



Application of ozonizers of OBP07 for elimination of putrefactive microflora

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One of the major directions, in the field of storage of food, is long storage and transportation of fresh vegetables, fruit, berries which in the majority, belong to the category of perishable goods. Nearly a half of vegetables and fruit don't reach the end user because of inadequate storage conditions and imperfection of system of food logistics. Therefore today especially sharply there was a question of development of new energy saving and ecologically safe technology solutions in the field of creation of optimum storage conditions and transportation of perishable fruit and vegetable and meat and dairy products which ensure their maximum safety.

Use of ozone technologies belongs to one of the most effective decisions in this area. Today in the world considerable experience of use of ozone for processing of fruit and vegetables for the purpose of increase in terms of their storage is accumulated. Ozonization sharply reduces an obsemenennost of fruit and vegetable products putrefactive and pathogenic microflora, and also sharply reduces the level of the proceeding metabolic processes, i.e. removes the main reasons for damage of agricultural and food products, providing considerable economic effect.

Practical use of ozone as the sterilizing means has begun with purification of air of warehouse. This way consisted in air saturation by the certain amount of ozone sufficient for destruction of main types of pathogenic microorganisms. The made numerous experiments have shown that when processing warehouse ozone a dose 2 - 35 mg O₃/m³ within 60 - 240 minutes provides their full disinfecting.

Ability of ozone to destroy various microorganisms, including putrefactive bacteria, mold, disputes of mushrooms allows to use effectively it for increase in a period of storage of food products in a vegetable - and granaries, refrigerators, refrigerators. Ozone destroys the ethylene emitted by vegetables and fruit which promotes acceleration of maturing of fruit and vegetable products and by that maturing detains them. The conducted researches have shown that duration of storage of fruit and vegetable products can be doubled on average with simultaneous preservation of delicate aroma of fruit. So when processing berries (strawberry, raspberry, grapes) ozone a dose 3 – 8 mgO₃/m³ the term of their



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storage increases twice; after processing by ozone of apples a dose 4 – 9 mgO₃/m³ their period of storage at the room temperature increases up to 15 days. After processing of apples ozone a dose 4 – 6 mgO₃/m³ their period of storage at a temperature +5°C increases up to 5 months. Similar results have been received at storage of the citrus processed by ozone, bananas, tomatoes, potatoes, cabbage and other fruit and vegetable products [1]. Processing by ozone of fruit and vegetable products increases terms of her storage 1.5 – 2 times, providing reduction of losses of the stored production by 1.5 – 2.5 times.

Table 1 – The recommended modes of ozone processing of fruit and vegetable products in the mode of long storage (an extract from "Temporary methodical recommendations about use of ozone for disinfection плодовоовощехранилищ and storages of potatoes").

Produce	Ozone concentration, mgO₃/m³	Ozonization time in a day, hours, not less	The number of processings in a week (reference)
Cabbage	7 - 13	4	1 - 2
Carrots	5 - 15	4	3 days in a row 1 - 2 times a month
Garlic	9 - 14	5	2 - 3
Onions	8 - 10	4 - 5	1-2 times a day
Grapes	3 - 8	3	3 - 4
Salad	9 - 12	2	4 - 5
Apples	4 - 9	5	2 - 3

Use of ozone at storage of potatoes is especially effective. So periodic processing stored in a potato storage at a temperature of 6 - 14 °C and humidity of 93 - 97% of potatoes ozone a dose 2 – 7 mgO₃/m³ allows to increase the term of his storage up to 6 months. At the same time in the stored potatoes increase in content of starch at simultaneous decrease in content of sugars was observed. Ozonization of potatoes considerably suppresses development of phytopathogenic microflora, so, for example, the quantity of the mold mushrooms which are on a surface of potatoes after processing of a potato



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storage ozone decreases by 1.5 - 2 times, and in the air environment of a potato storage the quantity of various microorganisms decreases by 10 - 12 times that also positively influences safety of the stored potatoes. Losses of potatoes at application of processing of a vegetable storehouse ozone decrease by 10 – 15% and more than [2].

Thanks to the disinfecting abilities ozone prevents formation on walls of storage, wooden boxes and containers of various colonies of microorganisms, including especially steady against low temperatures 0 ... +4 °C and the giving stored fruit and vegetable products a specific putrefactive smell of a blue mold. Because ozone is rather strong oxidizer, his oxidizing potential is about 20% higher, than at chlorine, he effectively destroys the aromatic hydrocarbons which are airborne vegetable storehouses and refrigerators, i.e. carries out process of deodorization of rooms. Besides, being one of unstable kinds of molecules of oxygen, ozone quickly enough breaks up and turns into safe oxygen, than it favourably differs from traditionally applied to sanitary processing of fruit and vegetable products and vegetable storehouses of toxic chemicals.

Use of ozone is of great interest to processing of the fruit and vegetable products transported by automobile and railway refrigerators. Application of periodic ozonization of the transported production allows to reduce the losses resulting from course of putrefactive processes at low temperatures by 10 – 15% and to reduce losses from damage of the transported production. Besides, periodic ozonization of the transported and stored production allows to increase temperatures of her storage by several degrees and to avoid loss of commodity quality of production as a result of her freezing, and also to reduce energy consumption of refrigerating units.

Summing up the results, it is possible to draw the following conclusions on expediency of use of ozone for processing of fruit and vegetable products:

1) ozone has strong disinfecting effect and harmful influences putrefactive and pathogenic microflora. Ozone effectively decomposes the toxins which are formed on a surface of fruit and vegetable products being waste products of microorganisms;

2) at application of ozone processing of the stored and transported fruit and vegetable products there is a delay of processes of her maturing, and losses from the proceeding processes of rotting of fruits decrease;

3) ozone effectively destroys unpleasant specific smells of decay and carries out deodorization of vegetable storehouses and the stored fruit and vegetable products;

4) after processing by ozone, the stored fruit and vegetable products, deterioration in their quality and consumer properties isn't revealed;



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5) periodic processing of vegetable storehouses small doses of ozone frightens off various rodents and effectively influences insects, providing improvement of safety of the stored fruit and vegetable products;

6) use of ozone for processing of fruit and vegetable products, refrigerators and vegetable storehouses differs in simplicity, efficiency and ecological safety owing to lack of harmful side effects as a result of bystry decomposition of ozone to oxygen;

7) the cost of processing of fruit and vegetable products with use of ozone is several times lower, than when using chemical disinfectants, ozone is received directly on the place by means of special devices – ozonizers. Electric power expenses for sanitary processing of the fruit and vegetable products which are stored in the 1000 m³ refrigerator make 4 – 8 kW · h in a week;

8) ability of ozone to destroy putrefactive and pathogenic microflora allows to apply effectively ozone to increase in a period of storage of perishable fruit and vegetable products at her transportation in refrigerators of refrigerators;

Use of ozone technologies at storage and transportation of perishable fruit and vegetable products allows:

- ✓ to reduce losses of perishable fruit and vegetable products;
- ✓ to considerably keep its biological value;
- ✓ to reduce energy consumption connected with storage of perishable production (application of ozonization allows to increase by several degrees temperature in the refrigerator that significantly reduces power consumption of technological process);
- ✓ to refuse the toxic chemical disinfectants applied to processing of production.

For ozone processing of fruit and vegetable and meat and dairy products it is the most expedient to apply the OBP07 series ozonizers developed by KHARKIV ENGINEERING COMPANY, Ltd. the company (OBP07T – to autorefrigerators).

Main advantages of ozonizers of the OBP07 series:

- ✓ formation of ozone is carried out directly from cold and crude air of vegetable storehouses, refrigerators and refrigerators;
- ✓ ozonizers have no source of high voltage that considerably increases their reliability and safety;
- ✓ unlike traditional electrodigit high-voltage ozonizers, ozonizers of the OBP07 series can work in the conditions of enough low temperatures and high humidity of air;
- ✓ supply of ozonizers (depending on modification) is carried out from low-voltage electric networks of a direct current of 12 or 24B, and also from the electric alternating current main with a frequency of 50/60 Hz with a voltage of 36 V, 110 V or 220 V that allows to apply them both in stationary, and in mobile refrigerators and automobile and railway refrigerators.



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Compactness and reliability of ozonizers of the OBP07 and OBP07T series allow to apply them to processing of containers with fruit and vegetable products in vegetable storehouses, refrigerators, directly in trading floors of grocery stores and supermarkets, in refrigerators. OBP07 series ozonizers along with effective suppression of putrefactive microflora provide elimination of specific putrefactive and other unpleasant smells.

The manage materials regulating use of ozone in the food industry

Use of ozone as disinfectant is recommended:

- ✓ The instruction "Disinfection and deodorization in refrigerators in the way of ozonization" (The Ministry of Trade of the USSR, 1973);
- ✓ Methodical recommendations about use of ozone as disinfectant, (Food Industry Ministry of the USSR, 1976);
- ✓ Temporary instruction for ozonization of left-luggage offices of firm abomasal cheeses (Ministry of Trade of RSFSR, 1975).;
- ✓ The instruction for acceptance, storage, commodity processing and production of sausages and smoked products on distributive refrigerators of trade (The Ministry of Trade of RSFSR, 1977);
- ✓ The instruction for acceptance, cooling treatment, storage and production of the cooled-down and cooled meat (The Ministry of Trade of RSFSR, 1977), and also other normative documents.

In 1984 ozone has been included in the list of new means of disinfection of veterinary objects. In 1997 in the USA ozone has been recognized by the decision of the government commission as safe means for use the existing and potential technologies connected with storage and processing of food. In 1998 ozone has been brought by the Ministry of Health of the Russian Federation in the list of disinfectants (reg. No. 0039 - 98/21) is also allowed for disinfection of air in MPI.

In Republic of Belarus ozone is officially recognized as an environmentally friendly disinfectant which is allowed for use in medicine, the food industry and other fields of the national economy. The resolution of Council of ministers of Republic of Belarus No. 573 (of May 17, 2004) has approved actions for realization of "The main directions of providing the population with qualitative raw materials and foodstuff" (No. 38 1204-487 of 25.11.04.), where sterilization of the remote production equipment, capacities and communications at the enterprises of the food industry and local water treatment for the enterprises of the food industry producing baby food are recognized as the main directions of use of ozone.



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