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REASONS FOR THE WAYS OF USING OILCAKES IN FOOD INDUSTRY

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Abstract: Using of secondary raw material resources from the oil and fat industry enterprises for new foodstuff development is an important task giving the chance of products range expansion, which are enriched in many indispensable components. The compliance with quality analysis of oilcakes from several types of olive raw materials, traditional and non-traditional for Russia, to fundamental technical requirements of the normative documents of the Russian Federation, determination of the list of quality and safety indicators of the oilcakes and reasons for the ways of processing them into food became the research purposes. Objects of researches were the oilcakes received in the conditions of specialized enterprises of Altai Krai from the appropriate types of olive raw materials. They are oilcakes made from: Siberian cedar pine kernels, walnut kernels, seeds of Cucurbita pepo, sesame seeds, black cumin seeds, flax seeds, milk thistle seeds, amaranth seeds. By research results, the list and standards of the regulated organoleptic and physical and chemical quality indicator of olive cakes are set; the permissible level of safety indices are justified and the conditional gradation on the prevailing macrocomponents defining the oilcakes nutrition value, their technological properties and the food use potential areas is recommended: 1) the composition is dominated by “proteins and lipids” (oilcakes from sesame seeds and pine nuts kernel) – mayonnaise, dairy and vegetable products; 2) “proteins and carbohydrates” (oilcake from amaranth and pumpkin seeds and oilcake from walnuts kernel) – dairy, vegetable, meat and cereal products, sugary and flour confectionery, food concentrates; 3) “proteins and alimentary fiber” (oilcake from milk thistle and flax) – bakery and flour confectionery.

Keywords: oilseed cakes, oilcakes nutritional value, oilcakes quality and safety factors, oilseed cakes using, processing algorithm of oilseed cakes

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INTRODUCTION

The struggle for customer and sales market stimulates a modern manufacturer to be engaged in sold products range expansion through new types of raw materials attraction and/or giving the functional directivity to worked-out production. It is connected to the fact that in recent years many enterprises of the domestic oil and fat industry process raw materials, rather various in chemical composition and technical characteristics. Walnuts, pine nuts, sesame, thistle, flax, pumpkin, water-melon, amaranth, black cumin seeds, grape and apricot seeds, sea-buckthorn fruit and other types of traditional and non-traditional for Russia olive raw materials are used.

For the last 10–15 years the considered branch has developed rather actively. It has involved a lot of new businessmen. Being guided by Internet-sources data, it is possible to say that today the number of the enterprises registered in this sphere is to one hundred. Chemical composition distinctions of raw materials allow vendors to work out a line of the vegetable oils oriented on a wide range of customers. Distinctions in technical characterristics and, respectively, in aerodynamic properties of raw materials cause the necessity of technology equipment mobile realignment that is more easily feasible in case of small outputs. As a result, preferentially small enterprises of narrow specialization are involved in the considered field of activity, many of which work according to the diagram given in Fig. 1.

Processing of raw materials by small batches is one of the advantages of the similar enterprises, as it allows to obtain products with very low measure values of oxidizing damage, which is often cannot be achieved in the conditions of large-capacity production.

In Altai Krai oil is get from cultivated commercially flax and nuts, pumpkin, sesame, milk thistle, black cumin and amaranth seeds delivered from other regions.

Walnuts (*Júglans régia*) and Siberian cedar pine nuts (*Pinus sibirica L.*) appear to be a valuable source of oil, rich in tokoferola and indispensable fatty acids ω-6 [1, 2]. The protein which is no less important remains as a part of oilcakes almost without any changes, as walnut and pine nuts oil is produced by technology of a one-fold cold extraction.

Flax seeds (*Linum usitatissimum L.*) are considered by the modern nutritionists not only as a source of the food oil rich with α-linolenovy acid (to 57% as a part of oil), but also as an additional source of protein in soluble and insoluble alimentary fiber [3, 4]. The growing popularity of their use and researches activity as food raw materials are connected to the marked properties of flax seeds [5].

The peculiarity of a milk thistle (*Silybum marianum*) nutrition value is silimarin flavonoid content which is conducive to liver cells regeneration [6, 7, 8] and keeping in oilcakes and oilmeals after allocation from oil seeds. Nowadays thistle-and-flax-seeds flour is massively used only in flour production [9, 10].

Sesame and pumpkin seeds have a certain likeness according to content and greasy oil composition. Sesame (*Sésamum índicum L.*), seeds of which contain about 60% of oil and to 20% of protein, is traditionally applied in seeds, paste or oil form in bread baking and Eastern cuisine cooking due to a pleasant smell and taste. In physiological value sesame is compared to flax seeds [11]. Tocopherols and lignan belong to the main antioxidants responsible both for physiological value and for oxidizing damage of sesame seeds, oil and oilcakes preventing [11, 12]. Modern clinical researches are focused on allergic response to sesame and products of its processing studying [13].

Pumpkin seeds (*Cucurbita pepo L.*), depending on a botanical sort of pumpkin, contain up to 28% of protein and 30–50% of the oil rich in carotinoids and tokoferola [14]. Reduced cellulose content in gymnospermous sorts facilitates technological tasks solution of pumpkin oilcakes use remaining after allocation as food raw materials [15, 16].

Amaranth and black cumin seeds are being researched most actively in recent years. Amaranth (*Amaránthus*) "grain" is appreciated for protein [17, 18] and the increased content of squalene, phytosterols and other minor components in oil [19]. Amaranth flour from is used in national and non-traditional flour products baking [20, 21].

Black cumin seeds oil (*Nigella sativa L.*) possesses the expressed toning and antibacterial properties. This fact is connected to fat-soluble vitamins, sterols, benzopyrones and terpenes composition [22, 23]. Increased content of linoleic acid in black cumin seeds oil (up to 58%) at unusually high content of minor antioxidant components explains the growing popularity of its processed products.

In spite of the fact that today oilcakes and oil meal of oil-bearing crops, including the discussed in this work, are applied as high-protein components of vegetable feed [17, 24] the perspectives of their wide food use are connected to a possibility of giving functional properties to new products not only at the expense of proteins [25], but also at the expense of food fibers [3, 11, 26], lignin [12, 27, 28] and other components [9, 29, 30].

The characteristic peculiarity of the worked-out oilcakes is absence in scientific literature of the accurate systematized data on their chemical composition, especially that within species different botanical sorts of oil-bearing crops can initially be characterized by certain distinctions, both in coloring/form of seeds and in principal components content [5, 14]. The equipment used by the operating enterprises can significantly differ on the operating characteristics, defining production with different residual content of lipids. Marked, as well as state standards absence, regulating figures of all range of olive cakes quality as food raw materials complicates the determination of perspective areas of their industrial food processing. The purposes of the work are the analysis of quality compliance of industrially produced oilcakes made from non-traditional olive raw materials types to fundamental technical requirements of regulatory documents (RD), determination of the regulated figures list of researched oilcakes quality and safety and reasons for their industrial processing in food.

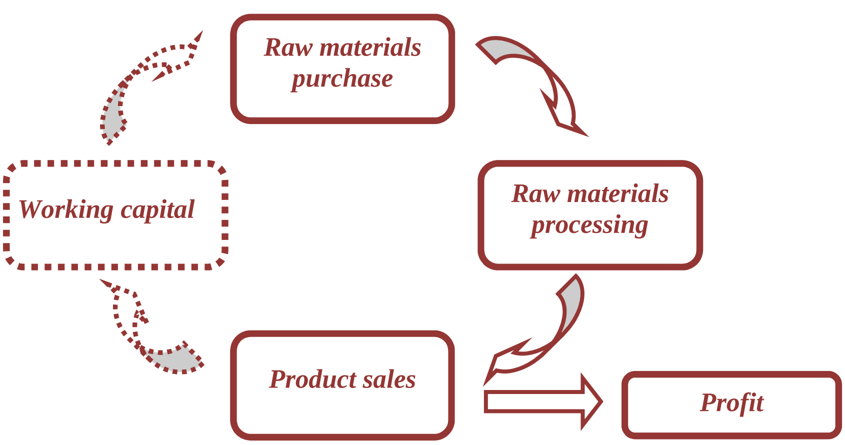

Fig. 1. Basic model of purchase, processing and selling structure of non-traditional types of olive raw materials.

OBJECTS AND METHODS OF STUDY

Tasks of the research are:
– assessment of the macrocomponents content in oilcakes composition;
– determination of the quality and safety regulated figures list;
– oilcakes systematization considering chemical composition and indices of safety data, reasons for the industrial processing in food.

Objects of the research are:
– regulatory documents on oil-bearing crops cakes of industrial value;
– oilcakes received at two specialized enterprises of Altai Krai (LLC Spetsialist, Biysk; LLC Sibirsky produkt, Barnaul) from the appropriate types of olive raw materials: oilcakes from Siberian cedar pine kernel (*Pinus sibirica Du Tour*), walnuts kernel (*Júglans régia*), pumpkin seeds (*Cucurbita pepo L.*), sesame seeds (*Sésamum índicum L.*), black cumin seeds (*Nigella sativa*), flax seeds (*Linum usitatissimum L.*), milk thistle seeds (*Silybum marianum*), amaranth seeds (*Amaránthus*).

For the theoretical material analysis methods of the comparative analysis and systematization of scientific publications and regulatory documents, periodicals and Internet resources were used. Results of own experimental studies are received with the use of standard organoleptic and instrumental methods of researches accepted in oil and fat branch.

Color, smell, look and existence of dark inclusions in oilcakes are determined by organoleptic methods.

The mass fraction of moisture and volatiles were determined by tests drying 5 g weight to constant mass at 103 ± 2°C temperatures, with the subsequent weighing and calculation of a measure value in %.

The mass fraction of a crude protein, in % of oilcake dry substance, was enumerated on the content in oilcakes of the proteinaceous nitrogen determined in hinge plates 2 g weight by Kjeldahl's method.

The mass fraction of crude fat in hinge plates 10 g weight was set by exhaustive extraction of lipidic fraction hexane method with the subsequent weighing and fraction calculation of the extracted fat in % of solid oilcake.

The mass fraction of crude cellulose was determined by Genneberg and Shtoman's method: serial processing of a hinge plate of cake by acid and alkali solutions, with subsequent combustion and quantitative fossil determination by a weight method, with index calculation in % of the dry unoiled oilcake substance.

The mass fraction of ashes was determined by tests calcinating of 5 g weight at 700°C temperature to the complete combustion (set on achievement by the crucible with a hinge plate of constant mass), with the subsequent weighing and measure value calculation in percentage of the dry unoiled oilcake substance.

The acid number of fat was determined by oilcake titration extracted from test crude (etanolo-chloroformic extraction) 0.1M KOH solution in fenolftalein presence.

The peroxide value of fat was determined by oilcake titration of the crude fat extracted from test (in the form of a mixture of acetic acid and chloroform) 0.01M $Na_2S_2O_3$ solution.

All the studies were conducted on the example of six oilcake batches of each name, in three-fold frequency for each index. Results of the researches were processed by statistic analysis method.

RESULTS AND DISCUSSION

Excerpts from operating state standards on the regulated physical and chemical indices of oil-bearing crops cakes used as raw materials for industrial production of compound feeds and foodstuff and realized as “Food oilcakes and oilmeals” are given in Table 1. It should be noted that in Russian normative documents there are no unified approaches to the list of the regulated quality figures:
– ashes is either regulated, or is excluded from the mandatory list;
– different norms of moisture, crude protein, fat and cellulose content are set;
– insoluble ashes content norms set depending on existence/absence of seed coats in oilcake are most justified.

Table 1. The regulated physical and chemical indices of olive cakes of industrial value according to regulatory documents' requirements valid in the Russian Federation

Index name	Oilcake index norm					
	sesame	sunflower	rapeseed	flax	peanut	soy
M.f. of moisture and volatiles, %	6.0–10.0	No more than 8.5	6.0–9.0	6.0–8.0	6.0–8.0	6.0–8.0
M.f. of crude fat in terms of solid, %, no more than	9.5	10.0	9.0	10.0	6.5	8.0
M.f. of crude protein in terms of solid, %, no less than	40.0	38.0	37.0	34.0	52.0	44.0
M.f. of crude cellulose in terms of the dry unoiled substance, %, no more than	6.0	20.0	16.0	9.0	5.0	5.5
M.f. of ashes in terms of the dry unoiled substance, %	–	6.2–6.8	No more than 7.0	No more than 10.0	–	–
M.f. of insoluble ashes in terms of the dry unoiled substance, %, no more than	1.0	1.0	1.5	1.5	0.2	0.6
Pass through a sieve with holes	–	–	–	–	1 mm in diameter, no more than 5%	15 mm in diameter, no less than 100%

Herewith according to normative documents' requirements quoted in table 1, any kind of oilcake which is industrially made from olive raw materials, regardless of the estimated direction of its further processing (fodder or food production) should be characterized by rather low content of fat: mass fraction (m.f.) of crude fat has to be no more than 6.5–10.0% in terms of dry solid. However when receiving oil with the help of one-fold cold molding without raw materials grinding oil output includes only free lipids fraction and the received oilcakes, as a rule, are characterized by naturally high residual oil content [31].

Oilcakes studied in this work are produced by the enterprises in two forms:

– in the form of the granules or flakes received after oil extraction;

– in the form of the powder of a certain dispersibility received after grinding of these granules or flakes. In the second case the size of particles is important to provide equal distribution of cakes in prescription compound.

All the researched oilcakes possess flavor and smell peculiar to the initial raw materials.

The olive raw materials used for oilcakes production has essential distinctions in anatomo-morphological structure therefore it is logical to expect certain discrepancies in the content of principal components of oilcakes chemical composition.

Value ranges of the regulated oilcakes quality figures are given in table 2. Moisture is in rather narrow, typical for all the studied oilcakes range (5.1–8.6%), which is caused by identical approach in oil allocation technology from raw materials. Therefore, it is possible to introduce a single standard for this index for again developed rules on oilcakes from non-traditional types of oil-bearing crops – no more than 9.0%.

On the main foodstuff content the analyzed oilcakes are characterized by the considerable variations. The crude protein content in different batches of different oilcakes types changes from 18% to 54.7% (in terms of solid matter); for six of eight oilcakes names the minimum value of this index is at least 30%. At this level it is possible to set the lower limit of crude protein content in oilcakes intended for processing as protein-bearing raw materials, including concentrates and protein isolates. Thistle oilcake which seeds are initially not rich with protein has the lowest protein content.

It is also important to note that various types of oilcakes differ among themselves on the crude fat content: in the researched batches from 5.3% to 23.9% (in terms of solid matter), in case of the main value range of 12–20%. The highest fat content among the tested samples is characterized by sesame seeds and pine nuts oilcake, which appears in lower flowability of these oilcakes as compared to other species. As oil percentage of cakes is directly linked to their technological qualities, this index norm should be set with restriction in greater party – no more than 25%: oilcakes with higher fat content oxidize quicker and turn rancid, and when grinding stick together in viscous pastelike mass and badly mix up with other free-flowing components such as flour, powdered milk, egg powder and other.

The cellulose making a basis of plant tissue cell wall is one of oilcakes macrocomponents. Several types of raw materials (cedar and walnuts) are exposed to cladding separation of seed/fruit coat or are initially almost deprived of it (gymnospermous pumpkin seeds). The result is rather low content of cellulose in the received oilcakes (from 2.2% to 5.0% for the dry unoiled substance). The content of cellulose, unrepresentative high for walnuts kernel, found in the received oilcakes (to 7.0%), is caused by complexity of these raw materials separation from husk near the kernel before oil allocation. Other types of raw materials are supplied on press without separation of a seed coat, giving oilcakes with more dark color and with higher cellulose content – up to 13.0–27.6%.

Taking into account that in recent years cellulose is considered as one of the major ingredients to develop products of functional purpose, oilcakes with the increased content of cellulose can be entered into new compounding as a source of insoluble food fibers.

For sesame oilcake the content norm of the ashes is not set by valid documentation; for sunflower oilcake the content of ashes depends on pod particles content in the oilcake; for flax oilcake which is produced without seed coat separation, the legal limit of ashes content is 10%. At the same time, for food assignment oilcakes of – soy and peanut cakes – the ashes content is not regulated (Table 1).

Oilcakes as research objects differ among themselves on the ashes content as significantly as on the remaining macrocomponents maintenance. In general, levels of ashes content correlate with existence seed coat (pumpkin seeds oilcake is an exception), but there is no correlation between the content of ashes and insoluble ashes. On the content of insoluble ashes (0.29–0.92%) all analyzed types and batches meet requirements of valid regulations to sesame and flax oilcake, and this index values do not go beyond 1% (Table 2).

Thus, on the basis of requirement analysis of the valid regulatory documents and results of own researches it is possible to designate a row of mandatory organoleptic and physical and chemical indices which can be generalized and controlled in each batch of olive cakes of food assignment. They are appearance, color and consistence, smell and favor, mass fraction of moisture and volatiles (no more than 9%), mass fraction of crude protein for cake from kernel cedar and walnut, pumpkin seeds, flax and sesame (at least 30% in terms of solid), mass fraction of crude fat (no more than 25% in terms of solid) for all types of cakes.

In our opinion, it isn't expedient to regulate in studied cakes the content of cellulose and general ashes – indices, personal for each type of grain of oil-bearing crops and, respectively, for the made cakes, but these cakes which aren't reflected in technical characteristics and making the positive contribution to formation of their nutrition value. Taking into account that on ashes it is also possible to judge existence in production of mineral impurity, as the regulated index it is necessary to enter mass fraction of ashes, insoluble into 10% solution of hydrochloric acid, and reflecting generally the content of mineral impurity, – no more than 1% in terms of solid.

Table 2. Organoleptic and physical and chemical figures of the researched olive cakes quality

Index name	Index value/Oilcake name							
	Cedar nut oilcake	Walnut oilcake	Pumpkin seeds oilcake	Sesame seeds oilcake	Black cumin seeds oilcake	Flax seeds oilcake	Milk thistle seeds oilcake	Amaranth seeds oilcake
Appearance and consistence	Whole – pieces or the dense flake granules of irregular shape. Ground – homogeneous in weight free-flowing powder with less than 0.3 mm dispersibility.							
Color	From cream to yellow and light brown, motley		From brown to brownish-green	From cream to grayish and light brown	From grayish-black to black	Different shades of brown	From brown to brown with a greenish shade	Light brown
Smell	Typical for the appropriate type of olive raw materials, neutral, without mold, musty, pro-rancid and other foreign smells							
Flavor	Typical, sweetish; the insignificant smack of bitterness typical for the husk near the kernel and not interrupting the primary flavor		Typical, insipid, sweetish		Typical, spicy and hot	Insipid, neutral	Insipid, with moderate bitterness	Typical, insipid and slightly bitter, spicy
	Without mold, musty, pro-rancid and other foreign smells							
M.f. of moisture and volatiles, %	6.0–8.5	6.0–8.2	5.5–8.2	5.8–8.0	5.4–6.4	6.9–8.6	5.1–8.3	6.7–8.2
M.f. of crude fat in terms of solid, %	16.4–21.2	12.4–18.2	11.7–19.4	16.1–23.9	18.7–19.7	10.9–19.0	14.1–16.9	5.3–11.4
M.f. of crude protein in terms of solid, %	30.2–45.3	32.2–46.4	45.6–52.3	34.9–54.7	31.9–32.9	32.6–38.1	18.0–21.1	24.7–29.6
M.f. of crude cellulose in terms of the dry unoiled substance, %	3.5–5.0	5.2–7.0	2.2–4.8	9.4–13.0	3.4–4.4	5.7–7.4	21.2–27.6	5.1–6.7
M.f. of ashes in terms of the dry unoiled substance, %	3.8–4.8	4.5–4.7	8.1–8.7	6.3–6.6	6.7–6.9	4.8–5.0	5.0–5.6	3.5–4.3
M.f. of insoluble ashes in terms of the dry unoiled substance, %	0.29–0.43	0.36–0.68	0.44–0.63	0.58–0.82	0.57–0.84	0.54–0.79	0.67–0.92	0.42–0.56

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According to microbiological standards of safety oilcakes conform to requirements of TR TS 021/2011 regarding the Application 1 and Application 2 (item 1.8 "concentrates of vegetable proteins (food) and soy flour"), on hygienic requirements of safety – regarding the Application 3 (item 9 "food meal and flour from seeds of bean, oil-bearing and non-traditional crops"), on the allowed levels of radionuclides – regarding the Application 4 (according to the item 15 "flour").

The unregulated course of the destructive, hydrolytic and oxidizing processes inherent in the destroyed cells of any olive raw materials is peculiar to oilcakes. Taking into account that the considered cakes differ in the content of quickly oxidized polyunsaturated fatty acids, additional introduction to the list of the regulated indices of safety of indices of oxidizing damage – acid and peroxide number, normed taking into account the residual content of oil in cakes is necessary.

Analysis results of the oil selected from cakes with an etanolo-chloroformic compound are provided in Table 3. According to the experimental data, for the considered row of cakes it is difficult to reveal accurate single-digit correlation between measure values of oxidizing damage of fat and composition of fatty acids. It is obvious that in case of almost equally high content of the amount of polyunsaturated fatty acids and existence of a personal set of natural antioxidants – tokoferol, terpenes and others – the speed of oxidizing processes in lipids of cakes and values of controlled indices will be preferentially defined by quality of the used raw materials (periods and storage conditions before processing) and the modes of thermal/moisture thermal treatment of raw materials provided by the exploited technology of separation of oil.

Table 3. Indices of the researched olive cakes oxidizing damage

Index name	Index value/Oilcake name							
	Cedar nut oilcake	Walnut oilcake	Pumpkin seeds oilcake	Sesame seeds oilcake	Black cumin seeds oilcake	Flax seeds oilcake	Thistle seeds oilcake	Amaranth seeds oilcake
Acid number, mg KOH/g fat	0.5–2.1	0.8–2.7	0.9–1.8	0.7–3.5	0.6–1.8	1.3–2.4	0.6–1.4	0.6–3.3
Peroxide value, millimole of active oxygen/kg fat	1.0–4.2	3.6–6.2	2.5–4.8	4.7–6.5	1.5–3.7	3.2–4.3	1.8–2.9	1.4–4.8

Fundamental factors in formation of quality of foodstuff are the raw materials and technology. In our case the choice of foodstuff group into which composition cakes can be entered should be based on data on their chemical composition.

According to literary data, cakes of several types of oil-bearing crops may contain the so-called anti-nutrients restricting their food application and capable to cause allergic responses [32]. Availability of such substances is marked, in particular, in products of processing bean and crucial cultures. However at seeds of non-traditional oil-bearing crops of the majority of sorts of the modern selection (in particular, flax, sesame and amaranth) similar components are present at trace quantities, not critical at aspect of food use of cakes. In kernel and walnuts and pumpkin seeds such components are absent.

Taking into account the experimental data, to justify food use of olive cakes the following algorithm of actions can be offered (Fig. 2).

Step I consists in complex research of cake chemical composition, with determination of the quantitative maintenance of the principal food components, the characteristic of qualitative and quantitative composition biologically of the active and anti-nutritious components, levels correlation of contents food and biologically active agents with the recommended norms of their consuming for preliminary reasons for foodstuff group.

Step II is based on results of the researches conducted at the first stage: data on the maintenance of the prevailing components of a chemical composition are used in case of a choice of the list of physical and chemical figures of merit and determination of their regulated values. Indices of toxicological and microbiological safety are set in compliance with valid TR TS 021/2011 [33], taking into account branch accessory of the considered food raw materials – regarding the Application 1 and Application 2 TP TS 021/2011 (item 1.8 "concentrates of vegetable proteins (food) and soy flour"), on hygienic safety requirements – regarding Application 3 TP TS 021/2011 (item 9 "food oilmeal and flour from bean seeds, oil-bearing and non-traditional crops").

Step III is aimed at research of oilcake influence on structural and mechanical properties of prescription masses and finished goods and, first of all, should include such operations as oilcake functional and technological properties study and value limits determination of its technical characteristics (flowability, bulk density, etc.) for the purpose of a technology equipment choice and oilcake introduction modes to prescription mass composition.

Justifying the oilcake introduction stage is carried out taking into account data about its chemical composition: regarding the maintenance of the components subject to corrupting under the influence of water and the increased temperatures, and regarding the maintenance of components, emulsifying, water and capable to retain fat properties of cake and prescription mass with its involvement. The regularities analysis of structural, mechanical and rheological properties change of prescription mass after oilcake introduction is necessary for timely adjustment of oilcake dosage and varied parameters of technological process guiding.

This step finishes researches complex directed to justifying foodstuff group and type of as any modification connected to change of a compounding of traditional foodstuff as a result of this or that type of cake introduction will be followed by nutrition value change and the regulated figures of finished goods quality and safety. Therefore, each specific example requires not only theoretical reasons, but also the experimental confirmation of a possibility of considered oilcakes use in new foodstuff names production, with special approaches development to support technological properties of semi-finished products and a nutrition value of received production.

Step IV, the last one, consists in oilcake dosage, compounding and technology of a new product approval, design and approval of the specifications and technical documentation.

Scientific literature analysis and own experimental data show that as a part of the studied oilcakes three options of components couples can prevail:

– proteins + lipids (sesame seeds and pine nuts kernel oilcakes);

– proteins + carbohydrates (amaranth and pumpkin seeds and walnuts kernel oilcakes);

– proteins + food fibers (thistle and flax seeds oilcake).

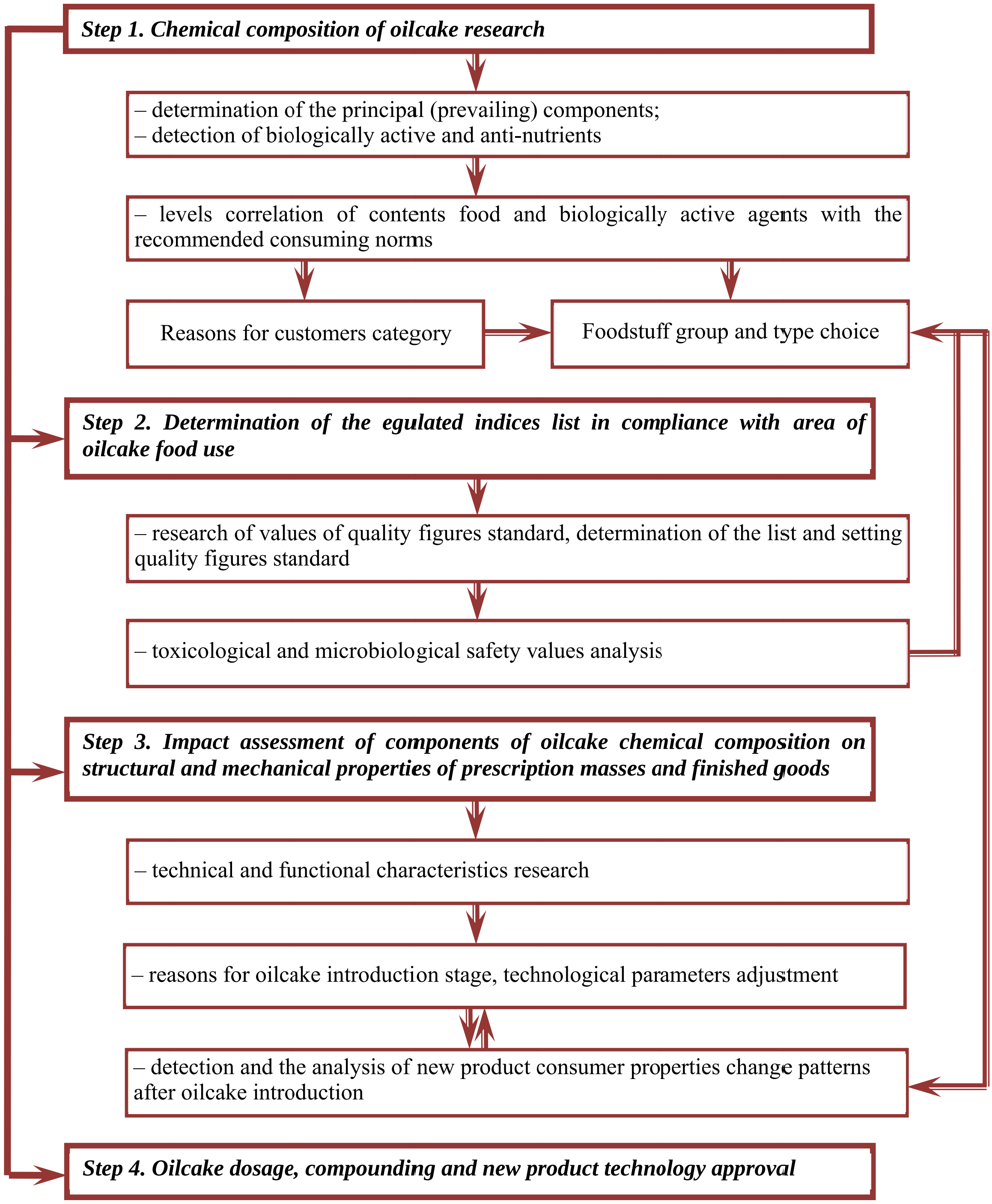

Fig. 2. Algorithm-sequence of actions in case of justifying the ways of industrial processing of oil-bearing crops cakes in food.

There are no bases to exclude that even within one type of olive raw materials for all batches of cakes the quantitative dominance of the marked couple of components will be absolute. So, for example, for black cumin seeds oilcake from a batch to a batch the prevailing couple of components will be either "proteins + lipids", or "proteins + food fibers" as black cumin seeds are processed without separation of seed coats; for pumpkin seeds oilcake and oilcake from walnuts kernel – either "proteins + carbohydrates", or "proteins + lipids". The marked inconstancy in olive cakes nutrition value of should be connected both to technological factors (used press power, initial olive raw materials preparation features), and to natural factors (in particular – maturity level of the nuts prepared for processing and oil-bearing crops seeds).

CONCLUSION

(1) The study of oilcakes chemical composition produced on the basis of new to Russia oil and fat industry, allows to create the conditional gradation taking into account the prevailing macrocomponents of a chemical composition defining a nutrition value and technological properties of oilcakes:

– proteins + lipids (oilcakes from sesame seeds and pine nuts kernel);

– proteins + carbohydrates (oilcakes from amaranth, pumpkin and walnuts kernel);

– proteins + food fibers (oilcakes from thistle and flax seeds).

By parity of reasoning other types of olive cakes can be studied and systematized.

(2) By results of fundamental consumer properties researches and a chemical composition the list and standards of the regulated organoleptic, physical and chemical figures of oilcakes from cedar, walnuts, pumpkin, sesame, black cumin, flax, milk thistle and amaranth seed the allowed levels of data security indices are justified.

(3) On the basis of that the raw materials are considered to be fundamental factors in consumer foodstuff properties formation the following can be offered as the potential directions of food use of the studied oilcakes:

– in case of "proteins + lipids" dominance – mayonnaise and dairy and vegetable products. In this combination oilcake proteins will show essential for mayonnaise and dairy and vegetable products emulsifying, water and capable to retain fat properties, polyunsaturated fatty acids of cakes – to enrich products composition, and the hindering influence of carbohydrates and food fibers will be less expressed;

– in case of "proteins + carbohydrates" dominance oilcake can include some dairy and vegetable (ice cream, desserts, pastes, cottage cheese products) and meat and cereal products (for example, pasty), sugary and flour confectionery, food concentrates. In this case oilcake won't be considered as the enriching ingredient any more, only as variety of a power-intensive filler;

– in case of "proteins + food fibers" dominance the most perspective way of oilcake production use will be bakery and flour confectionery for which introduction of food fibers sources is the traditional way of compounding modification for the purpose of new product names production.

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