

## **Stimulating effect of guanidinium-based cationic polymer on wheat seedlings growth**

It has recently been found that commercial polymeric biocide polyhexamethylene guanidine hydrochloride (PHMG-Cl) effectively stimulates growth and development of wheat seedlings, as well as significantly improves copper stress resistance of plants [1]. The latter factor may be due to antioxidant activity of PHMG-Cl [1, 2]. Overall, the reported data indicate that guanidinium-based cationic polymers can be promising crop protection agents. However, PHMG-Cl is moderately toxic to freshwater hydrobionts which may hinder its practical use [1].

The aim of this study was to synthesize new plant growth stimulator based on guanidinium-based cationic polymer comprising polar ether and hydroxyl groups in hydrocarbon chains. Such functionalization of cationic biocides is known to reduce their toxicity and biodegradability significantly [3]. Cationic polymer poly(DEG-GH) was synthesized by polyaddition reaction of diglycidyl ether of diethylene glycol and guanidine hydrochloride in isopropanol at gentle boiling. The obtained polymer is a semi-solid substance that is highly soluble in water.

The growth-promoting activity of poly(DEG-GH) was studied using a test-culture of winter wheat Podolianka. Wheat seeds were soaked in water solutions of cationic polymer for 1 h, placed into Petri dishes and germinated on filters, moistened with distilled water. Primary root length (L) and shoot length (l) was measured on 7-days-old-seedlings. After seven days, the length of shoots of the seedlings, soaked in poly(DEG-GH) solutions with the concentration of 0.001 % and 0.01 %, was higher compared to control samples (by 6.7 % and 17.8 %, respectively). The maximum increase in the length of seedling roots (14.5 % compared to the control) was established for the lowest cationic polymer concentration of 0.001 %. The concentration of poly(DEG-GH) of 0.1 % inhibited the growth of roots and shoots by 28 % and 18 %, respectively.

Thus, the cationic polymer poly(DEG-GH) demonstrates growth-promoting activity on wheat seedlings in the low concentration range of 0.001–0.01 %. Further research will be aimed at studying the effect of this polymer on plant stress resistance.

1. Lyoshyna L., Tarasyuk O., Bulko O., et al. Effect of polymeric biocide polyhexamethylene guanidine hydrochloride on morpho-physiological and biochemical parameters of wheat seedlings under copper stress // *Agric. Sci. Pract.* — 2020. — 7(1). — P.49–58. <https://doi.org/10.15407/agrisp7.01.049>

2. *Kamenieva T.M., Tarasyuk O.P., Derevianko K.Y., et al.* Antioxidant activity of polymeric biocide polyhexamethylene guanidine hydrochloride // *Catal. Petrochem.* — 2020. — 30. — P.73–82.  
<https://doi.org/10.15407/kataliz2020.30.073>
3. *Stolte S., Arning J., Bottin-Weber U., et al.* Effects of different head groups and functionalized side chains on the cytotoxicity of ionic liquids // *Green Chem.* — 2007. — 9. — P.760–767. <https://doi.org/10.1039/B711119C>