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ANALYSIS OF INFLUENCE OF SURFACE seed ELECTRIC FIELD FOR DISTRIBUTION

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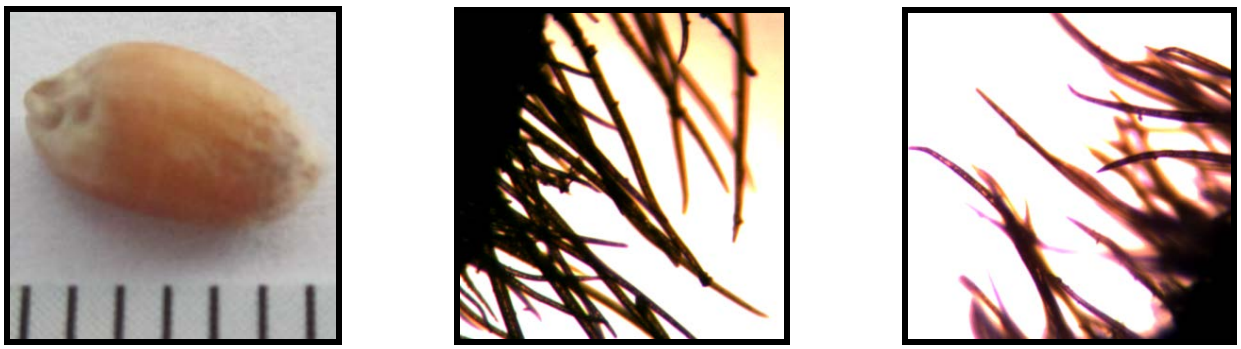
Now the important question is to increase efficiency and reduce the cost of disinfecting grain products. One way of disinfecting grain processing is ozone, which is formed by the passage of plasma-chemical reactions caused by the corona effect in the bulk grain weight [1]. However, analysis of quantitative and qualitative characteristics of the formation of ozone in the grain mass necessary to consider features caryopsides surface structure, in particular the presence at the surface mikrovystupiv based on their relative position.

In [4] shows that the distance between the seed and the radius of the rounding surface grains influences the characteristics of the electric field distribution in mizhzernynnomu space. Publication [8] devoted to the investigation of the structure caryopsides wheat. However, it should be noted that these works are not paid enough attention to the definition of the geometric dimensions of irregularities on the surface caryopsides, the presence of which in particular is typical for wheat. Research mikrovystupiv size is necessary because in [6, 7] proved that the presence of micro mikrovystupiv and significantly affects the value of the electric field and the heterogeneity of its distribution in space. Based on these studies can be assumed that the presence of irregularities on the surface of grains promotes corona discharge in the volume of grain mass.

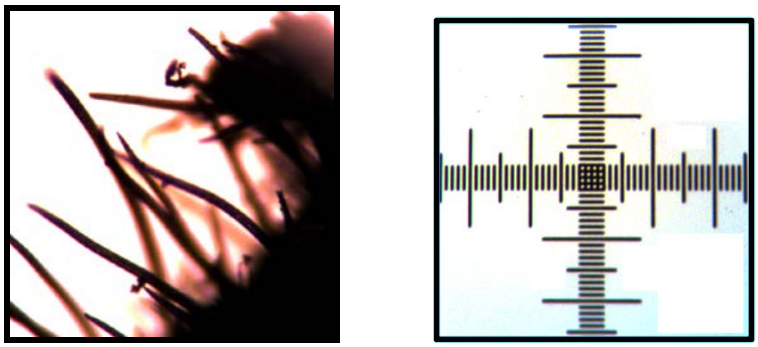
The purpose of research - determining geometric dimensions of the surface mikrovystupiv caryopsides wheat mikrovystupiv ascertain the impact on the distribution characteristics of the electric field in the grain mass.

Materials and methods of research. To determine the nature of the surface heterogeneity caryopsides wheat used in the microscope MISROMED XS-2610 digital camera MISROmed® 3.0 Mega CMOS. The resulting photographs (Fig. 1a-d) analysis using TSView, provided a complete camera and gauge glass (Figure 1, d) point value of 0.01 mm. To obtain reliable data sampled grains and executed a series of measurements indicate that the surface heterogeneity grains have a form close to cylindrical, with an average diameter of 0,012 mm and a length of 0.35 - 0.6 mm, the average distance between them 0.04 - 0.06 mm.

To analyze the impact of the presence of irregularities on the surface of grain distribution of the electric field in the first approximation proposed to use the average value of the size of heterogeneities length by 0.42 mm, 0,012 mm diameter and taken the average distance between inhomogeneities 0.05 mm.



a *b* *c*



d *g*

Fig. 1. Photos taken with a microscope MICROMED XS-2610:

a - the appearance of grains on the background of the measuring scale with scale division 1 mm; b, c, d - examples registration mikrovystupiv the surface caryopsides wheat with an increase of 40 times; g - photos gauge glass with a point value of 0.01 mm at a magnification of 40 times

To determine the effect of irregularities in the distribution of the electric field in the gap mizhzernynnomu need to solve the problem of the theory of the electric field. It can be formulated as a function of the scalar potential satisfying elliptic equation in partial derivatives of the second order (1) in a cylindrical coordinate system:

$$\frac{1}{r}\frac{\partial}{\partial r}(r\varepsilon\frac{\partial\varphi}{\partial r})+\frac{\partial}{\partial z}(\varepsilon\frac{\partial\varphi}{\partial z})=0, \quad (1)$$

where ε - relative dielectric constant of the medium; r, z - respectively radial and axial coordinate.

With the known distribution of the vector potential of the electric field E and its modules are determined using equations (2), (3):

$$\bar{E} = -grad\phi = -\left(r\bar{i}\,\frac{\partial\phi}{\partial r} + \bar{j}\,\frac{\partial\phi}{\partial z} \right); \tag{2}$$

$$|E| = \left[\left(\frac{\partial\phi}{\partial r} \right)^2 + \left(\frac{\partial\phi}{\partial z} \right)^2 \right]^{0.5} . \tag{3}$$

Results. To solve this problem applied software FEMM 4.2. The software package operates based on FEM [5]. He successfully used for the analysis of the various units of high-voltage equipment. [3] Fig. 2 shows the calculated areas containing fragments of wheat grains volume 1 of 2 heterogeneity and distribution of the electric field in the gap mizhzernynnomu other mikrovystupom to seed (Fig. 2a) and a group mikrovystupiv grains on the surface (Fig. 2b) . The simulation results of the electric field distribution indicate that increasing the number mikrovystupiv increasing the average value of the electric field and the amount of area with high intensity. Thus, from Fig. 3 shows that the electric field is greatest near the mikrovystupu that due to the high heterogeneity of the electric field in the area. On the edge mikrovystupiv electric field three times background values. It should also be noted that the nature of the electric field between the electrodes depends on their number and location (see. Fig. 3).

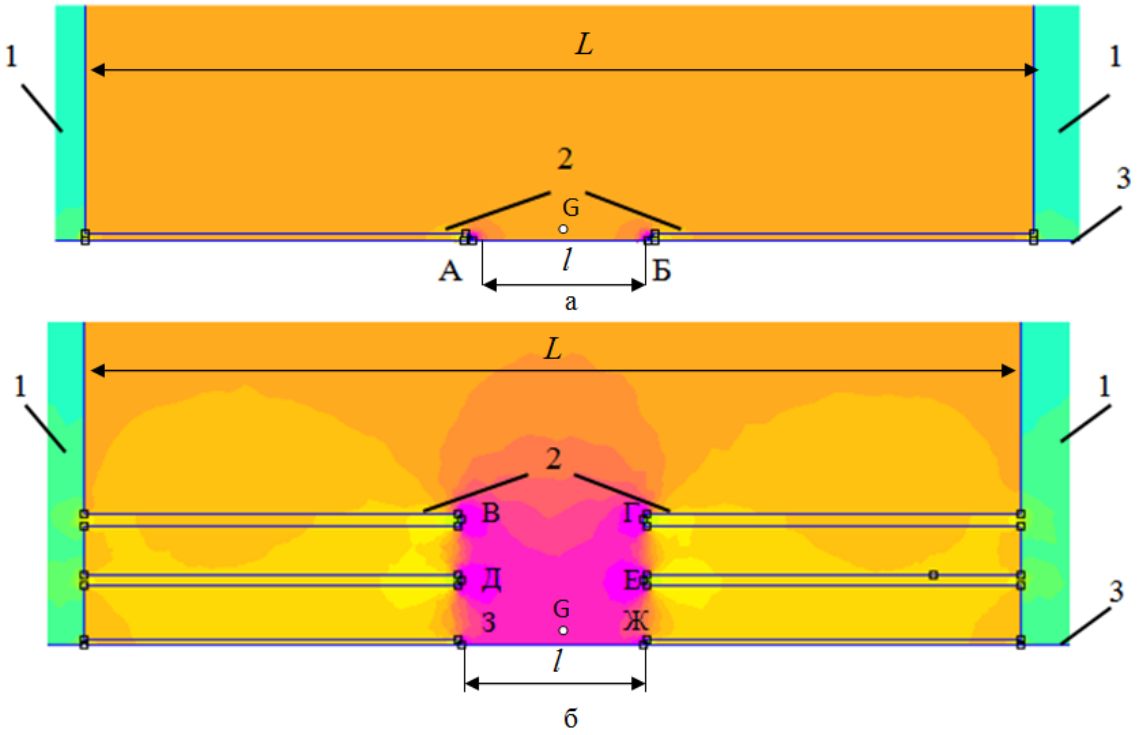


Fig. 2. Detail of the estimated area between grains:

a - other mikrovystupom at each facility; b - with three mikrovystupamy at each facility; 1 - wheat grains; 2 - on the surface mikrovystupy caryopsides wheat; 3 - axis symmetry

Fig. 4 shows how the value of the electric field in the centers of disturbance zones (point G) in Fig. 2, A and Fig. 2, to the distance between mikrovystupamy. It can be seen that the value of the electric field compared with background values increase with decreasing distance l between mikrovystupamy.

Fig. 5 built typical for cases of settlement areas shown in Fig. 2, A and Fig. 2, b, depending on the volume of the electric field of perturbed distance l. From the analysis of volumes disturbed electric field (see. Fig. 5) shows that the increase of the surface mikrovystupiv caryopsides wheat three times leads to an increase of two to three orders of volume calculation area with perturbed electric field.

It should be noted that if the case of one mikrovystupom (see. Fig. 2a) by changing the distance between the grains of L and constant distance between mikrovystupamy grains relative electric field in a characteristic point calculation area G insignificantly different from baseline values, so that the region virtually no

disturbance reaches this point (Fig. 6). Increasing the number mikrovystupiv increases the relative intensity of 5-10% (curve 2 in Fig. 6) compared with the version shown in Fig. 2 as well.

Changing the volume perturbed areas by changing the distance L for the case shown in Fig. 2, A and Fig. 2b, described by the curve 1 and curve 2 in Fig. 7.

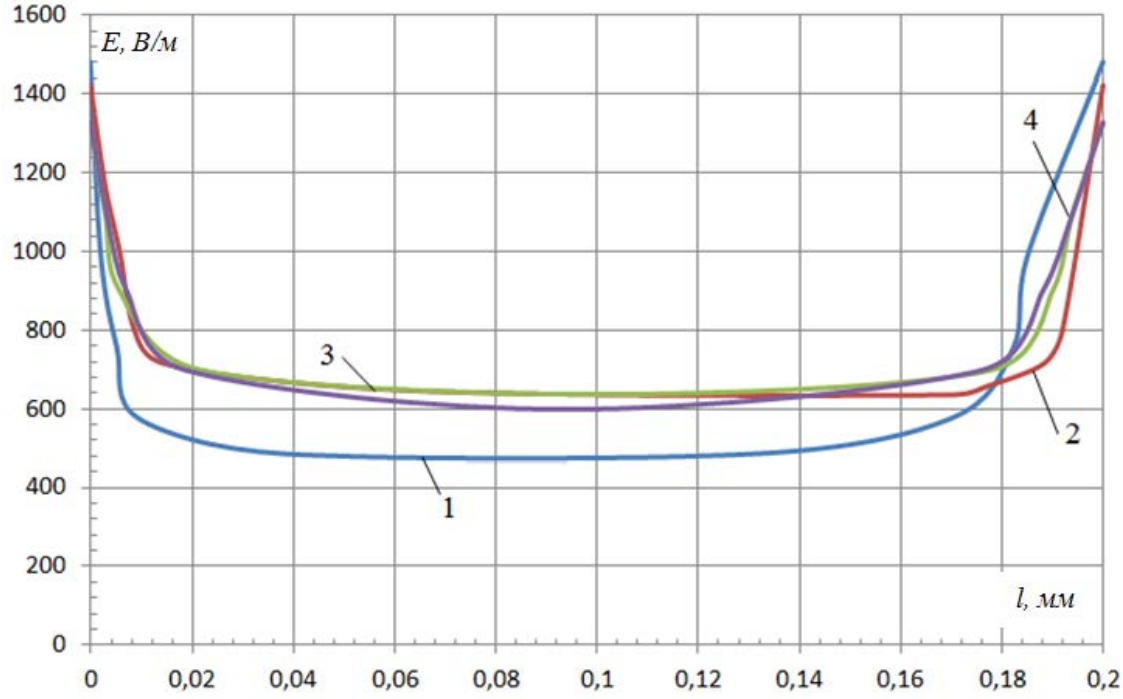


Fig. 3. The distribution of the electric field in mizhzernynnomu gap for the cases depicted in Fig. 2:

1 - between points A and Б; 2 - between points В and Г; 3 - between points Д and Е; 4 - between points Ж and З

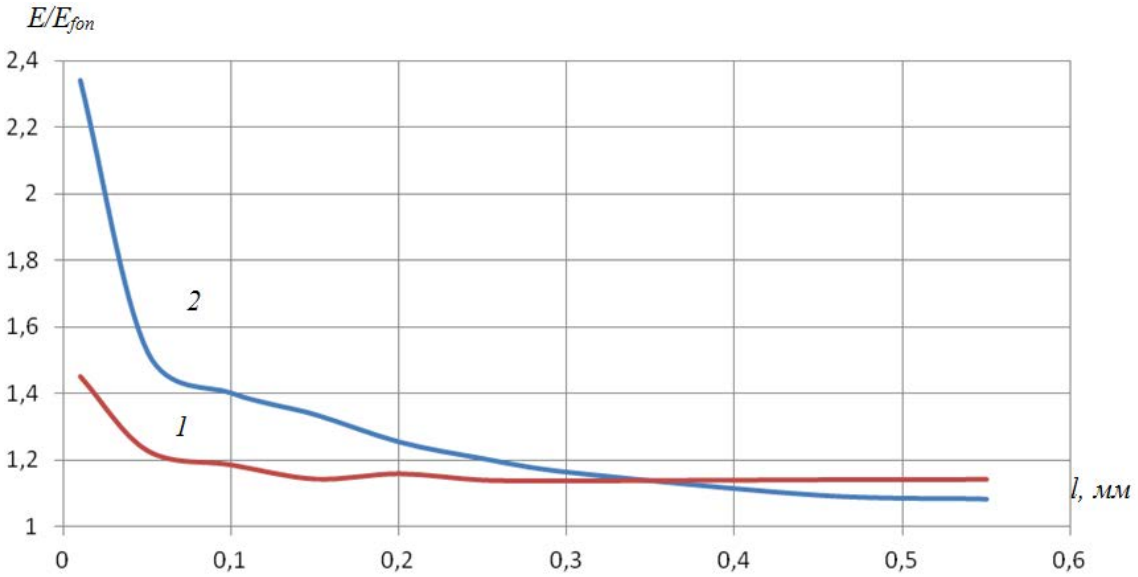


Fig. 4. Characteristics of the relative distribution of the electric field in a characteristic point calculation area G depending on the distance l:

1 - for configuration settlement area in the case shown in Fig. 2, and; 2 - for configuration settlement area in the case shown in Fig. 2b

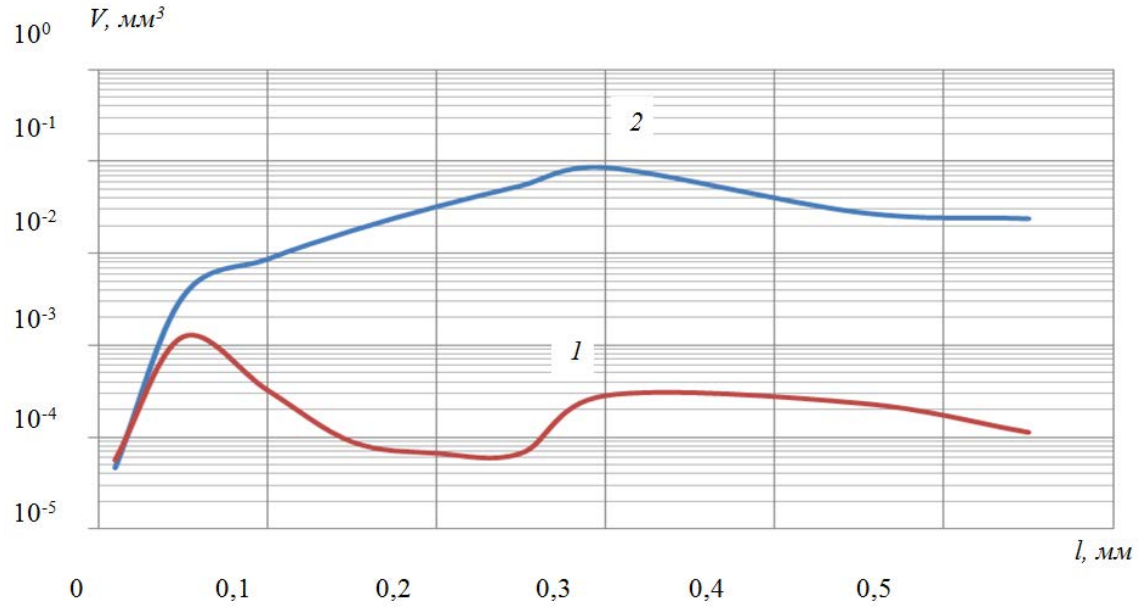


Fig. 5. Typical dependence of volume perturbed electric field mikrovystupamy the distance l:

1 - for the calculated area in Fig. 2, and; 2 - for the calculated area in Fig. 2b

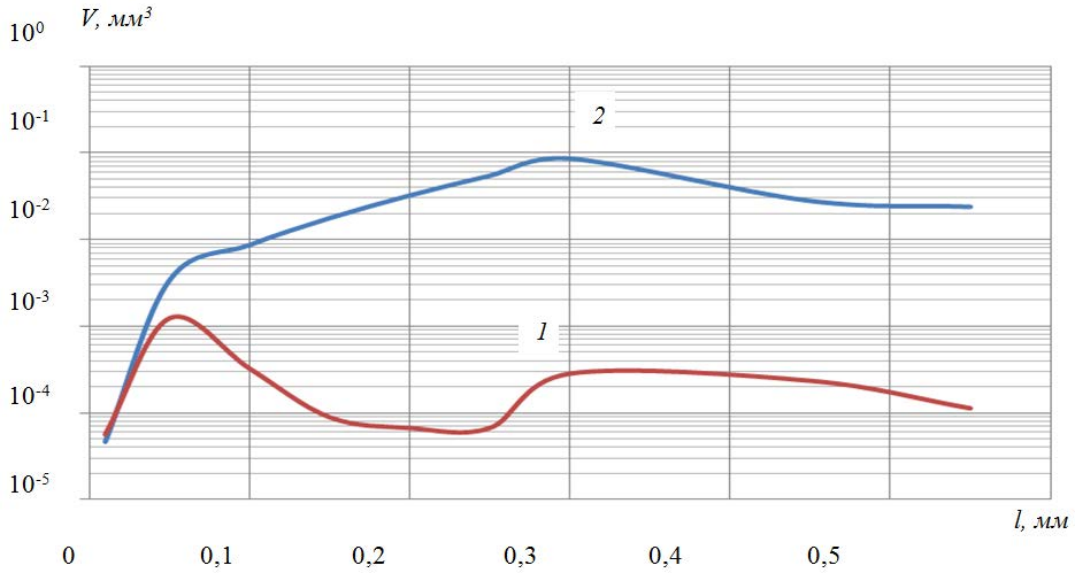


Fig. 6. Characteristics of the relative distribution of the electric field in a characteristic point calculation area G depending on the distance L:

1 - for configuration settlement area in the case shown in Fig. 2, and; 2 - for configuration settlement area in the case shown in Fig. 2b

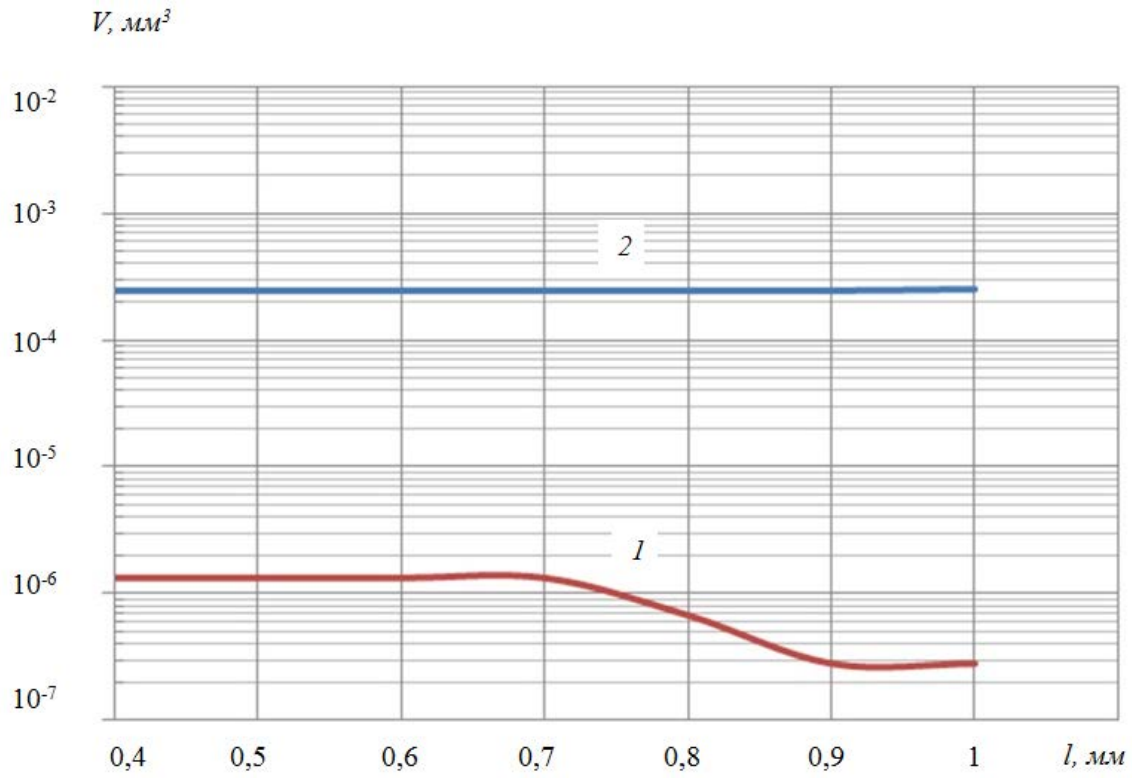


Fig. 7. Typical dependence of volume perturbed electric field mikrovystupamy the distance L:

1 - for the calculated area in Fig. 2, and; 2 - for the calculated area in Fig. 2b

Conclutions

In work on the basis of the data on the structure of the surface grains of wheat Numerical modeling of the electric field distribution depending on the number and size of irregularities on their surface. Based on the analysis of the data can be argued that the slight increase in the number of irregularities on the surface of grains contribute to the electric field of 5-10% and a significant increase in the volume of the electric field of perturbed zone two to three orders of magnitude, which creates favorable conditions for of corona discharge in the volume of grain mass. Therefore, for analysis of ozone generating corona discharge in the volume of bulk grain mass [2] it is advisable to take into account the heterogeneity of the surface caryopsides.