PLASMA-CHEMICAL MODIFICATION OF CHITOSAN AND EVALUATION OF ITS PHYTO-STIMULATING AND ANTIMICROBIAL PROPERTIES [[1]](#footnote-1)\*)

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Chitosan is applied in production of food and cosmetics, as well as in biomedicine and agriculture. In some cases, its use is constrained by poor solubility in water. Solubility can be increased by plasma-chemical treatment, which results in shortening of chitosan macromolecules and modification of their structure. For these purposes, both low-pressure plasma, for example, electron-beam plasma, and atmospheric pressure plasma in contact with a liquid (with a treated solution or an aqueous dispersion of chitosan) are used [1–3].

The report discusses the results of processing acetic acid solutions of chitosan and its aqueous dispersions with three methods of gas discharge excitation. These are a direct current discharge in air between a metal anode and a treated solution (liquid cathode), a discharge in vapor-gas bubbles near the surface of a graphite electrode immersed in a solution, and a pulsed discharge between two metal electrodes immersed in a liquid under treatment. Experimental setups are described in [2, 3].

In all cases, the average molecular weight of chitosan significantly decreases: according to gel permeation chromatography, the main fraction has a molecular weight of ~1000 Da. The yield of water-soluble products increases with the treatment time and depends on the concentration of the solutions: the maximum yield (24.4 wt.%) was obtained using a direct current discharge with a cathode solution (1% solution of chitosan in 2% acetic acid), less yield (<1 wt.%) - when processing aqueous dispersions. The results of IR spectroscopy and 1H NMR spectroscopy showed a change in the degree of deacetylation of chitosan. After treating a chitosan solution with a discharge between silver, copper, and zinc electrodes immersed in it, composite films were obtained with the inclusion of nanoparticles (Ag, Cu2O, ZnO), which suppress the reproduction of bacteria.

The use of water-soluble chitosan statistically significantly increased the laboratory and soil germination of pea seeds, the degree of their swelling during soaking, the rate of development of roots and sprouts when sown in the ground. A higher content of chlorophyll was found in the extracts obtained from plants, which indicates the intensification of photosynthesis processes. The use of aqueous solutions of low molecular weight chitosan when soaking seeds significantly slows down the development of bacteria and fungi.

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References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Lt/ru/FF-Titov.docx) [↑](#footnote-ref-1)