



# CHARACTERISTICS OF THE EFFECT OF STORAGE CONDITIONS ON THE QUANTITATIVE CONCENTRATION OF NITRATES IN FOOD PRODUCTS

## ХАРАКТЕРИСТИКА ВПЛИВУ УМОВ ЗБЕРІГАННЯ НА КІЛЬКІСНУ КОНЦЕНТРАЦІЮ НІТРАТІВ У ХАРЧОВИХ ПРОДУКТАХ

Koval T.V., / Коваль Т.В.

*s.a.s., as.prof. / к.с.н., доц.*

ORCID: 0000-0002-7132-5887

Prylipko T.M. / Приліпко Т.М.,

*d.a.s., prof. / д.с.н. проф.*

ORCID: 0000-0002-8178-207X

Publons: AAF-5445-2019

Kostash V. B. / Косташ В.Б.

ORCID: 0000-0002-2182-7723

*s.a.s., / к.с.н.*

*Higher education institution « Podolsk State University»,*

*Kamianets-Podilskyi, Shevchenko, 13, 32300*

*Заклад вищої освіти «Подільський державний університет»*

**Annotation.** The results of the study of sources of nitrosamines entering food products are presented. HAs have been detected in various types of fish and fish products, and less HAs are found in fresh fish. It was established that the technological processing of fish leads to an increase in the concentration of NA in the samples. If DMNA is found most often and in relatively large quantities in fish products, which is formed not only from dimethylamine, oils and from various compounds that contain a dimethylamino group, then in Npir is often found in clear products, and the largest amount of it is found in bacon. In cooked sausages, the concentration of HA is, as a rule, somewhat lower than in smoked ones, and in fresh meat they are not detected. The content of nitrosamines in dairy, vegetable and some other products was determined. NAs are absent or found in small amounts in these products. Exceptions are soybean oil, pickles, and spinach that has been stored. In many products, the NA content is quite significant, especially in smoked and canned products. It is shown that a decrease in the basicity of the amine, an increase in temperature, reaction time, and the concentration of components increase the yield of HA.

**Key words:** food products, concentration, nitrosamines, methods of analysis, temperature.

Nitrosamines are formed as a result of the reaction of secondary or tertiary amines with a nitrosating agent. Nitrous anhydride, which consists of nitrite in an acidic aqueous solution, is usually a nitrous agent in food products. Different food components and the physical structure of food affect the formation of nitrosamines. Ascorbic acid and sulfur dioxide are used to prevent nitrosamine formation in food products.

Nitrates are colorless crystalline chemicals that belong to the salts of nitric acid, HNO<sub>3</sub>. These compounds are formed in the reaction of the interaction of the following



acids: nitric acid with certain corresponding metals and/or their oxides (hydroxides) [1]

Nitrates are an important component of nitrogenous nutrition of plants involved in the metabolism of humans and animals, complex biological processes, namely protein synthesis, are impossible without the participation of nitrates. Nitrates are a natural part of the nitrogen cycle in nature, and metabolite products (nitrites or their salts) are present in soil and water [8].

The problem is that the entire life activity of a person and humanity in general historically shows a negative and harmful effect on the environment in most cases of its work. Non-compliance with maintenance technologies, excessive application of nitrogen fertilizers. The fact of poor cleaning of household waste in population centers is the poor quality work of treatment facilities [3].

Atmospheric air is excessively polluted with nitrogen oxide. The reason for this is the large flow of cars, as well as the industrial emissions of various enterprises. Taking into account all these factors, the number of nitrates increases, their concentration increases in water, air and, accordingly, in products, so a person consumes all of it.

The effect of nitrates on the human body is manifested in two ways that closely interact. The first - their content in the water we drink, the second - in the products we consume. Studies have shown that drinking water and vegetables are sources of nitrates in the human body. It has been proven that berries and fruits are less prone to the accumulation of nitrate-containing components. In fact, any of the products of animal origin - threads can be washed in milk, as this is one of the ways of removing them from the animal's organism. In the meat of pork, cattle, agriculture. In birds, an increased amount of nitrates is quite rare. As far as drinking water is concerned, the highest content of nitrates was found in the water of the mine wells. In most oblasts of Ukraine, there is a similar citation with drinking water. The laboratory research center informs about this. More than 60% of these sources exceed the permissible amount of nitrates. By their nature, nitrates do not cause much harm to the body of a healthy person, when they get into the body, they are quickly removed from it. The safe amount



of nitrates is 5 mg per 1 kg of human body weight - this is according to WHO recommendations. An adult person weighing 75 kg can receive approximately 375 mg of nitrates per day[2].

Practice has shown that green vegetables accumulate a large amount of nitrites. Usually, they are sent out in a greenhouse, on a protected ground in a place with low light, so they produce mineral resources, products for feeding the plants, etc.

Undoubtedly, the concentration of nitrates will be related to the vegetable itself, its variety, the time of ripening - early or late, the soil - open or in a greenhouse. For example, early radish absorbs nitrates from the soil together with moisture up to about 80%.

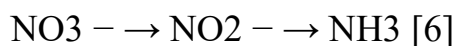
Several methods are known by which it is possible to determine the concentration of nitrates in products offered on the market.

This is a portable nitrate tester. It is quite expensive, but effective. If necessary, you can find out the amount of nitrates in vegetables directly on the spot, without leaving the seller. To do this, you need to immerse the device in a fruit or vegetable, and you will be presented with the results on an electronic device. In a few minutes we will receive information about the content of nitrates in the studied product. All data regarding the norm or exceeding the indicators are in the memory of the unit, so it provides a ready result on the display, which is very convenient [9].

The next method is test strips. This method is ideal for testing products at home. Our actions: cut the product under investigation, apply an indicator to the cut and wait for the answers and conclusions. With a large amount of nitrates in the test sample, the test strip will have an intense indicator color, which indicates a low-quality product.

Humanity has always had a problem with long-term storage of products. This limited his activity, ability to move, comfort of existence. However, over time, this issue was resolved by cooling, salting, immersing the product in fat, soaking, fermenting, pickling, canning. There was a problem in the quality of stored products.

Observations have shown that when salting, pickling and pickling vegetable raw materials, the nitrate content in products is reduced by about 60-70%. This is explained by their participation in the chain reaction of nitrogen reduction:



Currently, the most effective (effective) method of leaching nitrate concentration from: (carrots, radishes, table beets) is the fermentation method. The decrease in the amount of these substances is approximately: in beets from 70 to 90%, in carrots - from 90 to 100%, radishes up to 60% [4].

Temperature, method of storage and features of the court affect the amount of nitrates in leafy vegetable crops. Due to chemical reactions during storage, the nitrate content in some vegetables decreases, while in others it increases. This is related to partial natural drying.

The consumption of vegetables and fruits in cold water is not changed at all. It was found that the number of seeds consumed before consumption and after consumption did not change after consumption of cherries, blueberries, blueberries, green peas i [2,8].

After keeping green onions without access to air in a polyethylene container at a temperature from 0 to 1°C for about 60 days, their number in onions of all varieties will decrease by 30–67%. And when the cibyli-pepo coincides and is opened, the concentration of nitrates increases - 3 - 10%.

The content of nitrites almost does not change when the pedicles and polyethylene packages overlap at temperatures of 1-2°C [5].

Storing vegetables in contaminated packaging materials or containers can lead to an increase in nitrates, which will be facilitated by the intensive growth of nitrogen-producing microorganisms. At reduced storage temperatures of vegetable products, nitrates are transformed into nitrites (more toxic compounds), but this process occurs slowly [1,3, 7].

The nationally acceptable concentration of nitrates (MPC) that a person consumes per day is 500 mg (FAO UN Commission). However, for some countries, the acceptable daily dose of nitrites for an adult person is 300-325 mg. For children, the maximum daily dose is 5 mg per 1 kg of body weight. As for European countries, there is a slightly different trend, namely: y In Germany, 250 mg/kg is considered safe for children, y Switzerland – 400 mg/kg, y France and Belgium – 50 mg/kg. In wealthy



countries, there are no restrictions on the number of fruits and vegetables. Only some countries have accepted general limits - no more than 3500mg/kg for any fruit or vegetable. In European countries, standards are established only for spinach and summer vegetables, which should not exceed the data of indicators of 3000-2500 mg/kg, and the requirements for children's nutrition it is higher - 200 mg/kg [5,8].

Hops containing nitrates and vegetable production in the European Union are regulated by EC Decree No. 1258/2011. Having read this document, we received the following data - the maximum amount of nitrites and spinach is 3,500 mg/kg, and duck and spring chickens, and the period from April 1 to September 30, inclusive, is 4,000 mg/kg. Actions that are leased on a protected plot 3000 mg/kg, and production of open ground - 2500 mg/kg in production of protected ground - 2000 mg/kg and production of open road, and 6000 mg/kg in summer and in children's baths 200 mg/kg. In such vegetables: turnip, tomato, green onion, coffee, melon, the number of nitrites and the EU country does not have clearly limited parameters [4].

As far as our country is concerned, the Ministry of Agriculture and Forestry of Ukraine has approved the maximum amount of meat and fruit and vegetable production in accordance with the requirements by the laboratory of computer toxicology.

### References:

1. DSTU EN 12014-1:2002 (EN 12014-1:1997, IDT). Food products. Determination of nitrates and nitrites. Part 1. General provisions. URL: [https://online.budstandart.com/ua/catalog/docpage.html?id\\_doc=85550](https://online.budstandart.com/ua/catalog/docpage.html?id_doc=85550)
2. Hitska O.A. Risk-based food safety system: analysis of international and national legislation. Collection of scientific works of the Kharkiv State Zoo-Veterinary Academy Problems of zoo-engineering and veterinary medicine. Veterinary sciences. Kharkiv. Vol. 35. Part 2, Volume 3. 2018. P. 102–106.
3. Tetiana Prylipko, Volodymyr Kostash, Viktor Fedoriv, Svitlana Lishchuk, Volodymyr Tkachuk. Control and Identification of Food Products Under EC Regulations and Standards. International Journal of Agricultural Extension. Special Issue (02). 2021. P.83-91.



4. Prylipko T.M., Fedoriv V.M. Methods of modern types of quality examination, identification of falsification of food raw materials of animal origin Visnyk of Lviv University of Trade and Economics, Technical Sciences. Food technologies. 2023. No. 35. P.43-48

5. Tolchynskyi O.V. The origin and consequences of nitrate intoxication for humans and animals. Science zap Ternopil national ped. university Ser. Biol. 2013, No. 2 (55). P. 122-125.

6. Ustyanska O.V., Glinska L.Ya. Food safety and nutrition.: Proceedings of the XIII International scientific and methodical conference. Kharkiv. 2015 pp. 103-106. Prylipko T.M., Kostash V. B., Pidlisnyj V.V., Semenov A. M. Improvement of methods of identification of meat types. *The International Scientific Periodical Journal "Modern engineering and innovative technologies"* Karlsruhe, Germany Issue. № 26. Part 1. April 2023. P.72-77.

7. Prylipko T.M., Koval T.V. Method of operational quality control of meat raw materials and meat products. *The International Scientific Periodical Journal "Modern engineering and innovative technologies"* Karlsruhe, Germany Issue. № 26. Part 1. April 2023. P.78-83.

8. Prylipko T. Control of the Quality and Safety of Dairy Products in Ukraine: International and Legal Aspects. *European Food and Feed Law Review*. Volume 18. 2023. Issue 1. P. 22-30.

**Анотація.** Наведено результати вивчення джерел потрапляння нітрозамінів в харчових продукти. Виявлені НА в різних видах риби і рибних продуктах, причому менше всього НА у свіжій рибі. Встановлено, що технологічна обробка риби приводить до зростання концентрації НА у зразках.. Якщо в рибних продуктах найбільш часто і у відносно великих кількостях зустрічається ДМНА, який утворюється не тільки із диметиламіну, алей й з різних сполук, які містять диметиламіногрупу, то в м'ясних продуктах часто знаходять Нпір, причому найбільша кількість його виявлена у беконі. У варених ковбасах концентрація НА, як правило, дещо нижча, ніж в копчених, а у свіжому м'ясі вони не виявлені. Визначено вміст нітрозозамінів в молочних, овочевих та деяких інших продуктах. У вказаних продуктах НА відсутні або знайдені у невеликих кількостях. Виключення становлять соєва олія, соління і шпінат, який зберігався. В багатьох продуктах вміст НА досить значний, особливо в копчених і консервованих продуктах. Показано, що зниження основності аміну, зростання температури, часу реакції і концентрації компонентів підвищує вихід НА.

**Ключові слова:** харчові продукти, концентрація, нітрозаміни, методи аналізу, температура.