

Effect of nanoparticles on morphological parameters of wheat

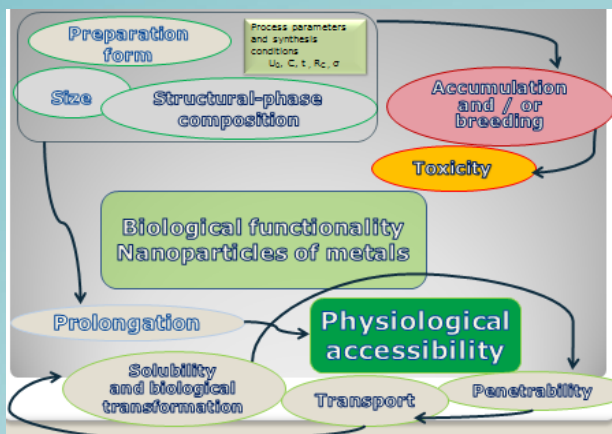
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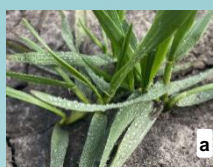
This work is devoted to the study of the peculiarities of the generation of metallic nanoparticles by underwater discharges and their use in the technology of growing grain crops. The goal of the research is the use of the latest nano-containing preparations based on nanoparticles of biofunctional metals, which will allow the introduction of modern technologies and technological processes for ecologically clean crop production and improvement of the quality indicators of the obtained crop on this basis. Nanodimension metal complexes were studied, including Fe - 1800 ppm; Cu - 400 ppm; Zn - 1000 ppm; Mn - 800 ppm. By means of electron microscopy (SEM, TEM), the average size of metal particles was determined - near 30 nm. Tests of the drug were carried out in field conditions during the cultivation of winter wheat at different stages of organogenesis. Foliar treatment was carried out with a drug application rate of 1-1.5 l/h. The analysis of grain quality indicators indicates the prospect of using newly developed drugs.

Abstract

Biological functionality and preconditions for the use of nanoscale objects



Field studies of metal nanoparticles, stages of organogenesis



- a- sunrise phase
- b- the tillering phase
- c- phase output to the tube
- d- the phase of the beginning of milk-wax maturity



Synthesis of metal nanoparticles by underwater discharges



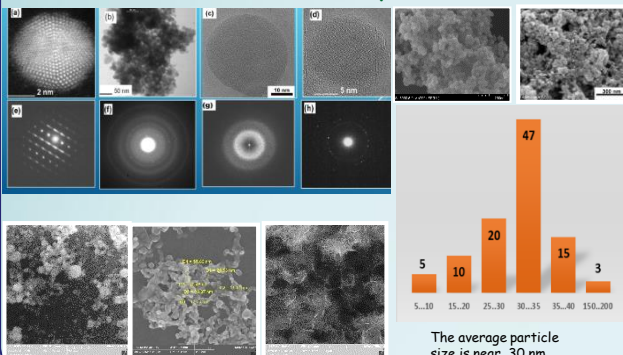
- 1- electric spark generator
- 2- bit cameras
- 3- discharge pulse control unit



Generator of discharge impulses

Concentration in colloidal solution 4×10^3 ppm

General structure of nanoparticles



Prospects for the use of metal nanoparticles



- a- end of tillering phase
- b- full maturation phase

Quality indicators	Control	Experiment	The difference between samples
Productivity, t/ha	5,5	7,31	33 %
Gluten content, %	37,9	38,8	2,5 %
Nature, g/l	739	716	3 %
The number of falls, sec	407±7	469±20	15 %
Protein content, %	11,36 ± 0,52	12,21 ± 0,28	7,5 %

Conclusions

- Using the methods of electron microscopy, it was established that nanoparticles obtained by the electrospark method have a predominantly polycrystalline structure. At the same time, there are particles with both a single-crystal structure and amorphous ones.
- The experimental program provided for three-fold processing of winter wheat crops, and at the main stages of organogenesis, phenological studies were conducted comparing the vegetative organs of plants from the experimental plots with the control. An increase in vegetative mass of 20-30% was established, and at the time of full maturity, the difference in vegetative mass was at least 50% compared to the control.
- Laboratory screening of the final harvest indicates an increase in the main quality indicators of winter wheat grain due to treatment with a complex (Fe - 1800 ppm; Cu - 400 ppm; Zn - 1000 ppm; Mn - 800 ppm) nano-containing preparation, namely, a total increase in protein - 7.5%, gluten - 2.5% and productivity by 33%.