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EVALUATION AND MICROBIOLOGICAL CHARACTERIZATION OF THE PEAT AND SOME SOILS CONTAMINATED WITH PETROLEUM PRODUCTS FROM SALONTA MUNICIPALITY, BIHOR COUNTY

Nistor Andrei *, Brejea Radu, Boroș Mădălina*****

*SC Ecopro Consult SRL, - 31A Padis Street, Oradea, Romania
e-mail: nistor_andrei_nicolae@yahoo.com
**University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048
e-mail: rbrejea@yahoo.com
***Environment Protection Agency, 26 Dacia Street
e-mail: madalina.boros@apmbh.anpm.ro

Abstract

This paper is based on results obtained from research conducted on soil samples contaminated with petroleum products from Salonta, Bihor County. Soil contamination occurred as a result of accidental oil spills from a liquid fuel depot of a former disused thermal power plant in the vicinity of the locality.

Key words: pollution, microflora; contaminated soil, oil product,

INTRODUCTION

Microbial degradation of petroleum products in natural ecosystems is a particular case of the activity of microorganisms, called by Ahearn (1973) hydrocarbons. It is a complex process, the evolution of which depends on the nature and relative proportion of the various constituents of oil, the nature of the communities of microorganisms characteristic of natural environments and a number of environmental factors that influence their activity.

Hydrocarbon microorganisms are active in most soils. The effects of soil pollution with petroleum products are variable depending on its quantity and composition, the nature of the soil, the type of vegetation, etc.

The present paper proposes the use of peat as a substrate for the absorption of petroleum products that contaminate different soils.

In the present paper, we aimed to characterize from a chemical and microbiological point of view, peat samples taken from Salonta, Bihor county, as well as a microbiological characterization of a soil sample strongly contaminated with petroleum products.

In order to better capture the microbial activity, we numerically determined the main ecophysiological groups of microorganisms involved

in the carbon and nitrogen circuit, microorganisms that have at the same time biodegradative properties of carbon and nitrogen compounds present in soil or peat.

MATHERIAL AND METHOD

To solve the proposed issues, an experimental model was developed, consisting of a series of concordant methods, microbiological analysis and assessment of soil biological activity.

All the results obtained were expressed numerically and presented in the form of tables and graphs.

Quantitative screening of microorganisms present in peat (highlighting the main ecophysiological groups of microorganisms involved in the circuit of biogenic elements, biochemical activity of microorganisms present in indigenous peat).

Performing the analysis of the peat sample taken from Poiana Stampei, the total number of germs of each physiological group of microorganisms that make up the circuit of carbon and nitrogen elements was determined.

The results obtained are presented in table 1.

In this experiment, the total microflora present in the peat sample was determined, finding that the number of microorganisms present is of the order of 10^7, which indicates the presence of an active microflora at pH 5.5, particularly active, at least under conditions of laboratory. The distribution of these microorganisms by ecophysiological groups is given by the determination of cellulosic, ammonifying, pre-proteolytic microorganisms, nitrogen fixers, as well as nitric bacteria, all of which contribute to the degradation of organic compounds containing carbon and nitrogen.

Table 1.

Determination of the main ecophysiological groups of microorganisms present in indigenous peat

No.	Microbiological indicator	Total No. microorganisms / g peat
1	Total microflora	890×10^7
2	Cellulosolytic	326×10^5
3	Amonificatori	158×10^{18}
4	Denitrification	143×10^2
5	Proteolytic	924×10^{12}
6	Nitrate	425×10^5
7	Nitrous	376×10^6
8	Aerobic nitrogen fixators	184×10^2
9	Anaerobic nitrogen fixators	215×10^2

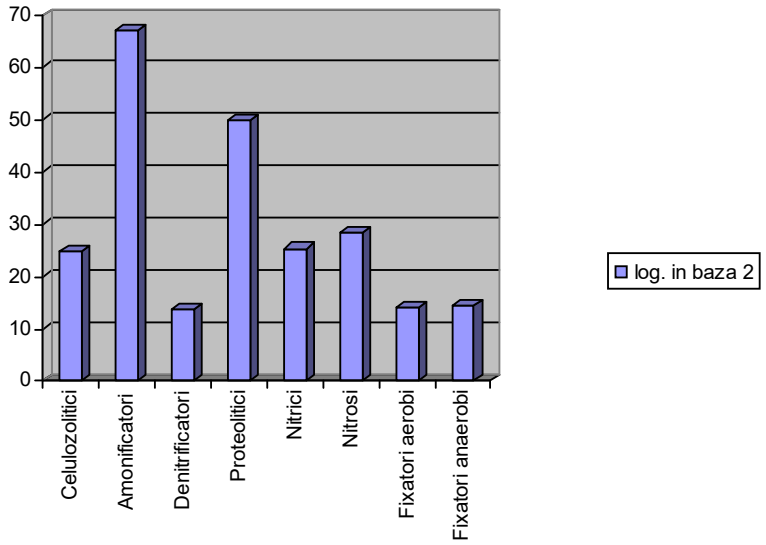

Fig. 1. Logarithm in base 2 of the number of microorganisms determined in the peat sample.

The graphical representation of the log in base 2 of the number of microorganisms highlights the presence in large quantities of ammonifying microorganisms and proteolytic microorganisms that have a role in the decomposition of organic substances into simpler substances or carbon dioxide and ammonia. Subsequent research will demonstrate the usefulness of the presence of these microorganisms in peat samples in the process of degradation of petroleum products.

Quantitative screening of microorganisms present in soil contaminated with petroleum products

Soil samples heavily contaminated with petroleum products were taken near gas station depots. The soil has been in contact with the pollutant for several years, which led us to assume that a microflora has developed over time that has adapted to the substrate. As in the case of peat, we proceeded to determine the main ecophysiological groups of

microorganisms potentially present in heavily contaminated soil. By sowing some soil dilution suspensions on selective media that allow the development of only some groups of microorganisms and incubate them at 280C optimal time necessary to highlight the biochemical activity of these microorganisms, the data presented in table 2 were obtained.

Table 2

Determination of the main ecophysiological groups of microorganisms present in the soil strongly contaminated with petroleum products

No.	Microbiological indicator	Nr. total microorganisms / g peat
1	Total microflora	970×10^{8}
2	Cellulosolytic	266×10^{5}
3	Amonificatori	429×10^{18}
4	Denitrification	182×10^{1}
5	Proteolytic	965×10^{12}
6	Nitrate	225×10^{5}
7	Nitrous	274×10^{6}
8	Aerobic nitrogen fixators	284×10^{1}
9	Anaerobic nitrogen fixators	183×10^{1}

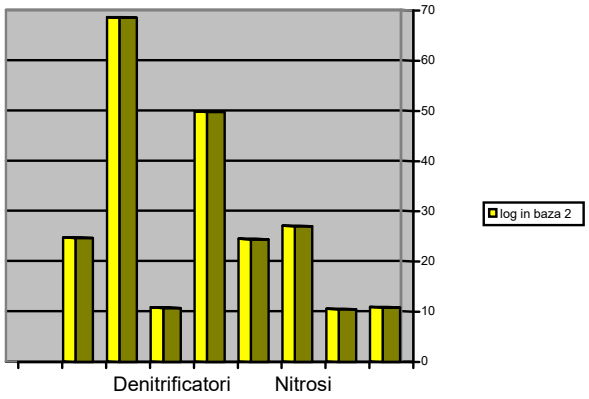

Fig. 2. Logarithm in base 2 of the number of microorganisms determined in the soil sample heavily contaminated with petroleum products

The graphical representation of the logarithm in base 2 of the number of microorganisms, highlights the presence of all groups of microorganisms studied in the contaminated soil sample, and through future experiments we will be able to exploit this existing microbiological potential.

CONCLUSIONS

Analyzing the data obtained from the quantitative screening of microorganisms present in peat, we observe the predominance of cellulosic and ammonifying microorganisms, which demonstrates the ability of microorganisms present in peat to degrade organic substances containing carbon and nitrogen.

Also, the presence of nitrogen fixatives and proteolytics demonstrates that the circuit of carbon and nitrogen elements that takes place in the peat is complete, so that this substrate can be used for various microbiological purposes. The best represented are the cellulosolytic, proteolytic and ammonifying groups, with positive implications for future studies.

Analyzing the data obtained from the quantitative screening of microorganisms present in the soil contaminated with petroleum products, we find the presence of a very rich total microflora, of the order of 108, which shows that in this soil subject to contamination with petroleum products, over time a adapted microflora, able to use these products in the metabolism process. Regarding the numerical distribution of microorganisms, the presence in large quantities of ammonifying and proteolytic microorganisms, as well as cellulosolytic ones is found. Nitrates and nitrous with a role in the formation of nitrites and nitrates are also richly represented, thus providing the necessary nitrogen source for the other groups of microorganisms present in the soil.

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