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Abstract. The relevancy of the problem of modified starches production is determined by its diversity by raw materials using in manufacture process (banana, chestnut, tapioca, rice, barley, wheat, corn, potato modified starches), by main consumers (food, construction, oil and gas industries), goals of use (production of biodegradable containers, bio-absorbents, micro composites, bio-lubricants, enzyme technology of nanotechnology). The regional relevance of the study problem is based on the need to produce iodized starches for the food industry consumption. Food products produced from these starches will reduce the thyroid gland incidence, at the same time the magnetized wheat starches production will reduce the cardiovascular disease incidence. The analysis of the Russian and world market of modified starches was conducted. The current state and capacity of the world market of modified starches, trends and technology of various modified starches (phosphate, acetate, cationic, cationic cold swelling starches, etc.) production were studied. Results of the study show that Russia's export of modified starches has a weak potential for growth. Russian market of modified starches demonstrates a tendency of increase the competition between modified starches manufacturers due to the new participants' entry in the market. Generally it stimulates the import substitution process. The volume of modified starches imports in Russia is associated with the correlation of manufacturers' prices and expectations of Russia state support for the deepening of domestic agricultural products processing.

1. Introduction

Marketing research of the modified starches market is a very important and relevant task, which allows making effective decisions on the development of modified starches production in the conditions of market conjuncture dynamics and fast development of industries that traditionally consume various modified starches. Today, modified starches are used in food industry [1], cellulose production [2-3], bio-fuel production [4-5], cationic modified starches are used for drilling oil wells, and phosphate, acetate and others - for the chemical industry [6].

Food industry usually uses wheat starches, which are produced from the 1st wheat; various drinks are making from wheat and potato starches [7]. In our opinion, iodized starches producing for the food industry is also significant task. Food products produced from these starches will reduce the thyroid

gland incidence, at the same time the magnetized wheat starches production will reduce the cardiovascular disease incidence.

Modified starches - is a production that needs to be developed in the Russian Federation, since many modified starches are currently importing [8-9].

This production needs to be developed due to import substitution and to produce these products from. Russia's agricultural potential of cultivating the crops (wheat, oats, potatoes, corn, etc.), traditionally using for starches manufacturing is huge. Russia is steadily growing 100-120 million tons of grain annually, including about 70 million tons of wheat. The export potential of our country reaches 40 million tons per year.

According to the association "Roskrakhmalpatoka" (Starches and Molasses of Russia), in Russia about 2.5 million tons of grain per year, including 1 million tons of corn are used for deep processing. Mainly we produced industrial starch, as well as various types of molasses, corn and wheat gluten [10].

As said above, modified starches are widely using in food industry, as well as in a number of other industries such as textile (sizing and preparation of thickening compounds) and chemical (production of glue) ones. The functional properties of starches, mostly relevant for the food industry are given in Table 1.

Table 1. Starches properties that are important for food products

Specific viscosity	Taste, slippery, aftertaste
Liquid boil	Suspension Characteristics
Resistance to acid treatment and mechanical shear	Stickiness (adhesiveness)
Freeze-thaw stability	Crystallinity
The gel texture at different temperatures	Neutral taste
Transparency or haze	Long shelf life
Resistance to processing conditions	Hygroscopicity
Fat Retention	Color
The gel resistance to retrograde	Non-caking
Shine	Dispersibility or swelling in cold water
Gel Flow Properties	Swelling and swelling resistance
The ability to stabilize emulsions	Film forming properties

Source: Starch in the Food Industry**.** Retrieved: https://pkz1.ru/primenenie-kraxmalov/v-pishhevoj-promyishlennosti.html

Therefore, it is necessary to develop the modified starches production in the Russian Federation, both because of import substitution and domestic production development, large agricultural resource potential, which must be used for the development of certain regions with favourable agro-climatic resources for agricultural starch-containing crops cultivating [11].

It should be noted that the production of modified starches in Russia has an increasing tendency. So in 2016 the production of dextrins and other modified starches was 7525 tons, which is 44.3% more than in 2015. According to Russian Statistic Service data in 2018 Russia increased the production of starch, glucose, fructose and their syrups for 1.66 million tons (17% growth comparing with 2017) [12].

2. Methodology of the study

The study uses empirical method of comparison, as well as general theoretical methods such as generalization and analysis. The theoretic basis of the study consists of fundamental works of Russian

and foreign scientists on the problems of biotechnology and modified starches production. For example, there are methods for modified starches using in the production of rubber mixtures [13], in the starch [14], confectionery [15] industries, production of meat and dairy products [16], gelatin [17], cookies [18], and also there are a number of methods for assessing starch and starch products impact on human health [19-20]; physicochemical properties of modified starches for food and chemical products from banana flour [22,23], beans [24] and other crops; the starch physical resistance for various industries [25], and there are also a number of methods for the production of starches with specified qualities and properties for the food, chemical and light industries [26], for pharmaceuticals [27], for functional nutrition [28-29] and phyto-chemistry [30].

Special attention should be given to the search of methods to assess the nutritional properties of various starches, especially for functional nutrition [31-32], as well as innovative methods for the modified starches production [33-34]. All these achievements will increase multi-industrial demand for modified starches [35-36] in the Russian market particularly and in the global market – in general.

To solve the problem of modified starch import substitution, it is necessary to possess information that reveals the current state of the modified starches market. Professional marketing research of this market is carried out by DISCOVERY ResearchGroup, ROIF Expert, etc.

Today, it requires not only marketing but technical analysis of specialized technological equipment for the modified starches production.

In Russia, production, installation supervision, commissioning, and maintenance of such equipment is handled by Krahmalprom LLC, Zhengzhou Jinghua Industry Co. Ltd. (China), “Bavar +”.

For the modified starches production we propose the following technology:

- preparation of aqueous solutions with dissolved mineral chemical elements and then
- starches drying in the special drying machines.

After their enrichment with mineral elements, starch can be used for the baking, pasta and confectionery industries. The recommended content of chemical elements in the solution (mg / dm3) for the starches modification and their further use in the baking and confectionery industries is presented in Table 2.

After the modification of wheat and corn starches with these solutions, they are enriched with chemical elements (in particular iodine and magnesium), and the nutritional value of bakery and confectionery products increases. Iodine is needed to prevent thyroid disease, and magnesium is to prevent heart disease. It is recommended to use 100 litres of solution per 1 ton of starch (based on 1 ton of dry matter). The proposed technology is profitable, since the cost of producing modified starches is only 2100 - 5200 rubbles per ton [35].

Table 2. Recommended chemical composition of the solution for the modification of wheat and corn starch for use in the confectionery and baking industries

Chemical element	Chemical element content in a solution for wheat starch modifying, mg / dm^3	Chemical element content in a solution for wheat starch modifying, mg / dm^3
Potassium + Sodium	2,1	2,1
Calcium	2,4	2,4
Iodine	27,4	33,4
Magnesium	7,2	15,2
Chlorides	2662,5	2662,5
Fluoride	0,61	0,61
Sulphates	9	9
Hydrocarbonate	579,5	579,5

3. Results of the study

Conducted marketing research of Russia domestic market of modified starches and technologies for their production, allows obtaining the following results:

1. Number of domestic modified starches manufacturers (LLC Chuvashenkrakhmal, LLC Amil, LLC TRIUMF, etc.) is small,
2. About 95% of modified starches in Russia is imported; some kinds of starches, for example, caton starch from wheat is not produced in Russia, even being extremely necessary for drilling to produce hydrocarbon raw materials.
3. High capital intensity of modified starches production - the payback period of cationic, acetate, phosphate starches manufacturers is 7-10 years.
4. The presence of substitute goods with a significant difference in starch production costs and output (banana, chestnut, tapioca, rice, barley, wheat, corn, potato modified starches). For example, corn starch is more than 2 times cheaper than potato starch. Depending on the varieties, potato tubers contain up to 25%, wheat grains – 65% - 75%, rice 75-86%, and corn up to 70% of starch.
5. Supply of high-quality raw materials for production of modified starches for different purposes and industries is very limited.
6. Government declared own support for modified starches import substitution.
7. Small amount of domestic modified starches obtained from genetically modified raw materials, although, undoubtedly, its use in the food industry is also permissible.
8. There are various technologies for the modified starches production from different crops for various industries, that are differ in relatively high cost of production (47000 to 65000 rubbles per ton [37]).
9. Our proposed method for the production of enriched with magnesia and iodized modified starches for the baking and confectionery industry has a low cost, as based on creating solutions with minerals and a simple technology for their further wetting and drying. The iodine used in this technology is bound by sulphates, bicarbonates and chlorides and is retained without significant loss of its content for several weeks in the manufactured products.

The analyzed instruments of modified starches market state support are primarily focused on the practical significance of this production, and creation of positive background for the future biotechnology business development. According to the calculations of DISCOVERY Research Group analysts in 2016, the leading regions in production of dextrins and other modified starches in Russia are Oryol Region (80.2%) and Vladimir Region (19.6%). New participants (potentially in the Omsk region, JSC “Titan Group of Companies”) market entry will surely increase industrial competition. There are a lot of not implemented and announced projects in the field of biotechnology, but there are only a few implemented clusters, as is the case with the American company Cargill (in 1991, the company invested more than $ 1 billion in projects in Russia and is actively operating now together with its subsidiary Cargill LLC in the regions of Russia).

4. Conclusion

The analytical data presented in the study allowed obtaining conclusions:

1. The Russian modified starches export has a weak potential to grow, but it should be noted that a modified starches production plant with planned capacity of 240 thousand tons per year is being built in the Chuvash Republic, the growth of the modified cationic starches production from corn and potatoes in Tatarstan is rapidly developing. But the main problem is the almost complete absence of modified starches production in Siberia and the Far East.
2. On the Russian market of modified starches, a weak trend towards increase of competition among modified starches manufacturers due to the entry of new business participants into the market, which stimulates the process of import substitution, is identified.
3. The research results can be used in scientific and industrial activities when considering business issues of biotechnology products, as well as for developing economic programs for the regional development that aims to modified starches producing for various industries.

4. Our proposed methodology for the production of magnesia-enriched and iodized modified starches for the baking and confectionery industries has a low cost, and the demand for such products is very high, since in some areas of the globe there is an acute shortage of iodine, which contributes to the development of thyroid disease. Therefore, the demand for these products will be huge.

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