

## **Abstract of Doctoral Thesis**

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### **EFFICIENCY OF REMOVING SELECTED PESTICIDES FROM SEWAGE BY THE HYDROPHYTE TREATMENT METHOD**

Pesticides are one of many chemical contaminations of wastewater. Reports on pesticides elimination during wastewater treatment are rare since these substances are typically considered of agricultural rather than of urban origin. These compounds are used in small agricultural farms. Because, the Podlaskie is a typical agricultural region, this problem of the wastewater treatment exists. There are few scientific reports on pesticide removal efficiency using hydrophyte methods. In this context, the aim of this work was to present the possibility of applying the hydrophyte method for elimination of various pesticides from wastewater samples and evaluate the effectiveness of their removal. Moreover, it was expected to increase the efficiency of the process, the rate of degradation and shorten the half-life of compounds by the use of a biopreparation. For experiments eleven pesticides from three groups: fungicides, insecticides and herbicide were chosen which are commonly used in agriculture sector. The research was carried in a pilot-scale, in three years, in three identical sewage treatment, unsupported and assisted by microorganisms. For this purpose, an analytical method based on isotope dilution on-line solid phase extraction-liquid chromatography-tandem mass spectrometry (SPE-LC-MS/MS) was optimized, allowing the determination of the 22 target pesticides in wastewater with satisfactory sensitivity (limits of detection below 30 ng/L), accuracy and precision. Concerning the results, the use of the hydrophyte bed technique consisting of three layers of chemically inactive filter material with different granulometry for the purification of pesticides from sewage using *Phragmites australis* was characterized by a high average efficiency of 96.6%. Fungicides were characterized by the lowest degree of reduction - 88.1%, and insecticides - the highest - 96.8%. In the group of insecticides, on day 1, the removal efficiency was in the range of 25.9% - 49.5% and the aided MIK 49.1% - 54.6%, herbicides 15.3% - 26.1% and 28.5% - 40.9% / MIK and fungicides 10.2% -23.2% and 7.8% - 33.1% / MIK. The removal efficiencies on day 14 were as follows: fungicides-88.1%, herbicides-96.0% and insecticides 96.8%. Seven chemical groups of pesticides were tested, of which triazoles were the slowest to decompose. Twenty two mathematical models were built, 22 unique dynamics of the disappearance of pesticides from wastewater and aided MIK, characterized by good statistical parameters, were determined. Twenty-two parameters were determined for the half-lives of pesticides in wastewater and MIK-assisted DT50 from 1.9 - 8.9. Twenty-two parameters were determined for the theoretical time to reach 0.01 mg / kg t0.01 from 20 to 99 days. The applied microorganisms increased the pesticide removal efficiency from

0.2 to 7 days. The presence of pesticides in plants has been observed, which confirms their ability to bioaccumulate pesticide contamination from sewage. Most of the scientific studies concern the effectiveness of wastewater treatment in soil-plant systems and focuses on primarily problems of removing general suspension, organic substances and biogenic elements (nitrogen and phosphorus) or single pesticide. Technology of hydrophyte deposits proved to be a highly effective method of removing broad spectrum pesticides present in the wastewater.

The scope of work includes:

- A review of the literature data on the characteristics of wastewater and their purification methods, bioprepartes
- The characteristics of the hydrophyte method and pesticides
- Description of the object of research
- Research on the effect of reduce pesticide from wastewater with and without microorganism using hygrophyte method, behavior of pesticides, half-time degradation
- Final conclusions