity.

Lecithin, with a 40% hydrolysis degree (E-40), had the greatest influence on gluten quality indices (Table 4).

It is known that phospholipids (lecithin), depending on the composition and structure (association of molecules, differences in the structure of hydrophobic radicals), have different effects on the properties of gluten: phosphatide acids significantly strengthen it, while phosphatidylcholines relax, increasing its elasticity.

These changes in the rheological properties of the test suggest that lecithin has a dual function. On the one hand, it is a structural component that changes the gluten properties of wheat flour, and on the other hand, lecithin plays the role of a plasticizer that modifies the rheological properties of the dough.

The ability of surfactants (surfactants) to interact with the structural components of flour, with the formation of different strength compounds, leads to changes in the properties of the dough and gluten (increases the dough stability and the tensile strength of the gluten).

Further, we studied the influence of enzyme preparation with phospholipase activity on the quality of bakery products made of first grade wheat flour.

Baking enhancers, which include enzyme preparations, have multifunctional properties. Their use allows us to modify the structural components of flour and dough properties.

This is due to the active participation of flour's lipids and introduced phospholipids in the formation of gluten skeleton in the process of dough mixing, which leads to an increase in the specific volume of bread, improving the structure of porosity.

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Baking enhancers, which include enzyme preparations, have multifunctional properties. Their use allows us to modify the structural components of flour and dough properties.

As a result of the research, it was revealed that the highest specific volume and the best organoleptic indices (control - liquid fat for baking) had bread samples with phospholipase introduction in the amount of 0.001% to the mass of flour and phospholipid STERNCITHIN F-10 in the amount of 1.0%.

Table 6.: Influence of phospholipids and enzyme-containing enhancer, introduced together, on bakery quality indicators

Bread Quality Indicators	Bakery samples with the use of phospholipids and enhancer								
	Liquid fat control for bakeries	Softgrain Germinated Cereal CL Amplifier (5,0%) +F-10 (1,0%)	Softgrain Germinated Cereal CL Amplifier (10,0%) +F-10 (1,0%)	Softgrain Germinated Cereal CL Amplifier (15,0%) +F-10 (1,0%)	Softgrain Germinated Cereal CL Amplifier (20,0%) +F-10 (1,0%)	Softgrain Germinated Cereal CL Amplifier (5,0%) +F-10 (1,5%)	Softgrain Germinated Cereal CL Amplifier (10,0%) +F-10 (1,5%)	Softgrain Germinated Cereal CL Amplifier (15,0%) +F-10 (1,5%)	Softgrain Germinated Cereal CL Amplifier (20,0%) +F-10 (1,5%)
Specific volume, cm^3/g	3,90	3,81	4,09	4,42	4,15	4,66	4,63	3,75	3,72
Porosity, %	78	80	83	85	84	85	86	82	81
Total crumb compression deformation, penetrometer unit	132	145	139	150	153	149	144	154	137

Table 5 shows that using lecithin and their compositions with monoglycerides in the structure of fat products with enzyme preparation allows improving rheological properties of the dough, organoleptic and physicochemical indicators of finished products quality.

It is established that in the process of storing the index of bread crumb swelling (flour of the first grade) when using the studied composition, changed insignificantly, which indicated a slowdown in the process of hardening.

At the storage of products within the first day, all bread samples had a good appearance, expressed coloring, smooth crust, pleasant taste. When stored

for three days, organoleptic indices of control samples decreased, their taste deteriorated, the crust became wrinkled. Bread samples, with the introduction of phospholipids and monoglycerides, had a good appearance and pleasant taste.

The studied preparations of lecithin in concentrated or isolated form can be recommended to regulate the technological properties of wheat flour intended for baking purposes.

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