Innovative technology for destruction of grain pests

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***Abstract*—** In this work, effect of ion ozone treatment with and without cavitation plants on technological and seed properties of wheat grain and destroyed grain pests.

***Keywords* —** ion, ozone, cavitation, pests, technology.

I. Introduction

PRODUCTION of bakery is inextricably links with living organisms, the activity of which depends largely on environmental conditions. To improve the safety and quality of grain for short-term and long-term storage efficient is production of ion-ozonic processing in area of electromagnetic cavitations using laser technology, increase the intensity of technological processes, which significantly reduces the cost and time of processing of grain raw materials [1].

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In recent years, there has been increased scientific interest in the problems of the interaction of electromagnetic fields with matter, and, of particular interest is the study of the impact on different environments powerful high frequency (HF) and ultra high frequency (UHF) radiation. High frequency and very high frequency processes are widely used and distribution for heating and heat treatment, drying, storage, pest control, etc**.**

Treatment of grain in a continuous stream UHF, in which, the main advantage is the creation of a uniform field on the surface of the cylindrical chamber through the use of a combination of a coaxial line with a tapered mouthpiece [2].

Thanks to the creation of laser light sources, provided the given initial condition achieved to increase the biological activity of plants and more fully realize their potential [3].

The scope and extent using of ozone in the last decade, growing at fast pace. Currently the most important application fields: cleaning and disinfection of drinking and industrial water, pre-sowing and post-harvest handling of seeds, food storage, packaging and sterilization of dressings in the pharmaceutical industry, therapy and prevention of various medical diseases and others [4].

In order to improve use efficiency of grain Kazakhstani scientists have developed various electro physical methods of processing, storage and processing of grain products: magnetic, electromagnetic, ultrasonic, laser, ion, ozone and ion ozone grain processing that contribute to improving the quality and safety of grain [5].

The using combinations of known electro physical methods allow you to create nanotechnology processing, storage and processing of grain in field electromagnetic cavitations.

Nanotechnology formed of particles of molecular ions, ozone and oxygen, magnetic field, wave electro valve. As a results of influence of the magnetic flux and ultrasonic vibrations generated electromagnetic field of cavitations, where exposed to wheat grain.

Adjustable impact on the biological environment ion ozone mixture with application ion ozone cavitations in the field of the electromagnetic field allows intensively barb throat with the activation and stimulation of biological media of wheat, as well as to inhibit viruses, bacteria, spore formation detention flow of physiological and physic-chemical processes, suppression of their infectious activity [6,7].

Electromagnetic devices have some advantages over the devices of the permanent magnet, namely the possibility of adjusting the parameters of the magnetic field and it is not accumulated ferromagnetic iron oxides [8].

The basis for increasing the biological value of the processed seed and food grain and produce the effect are structural and functional changes of membrane formations of cells and intracellular organelles, which in our understanding are targets ion ozone electromagnetic cavitations. Because of this interaction the physic-chemical basis for changes in the metabolic rate associated with transfers of protons and electrons in the cell membranes, and on this basis, there are consistent nonspecific reactions of the cell and organism as a whole. The differences exist only in the intricacies of biophysical interactions ion ozone electromagnetic cavitations and biological tissues [8].

The grain all grain crops assessed by organoleptic and physic-chemical parameters. In standard methods for the examination of technological parameters of wheat grain is the quality of all grain crops, namely color, smell, status, and type of grain, moisture, weed content, including harmful impurities and grain, infestation by pests.

For these experiments necessary in laboratory populations of insects and mites. For this purpose, surveys conducted to collect the test objects and the evaluation of the fitosanitary state granaries, warehouses, grain elevators, grain enterprises, warehouse areas and feed mill or district, Almaty region,

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Almaty. Surveyed "LLP Bayserke", LLP "Altyn dermen", feed mill "Bacon". Selected and analyzed 58 samples. Identified pests: lygus bugs, carpet beetle larvae, brritney infected in the second degree, and the worms, mumedi - I degree.

In special containers different grain moisture weighing 3 kg, infected the main pests were subjected to the ozone treatment of 10 g/m3 exposure time = 20 minutes and cavitations 0.6 MPa exposure time = 10 minutes by combining ozone and capitation exposure 20 minutes. Their effects on insect pests presents in tables 1-3.

TABLE I
THE EFFECT OF OZONE ON ADULT STORED PRODUCT PESTS, 2014

ozone concentration, g/m^3	infestations degree	Exposition minutes	Biological efficiency (%) through.... days								
			granary weevil			Surinamese mucoid			small flour castaneum		
			3	5	10	3	5	10	3	5	10
10	I	20	10	20	60	10	45	55	15	60	80
10	II	20	15	40	50	30	40	50	45	80	90
10	III	20	35	45	65	30	65	90	45	80	90

As follows from table 1, if the ozone concentration of 10 g/m3 exposure 20 minutes and degree of infestation by the death of the grain weevil on day 10 was 60%, Surinamese of mucoid - 55%, flour beetles - 80%, and at III level on day 10 were lost 65% weevil, 90% of mucoid and castaneum.

TABLE II
EFFECT OF CAVITATION ON ADULT STORED PRODUCT PESTS, 2014

Cavitation, MPa	infestations degree	Exposition minutes	Biological efficiency (%) through.... days								
			granary weevil			Surinamese mucoid			small flour castaneum		
			3	5	10	3	5	10	3	5	10
0,6	I	10	40	45	80	5	45	85	45	75	80
0,6	II	10	20	45	85	5	55	85	25	80	85
0,6	III	10	45	50	85	10	65	90	20	60	90

TABLE III
OZONE + CAVITATION ON ADULT STORED PRODUCT PESTS, 2014

ozones concentration + cavitation, g/m^3+ MPa	infestations degree	Exposition minutes	Biological efficiency (%) through.... days								
			granary weevil			Surinamese mucoid			small flour castaneum		
			3	5	10	3	5	10	3	5	10
10 g/m^3 0,6 MPa	I	20	25	45	80	15	45	75	20	55	90
10 g/m^3 0,6 MPa	II	20	45	90	95	45	80	90	45	70	95
10 g/m^3 0,6 MPa	III	20	50	95	100	50	85	100	45	95	100

In the processing of cavitation at a concentration of 0.6 MPa, exposure for 10 minutes at the II degree of infestation by pests efficiency it was on day 10 - 85% of grain weevil, the Surinamese mucoid and flour beetles, and in the grade III - 85% weevil, 90% of mucoid and castaneum.

When ozone treatment and cavitations if the ozone concentration of 10 g/m3 and cavitations 0.6 MPa exposure time = 20 minutes, the death of weevil, the Surinamese mucoid and flour beetles within 10 days ranged from 75 to 100%.

When analyzing the performance effects of ozone and cavitation on the preimaginal stages of development of the grain weevil had no influence, while the Surinamese mucoid and flour beetles the most resistant stages egg, nymph and sensitive larvae, flour mite larvae and nymphs.

TABLE IV
CONDITIONS OF THE EXPERIMENTS AND THE RESULTS OF THE INFLUENCE IONOSONDES TREATMENT ON TECHNOLOGICAL PROPERTIES OF WHEAT GRAIN

Experiences No.	Processing modes			Technological characteristics of grain					
	ions concentration, unit/dm^3	ozone concentration, g/m^2	Duration ionosondes processing, min	protein, %	Crude gluten, %	starch, %	Index of Greenery, ml	Compressive deformation, %	Tensinet
1.	9	2	5	13,8	28,53	61,66	49,57	350,4	57,47
2.	64	2	5	13,88	27,91	61,4	48,97	339,2	61,97
3.	9	6	5	13,81	28,33	61,46	49,25	344,62	58,3
4.	64	6	5	14,1	29,82	61,47	52,73	356,79	52,85
5.	9	2	20	14,01	28,95	61,5	50,12	361,92	59,27
6.	64	2	20	13,91	28,33	61,67	47,82	350,67	61,58
7.	9	6	20	13,97	28,6	61,27	48,84	353,75	63,27
8.	64	6	20	14,19	28,78	61,22	52,76	347,7	62,25
9.	9	4	12,5	13,66	29,41	61,45	48,80	373,80	66,77
10.	64	4	12,5	13,50	29,51	61,40	48,13	381,83	67,75
11.	36,5	2	12,5	13,70	29,72	61,36	47,97	391,38	66,80
12.	36,5	6	12,5	13,23	30,14	61,63	48,54	383,83	54,42
13.	36,5	4	5	13,81	30,03	61,46	48,72	401,89	66,58
14.	36,5	4	20	13,43	29,93	61,63	47,56	400,88	63,43
15.	36,5	4	12,5	13,19	28,94	61,86	43,58	398,43	62,91
control				14,32	29,31	59,67	51,23	372,04	76,64

When ion ozone processing grain reserves there is a simultaneous impact on pests and technological properties. The ratio of ion concentrations and ozone, settled subject of pest control and improving the quality of grain.

In studies it has been shown that the dependence of the investigated technological quality of grain of wheat after ion ozone processing is complex. Therefore, to determine the optimal conditions ion ozone processing of wheat grain was scheduled series of experiments, allowing to consider the ambiguous nature of the change of quality indicators on the processing conditions. This was chosen plan Boxing type B3, close to the D-optimal. The plan was additionally included experience in the heart of the experiment. Experiments randomizable using a table of random numbers, thus reducing the influence of uncontrolled variables on the results of the experiments.

The planning matrix and the results obtained by definition of process quality indicators are shown in table 4.

One of the most successful approaches to solving such optimization problems with many optimality criteria is the application proposed by Harrington's desirability function D to build which local optimality criteria Yi is converted to dimensionless scale of desirability di, and generalized

(complex) criterion D (desirability function) calculated as their geometric mean. To obtain a dimensionless scale d, it is convenient to use the method of quantitative estimates of the range of values from zero to one. The value of d = 0 corresponds to a totally unacceptable to the value of the optimality criterion, and d = l - best value of the criterion.

The transformation of local criteria yi in di has exponential type:

$$d = \exp[-\exp(-y')], \quad (1)$$

where y' = b0 + b1y

in an expression y' = b0 + b1y coefficients b0 and bi determined by asking two values y, corresponding to the values of d in the interval 0,2 < d < 0,8. Based on the underlying scale of desirability and requirements for criterions yi, amounted to an auxiliary table to determine the coefficients b0 and bi.

Substituting the value of di in equation (9) by simple mathematical transformations we get the expression for individual desirability function di:

d1 = exp [exp(–26,671–1,986 y1)];
d2 = exp [exp(–25,332+0,891 y2)];
d3 = exp [exp(–190,449+3,103 y3)];
d4 = exp [exp(–9,904+0,216 y4)];
d5 = exp [exp(–11,222+0,032 y3)];
d6 = exp [exp(–7,520+0,133 y4)].

Next, using the obtained expressions for all terms yi in accordance with the plan of experiments in each experiment were calculated di and, then, by the expression.

$$D = \sqrt[6]{d_1 d_2 d_3 d_4 d_5 d_6} \quad (2)$$

the value of the generalized function of desirability D.

II. Summary

The regression equations for ion ozone processing of wheat grain cavitation zone have a high degree of adequacy and reliability to determine the optimal modes ion ozone processing of wheat grain cavitation zone.

The results of the tests showed that the use of electro technology in the processing of grain is promising, because it allows you to reduce storage losses due to the destruction of pests and pathogenic flora, improve baking properties of flour.

We have conducted research and development and testing of the original installations allows the grain to reduce its losses during storage and improve baking properties of flour.

According to the result of experiments investigated the effect ion ozone processing with and without the use of cavitation fitting to technological and seed properties of wheat, also with the help of this innovative technology destroyed is ebania the grain pests.

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