



Uniwersytet Przyrodniczy w Poznaniu

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ROZPRAWA DOKTORSKA

**Analiza czynników determinujących efektywność degradacyjną
biopreparatów mikrobiologicznych wykorzystywanych w remediacji
środowiska zanieczyszczonego węglowodorami**

Rozprawa doktorska wykonana:
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pod kierunkiem **prof. UPP dr hab. Romana Marcika**

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SUMMARY

Contamination of the environment by hydrocarbon compounds not only decreases its biodiversity, but also limits its production abilities. Furthermore, it negatively affects people's health and lives. One of the most widely-used methods of cleaning the environment contaminated by hydrocarbon compounds is bioremediation. The aforementioned method can be influenced by a wide variety of factors which determine the achievement of the presumed effect within acceptable time.

In the literature review, the main types of hydrocarbons with their properties, and hazards from the contamination of the environment by petroleum products were described. Moreover, the literature review provides insight into the methods used in remediation of the contaminated environment with particular consideration of biological methods and factors affecting the efficiency of biodegradation of hydrocarbons. One of the chapters is devoted to an analysis of the most important legal requirements for the process of remediation alongside the indication of the acceptable concentration of the hydrocarbon contamination in the soil.

The main part of the thesis describes experiments aiming at gathering and characterising parameters of growth of microorganisms with potential abilities to degrade hydrocarbons. Consortia collected in the permanently contaminated sites were researched in terms of their kinetic growth and metabolic activity as well as the influence of multiple passaging the cells on the metapopulation changes of microorganisms. Furthermore, the influence of chosen environmental factors such as temperature, pH value, Carbon to Nitrogen ratio, and the concentration of rhamnolipids on the increase of isolated consortia during their cultivation in selected substrates with diesel as its only source of carbon were described. The subsequent part of the thesis analyses the degradation potential of the obtained consortia in relation to hydrocarbons of the diesel, as well as the influence of immobilization on their viability. The success rate of the degradation of the particular consortium was also studied in the field experiments while analysing the metapopulation changes in the soil environment.

As a result of the undertaken research, the possibility of obtaining microorganisms from the permanently contaminated areas and their use for the efficient degradation of hydrocarbons was proved. What is more, the effect of abiotic factors on growth of microorganisms was demonstrated. Subsequently, the taxonomic classification and changes in biodiversity of microorganisms able to degrade hydrocarbons due to multiple passaging were determined.

The collected results enabled the verification of the hypothesis which called into question the role of rhamnolipids as a factor increasing degradation of hydrocarbons during the bioremediation processes. Laboratory examinations as well as field experiments demonstrated that the supplementation of the contaminated environment with the rhamnolipids does not affect the parameters of the consortia growth thereby it has no impact on the efficiency of the degradation processes.

The comprehensive research, the analysis of the obtained data, and the drawn conclusions facilitated development of the guidelines enabling the effective use of microbiological biopreparation which will be further used in the practical implementation of the projects for remediation of the sites contaminated with hydrocarbons.

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