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ИССЛЕДОВАНИЕ ПРОДУКТОВ РАСТИТЕЛЬНОГО ПРОИСХОЖДЕНИЯ НА НИТРИТЫ, НИТРАТЫ И РАДИОАКТИВНОСТЬ

STUDY OF PLANT PRODUCTS ON PRESENCE OF NITRITES, NITRATES AND RADIOACTIVITY

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Аннотация. *В данной статье будут рассмотрены образцы продуктов растительного происхождения и их соответствие на маркировку «organic». Действительно ли в магазинах, которые позиционируют себя, как Organic, реализуются органически чистые продукты, или это является маркетинговым ходом и подобные продукты ничем не отличаются от тех, что были выращены при традиционном сельском хозяйстве. Была поставлена цель сравнить продукты растительного происхождения трех разных производителей, включая производителя органических продуктов на содержание в них нитритов, нитратов и радиоактивного фона, так как эти показатели являются одними из важных, при производстве органической продукции.*

Ключевые слова: огурцы, органические продукты, нитраты, нитриты, радиоактивность, производители.

Abstract. *The samples of plant products and their compliance with the labeling "organic"are examined in this article. It is being investigated whether the stores that position themselves as «organic» sell organically pure products, or whether this is a marketing trick and there is no difference between such products and those grown in a traditional way. The goal of the research is to compare plant products of three different manufacturers, including the manufacturer of so-called organic products on presence of nitrites, nitrates and radioactivity, since these indicators are important in assessing the quality of organic products.*

Key words: cucumbers, organic products, nitrates, nitrites, radioactivity, manufacturers.

Introduction. Currently, the concept of "healthy eating" is relevant and many people become adherents of a healthy lifestyle. It is impossible to imagine a single store in which there would be no "organic" or "non-GMO" labels on any of the products now. What is organic food and why is it in demand these days?

Depending on how the food is grown, it can have a serious impact on a person's mental and emotional health as well as the environment. Organic foods often contain more beneficial nutrients, such as antioxidants, than their regular counterparts, and people who are allergic to food, chemicals, or preservatives often find their symptoms diminish or disappear when they eat only organic foods. [1.15]

When growing such products, no pesticides, herbicides, radioactive radiation, synthetic fertilizers and other technologies that do not meet the requirements for the production of organic products are used. Vegetables and fruits grown on specialized farms, due to this, contain less nitrogen-containing compounds, and the radioactive background is less than that of products grown in a traditional way. There are three international systems of standards in the world that are guided by farmers in the production of organic products, these are:

1. EU Regulation 2092/91 (EC 834/2007)
2. Codex Alimentarius Guidelines for Organically Produced Food 1999/2001
3. IFOAM Basic Standards (IBS).

The production of organic products is not controlled at the federal level in Russia now, so unscrupulous producers can pass off such as products those that were grown in traditional agriculture. The federal law "On the production and circulation of organic products (organic products)", which allows the production of organic products, will enter into force on January 1, 2020. [2.12]

Four regulatory documents have been introduced in Russia for the production of organic products at the moment:

1. GOST R 56104-2014 “Organic food products. Terms and Definitions"
2. GOST R 56508-2015 “Organic products. Rules for production, storage, transportation "
3. GOST R 57022-2016 “Organic products. The procedure for conducting voluntary certification of organic production "

4. SanPiN 2.3.2.1078-01 "Hygienic requirements for safety and nutritional value of food" (from Chapter 2, Clause 2.18 and Chapter 6) [1,3,4,5].

There are no exact data showing the maximum permissible concentration of nitrites in plant foods, however, when they enter the body, nitrates pass into nitrites, which, with their high content, can deprive the body of oxygen, thereby being a catalyst for oxygen starvation, and also cause diseases of the gastrointestinal tract. So, the more nitrites there is in the product, the more nitrates in it, which are one of the main indicators of organic production.

The task in this article is to compare products of plant origin from three different manufacturers, including a product labeled "organic" on presence of nitrites, nitrates and radioactive radiation, since according to the normative European standards [6, 7], nitrates and background radiation are some of the important indicators that prove the purity of the product and justify its name as organically pure product.

Materials and methods. Cucumbers were chosen as the object of research, since it was easier to obtain a water extract from this product. The method for the determination of nitrites with the Griss reagent was chosen as a method of research for nitrites. This method is based on the fact that in the presence of nitrite ions, the reagent stains them red, and, as a result, the more intense the color is, the more nitrite in the product. [2,10]

The following cucumber samples were taken for this experiment:

1. Medium-sized cucumbers of Agrofirm "Vyborzhets" Company.
2. Medium-fruit cucumber "Meva" of "Greenhouse Complex Belogorya" Ltd – «Green garden bed»
3. Short-fruited fresh cucumbers "Mirinda", of «Organica» supplier.

Water extracts were taken from the presented names of cucumbers, which were then filtered.

To assess the content of nitrites in the samples under study, standard solutions of $NaNO_3$ of various concentrations were prepared. It was necessary to construct a calibration graph from the data of standard solutions. A standard working solution of $NaNO_3$ was brought for this into 9 volumetric flasks of 50 ml in an amount of 0 - 0.1 - 0.2 - 0.5 - 1 - 2 - 5 - 10 - 15 ml, which corresponds to 0 - 0.1 - 0.2 - 0.5 - 1 - 2 - 5 - 10 - 15 μg of nitrite ions. Then, distilled water and 2.5 ml of the prepared Griss reagent were added to these flasks to the mark.

Then, the resulting solutions were photometrically measured on a photoelectric colorimeter with a green filter at a wavelength of 540 nm for subsequent construction of a calibration graph in the coordinates «optical density - nitrite content» (μg). The optical density of each concentration is shown in Table 1.

Table 1

Optical density

Nitrite content (μg)	Optical density
0	0,001
0,1	0,018
0,2	0,007
0,5	0,019
1	0,015
2	0,047
5	0,123
10	0,199
15	0,306

A calibration graph based on the results of Table 1 is shown in Figure 1.

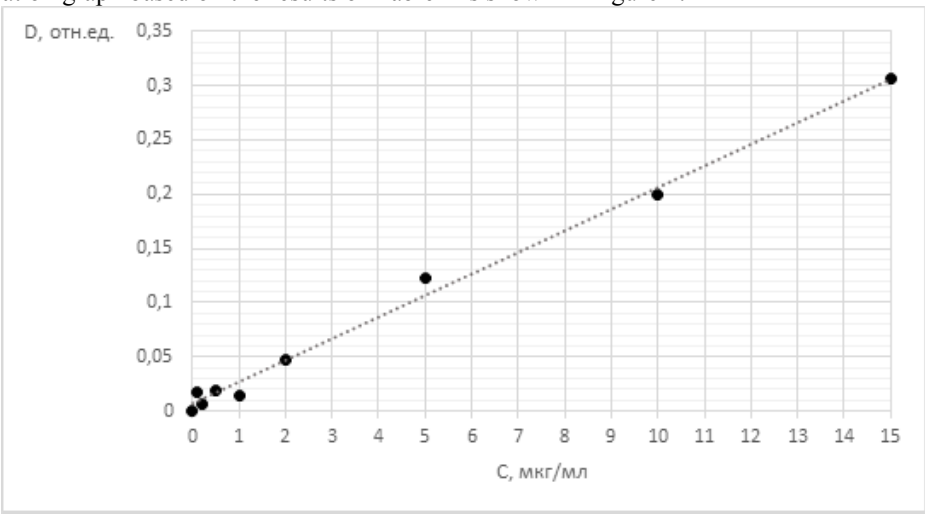

Fig. 1. Calibration graph of standard solutions

In 20 ml of each of the tested filtered aqueous extracts of the presented cucumber samples, 1 ml of Griss reagent solution was added and left for 40 minutes until a stable color was obtained.

The obtained extracts were photometric, the obtained optical densities are presented in Table 2.

Table 2

Optical densities of extracts

Sample No.	Optical density, rel. units
3	1,09
1	1,05
2	1,13

Based on the obtained optical density results, the concentration of nitrite ions obtained in the extracts was calculated on the basis of the calibration straight line. The results are shown in Table 3.

Table 3

Concentration of nitrite ions in the test solutions

Sample No.	Optical density, rel. units	Concentration of nitrite ions by optical density (µg / ml)	Content of nitrite ions in the test sample (µg)
3	1,09	1,07	22,47
1	1,05	1,03	21,63
2	1,13	1,12	23,52

A graph, based on the Table 3 data, is presented in Figure 2.

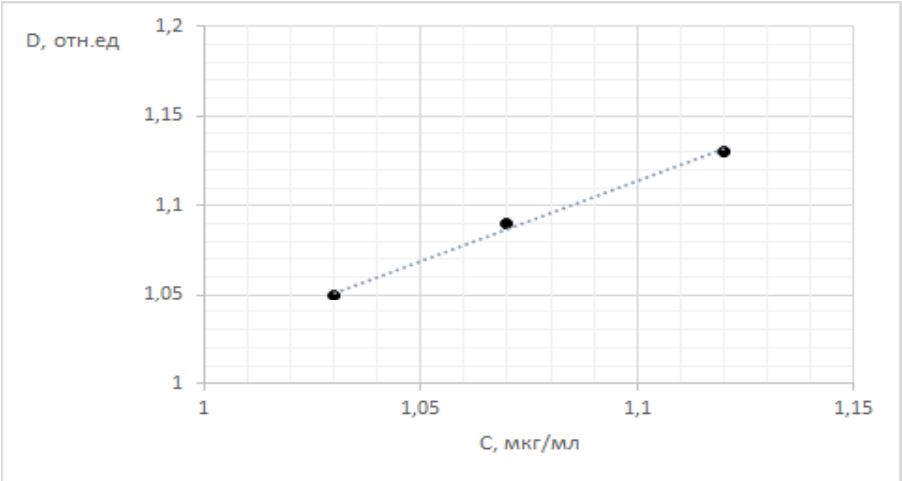

Fig. 2. Graph of optical densities of the investigated solutions

In addition to the study of the three types of cucumbers for nitrites using the Griss reagent, they were also tested for nitrates and radioactivity by the express method, using a SOEKS nitrate meter.

Table 4 shows the obtained measurement results and standardized indicators for cucumbers: sample 3 is a greenhouse cucumber, which corresponds to a nitrate norm of 400 mg / kg, samples 1 and 2 are ground and the nitrate norm is 150 mg / kg, according to the Resolution of the Chief State Sanitary Physician of the Russian Federation from November 14, 2001 N 36 "On the introduction of sanitary rules". Table 5 shows the background radiation.

Table 4

Content of nitrate ions

Sample No.	Average value, mg / kg	Norm, mg / kg	% of the norm
3	58	400	14,5
1	78,3	150	52,2
2	88,7	150	59,13

Table 5

Background radiation

Sample No.	Background radiation, µR / h	Norm, µR / h	% of the norm
3	18,3	30	61
1	24	30	80
2	21,3	30	71

Results and discussion. Based on the results of the study, it was found that the extract from the sample marked "organic" contains much more nitrite ions than in other samples, but it should be borne in mind that when examined with a photoelectric colorimeter, the extract from the sample was turbid, and it could lead to distortion of results. However, this extract has a less intense color, unlike other samples presented. However, sample no. 2 contains more nitrites than sample no. 1.

According to the data of table 4 – cucumbers labeled "organic" contain the least amount of nitrates relative to the norm, and from table 5 it can be seen that this type of cucumber contains the lowest level of radiation background, in contrast to the other two samples presented. However, all tested samples comply with the prescribed standards.

Conclusions. According to the data that were obtained as a result of the study, it was revealed that cucumbers labeled "organic" actually contain significantly less nitrates, as well as the lowest radiation background, in contrast to other samples presented. Thus, the sample under No. 3, unlike other samples, can be considered organic and a man will not receive much harmful substances by eating it.

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ИНТЕЛЛЕКТУАЛЬНАЯ СИСТЕМА КОНТРОЛЯ КАЧЕСТВА ТВОРОГА

INTELLIGENCE SYSTEM OF COTTAGE CHEESE QUALITY CONTROL

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Аннотация. *В статье обоснована необходимость создания автоматизированной системы диагностики качества творога. Для базы знаний разработан метод обратного нечеткого вывода зависимости качества конечного продукта от качества используемого сырья и правильности организации технологического процесса.*

Ключевые слова: нечеткий логический вывод, сырье, технологический процесс, фактор, эксперт, нечеткая импликация, база знаний.

Abstract.*The need of creation of the automated system for diagnostics of cottage cheese quality is proved in the article. The inverse fuzzy inference method of dependence of the final product quality on the quality of the raw materials and the correctness of the technological process organization has been developed for the knowledge base.*

Key words: fuzzy inference, raw materials, technological process, factor, expert, fuzzy implication, knowledge base.

The development of computer technology has led to the creation of automated control systems for technological processes (ACS). One of the important areas of use of ACS are quality control systems in the food industry. The importance of this problem is determined by the concept of life safety. Non-automated food quality control methods are subjective and imprecise. Rospotrebnadzor intends to create a modern food quality control system using digital technologies. To solve this problem, it is necessary to develop expert systems for product quality control. The basis of an intelligent expert system is a knowledge base containing inference rules. Various methods can be used to set inference rules, for example, neural networks [1-4], fuzzy logical inference rules [5].

A method to control the quality of curd and curd products by building an intelligence system for assessing the quality of a product applying input and output data based on fuzzy inference has been developed in this work.

The relevance of the research is determined by the fact that cottage cheese is one of the main food products, which is included as a main component in many therapeutic diets. Sales of cottage cheese and curd products in Russia increased in 2017 compared to 2013 by 5.1% and amounted to 802.5 thousand tons. Demand for cottage cheese and curd products in January-July 2018 increased by 6.8% compared to with the same period in 2017. This trend will continue in the coming years.

According to GOST [6], the quality of cottage cheese is determined by organoleptic indicators, which include: taste, smell, consistency, color and acidity (Table 1).

Table 1

Organoleptic characteristics of cottage cheese

Indicator name	Characteristics
Consistency and appearance	Soft, smudgy or crumbly with or without noticeable milk protein particles. For a fat-free product, there is little whey emission.
Taste and smell	Clean, fermented milk, without foreign flavors and odors. For a reconstituted milk product with a