Phytostimulating Activity of Products of Plasma Chemical Treatment of Aqueous Solutions and Chitosan Suspensions [[1]](#footnote-1)\*)

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One of the promising areas of low-temperature plasma application is associated with its use in agriculture and food production [1]. Treatment in low-pressure or atmospheric pressure plasma promotes faster seed germination, increased germination and accelerates plant development. The use of water after gas discharge treatment also leads to similar effects, which is due to the accumulation of nitrogen compounds acting as fertilizers (growth stimulants), as well as hydrogen peroxide, which helps to suppress pathogenic microflora [2]. Plasma is also promising for the production of phyto-stimulants from natural raw materials, for example, chitosan.

This report presents the results of gas-discharge treatment of an aqueous dispersion of chitosan or its solutions in dilute acetic acid to obtain water-soluble fractions. Two types of discharge were used: (1) a direct current discharge in air between a metal anode and a liquid cathode - the treated solution, (2) a discharge in vapor-gas bubbles formed at the end of a graphite electrode immersed in the treated liquid medium when current passes through the cell. Schemes of set-ups, processing parameters, and procedures for isolating water-soluble chitosan fractions are described in [3]. The products were characterized by 1H NMR, IR spectroscopy, gel permeation chromatography, and X-ray diffraction.

The phytostimulating effect of the products was tested on the seeds of flax, pea and spring wheat. The data on seed germination, the rate of development of seedlings and the root system, obtained using water-soluble fractions of chitosan and the commercial phyto-stimulant "Epin-extra", showed that the water-soluble products of plasma-treated chitosan are not inferior to the commercial product “Epin” in terms of stimulating effect (Table).

Microbiological tests also showed that the use of water-soluble degradation products of chitosan prevents the development of fungi and bacteria on the surface of seeds.

Seed germination (%) / seedling length (cm)

|  |  |  |  |
| --- | --- | --- | --- |
| Phyto-stimulant | Flax | Pea | Wheat |
| Control (tap water) | 86 / 2 | 85 / 4 | 65 / 8 |
| Epin | 90 / 3 | 87 / 11 | 91 / 11 |
| 0.2% chitosan solution | 93 / 4 | 88 / 10 | 89 / 12 |

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References

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3. Khlyustova A., Sirotkin N., Naumova I., Tarasov A., Titov V., Plasma Chem. Plasma Process. 42. 587–603 (2022).

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