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CONTAMINATED SOIL by HEAVY METALS

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Abstract

A mathematical model of growth and development of a new bioenergy phyto plant *Miscanthus x giganteus* on soil contaminated by heavy metals in different concentrations using the least squares method for the differential equation was development

Key word: mathematical modeling, plant, growth, heavy metal

Mathematical models of plant growth and development, taking into account the processes occurring in anthropogenically disturbed soils, due to the increase the polluted soil by xenobiotics are insignificant. Technogenic influence on plants is studied mainly at the biological level. The developed models are aimed at solving applied problems, such as, for example, diagnosing agrometeorological conditions for crop and assessing the influence of observed and expected climate changes on crop productivity [1]. To create such models, various approximating dependencies are proposed, such as exponential, linear, parabolic, and others [2, 3]. This does not take into account the internal biological processes that cause plant growth, and external influences, such as additional nutrition, temperature changes, and anthropogenic factors [4]. The purpose of the study was to create algorithms for modeling the growth and development of plants under conditions of soil contamination with xenobiotics, depending on the concentration of heavy metals in the soil.

In this paper, we propose a mathematical model for the growth and development of the new phyto plant *Miscanthus x giganteus* in conditions of soil contamination with heavy metals in two concentrations. The geochemical indexes (Z_c) of soil contamination are 165.4 ± 17.1 mg/kg and $Z_c 20.0 \pm 3.1$ mg/kg). For create a mathematical model were use the experimental data of plant growth and development on the contaminated soil by heavy metals [5].

All experimental data on growth kinetics are close to logistic dependence. The parameters of the growth curve were determined using the method of least squares

In this case, the value of the reliability of the approximation is: $R^2 = 0.9845$
The empirical equation of the theoretical curve of growth dynamics on
contaminated soil with a high level of contamination ($Zc\ 165,4 \pm 17,1\ \text{mg/kg}$).

$$y = -0.0045x^2 + 380.45x - 8E + 06$$

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In this case, the value of the reliability of the approximation is: $R^2 = 0.9614$
Thus, the equation of growth kinetics was obtained and theoretical curves of the
dynamics of the development of the new bioenergetics plant *Miscanthus x giganteus*
on contaminated soil by heavy metals in different concentrations were established.
These results are of interest in environmental biotechnology. Cultivation of
Miscanthus x giganteus on contaminated soil will not only improve the ecological
situation but will also ensure biomass production of second generation biofuel as an
alternative fuel.

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