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THE STUDY OF OIL-CONTAMINATED SOIL AT STARYI SAMBIR PETROLEUM DEPOSIT

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Анотація

Об'єктом досліджень були ґрунти ділянок нафтових свердловин № 60, 65, 76 Старосамбірського родовища – техногенні геокомплекси зі зруйнованим біогеоценотичним покривом. Встановлено ступінь токсичності та сумарну кількість нафтопродуктів у ґрунтах. Проведені дослідження дають змогу зробити висновок, що ґрунти в регіоні потребують впровадження заходів, які забезпечили б поліпшення їхнього якісного стану, зокрема визначення оптимальних умов для проведення фіторемедіації.

Ключові слова: Старосамбірське нафтове родовище, забруднення, нафта, нафтопродукти, ґрунт, фітотоксичність.

Abstract

The object of research was the soil from oil wells No. 60, 65, and 76 of Staryi Sambir Petroleum Deposit – man-made geocomplexes with destroyed biogeocenotic cover. The degree of toxicity and the total amount of petroleum products in the soil were measured. Based on the conducted studies we can conclude that the soil in the region requires measures that would improve its quality, in particular, determining the optimal conditions for phytoremediation.

Key words: Staryi Sambir Petroleum Deposit, contamination, oil, petroleum products, soil, phytotoxicity.

Introduction

The industries of oil production and oil refinery are one of the most detrimental to the environment. The negative impact of these activities can be observed at all stages of mining operations: from geological exploration to the completion of well operations. Ukraine has a dense network of petroleum product supply facilities. Almost the entire country is under the potential threat of oil contamination. Staryi Sambir Petroleum Deposit is located in Staryi Sambir district of Lviv region. Oil production there started in December 1969. As a result of intensive long-term oil production and various types of construction, the natural topography of the field has undergone a strong anthropogenic transformation and caused environmental problems in ecosystems, in particular, in their most important components - soil and vegetation cover [2, 3, 4, 5].

Oil and petroleum products are liquid pollutants that can actively migrate in any soil. The high mobility of pollutants is the reason for their ability to spread over large areas in case of emergency situations and get into underground and surface water. Oil contamination of soil causes changes in their physical and chemical properties. Due to the microrelief, the substrate composition disturbed by water and changed temperature conditions, a specific microclimate is formed in contaminated areas, and a specific smell appears. The harmful effect of resin-alphalten components on soil ecosystems lies not just in chemical toxicity, but also in a significant change in the water-physical properties of soil. If oil seeps from above, its tar-asphalt components are sorbed mainly in the upper humus horizon, firmly cementing it. The black colour of oil-contaminated soils leads to excessive absorption of solar radiation [2, 3].

The object of research was soil from oil wells No. 60, 65, and 76 of Staryi Sambir Petroleum Deposit – man-made geocomplexes with destroyed biogeocenotic cover (fig. 1).

Fig. 1. Staryi Sambir petroleum deposit

The temperature regime, acidity and phytotoxicity of the soil were measured. For research, soil samples were taken directly at the wells, as well as at a distance of 10 and 20 metres from the wells according to the generally accepted method. The soil without oil selected from the relatively clean area in Staryi Sambir was considered the control. Soil toxicity was determined with a growth test using *Linum usitatissimum* L. [1, 2]. The total amount of petroleum products in the soil was determined with the gravimetric method with combustion. The method involves calibration using uncontaminated soil in order to eliminate the influence of the humus component and moisture [4].

Results

As a result of the development of the petroleum deposit, the vegetation of this region has undergone significant anthropogenic changes. Since the transportation of oil from the field is carried out by motor vehicles, there are constant oil spills that occur when filling tank trucks; as a result, the soil gets compact, its hydrological regime changes, and the vegetation cover degrades.

Oil-contaminated soil from Staryi Sambir petroleum deposit had a higher temperature as compared to the control and a lower temperature as compared to that on which the plants grew. Vegetation cover prevents degraded oil-contaminated soils from overheating. With the use of plants at all points studied, the soil temperature was lower by an average of 3-5 degrees Celsius [2].

Based on the results obtained, the degree of contamination and the total amount of petroleum products in the studied soil samples of Staryi Sambir petroleum deposit were established: Well No. 60 – the maximum level of phytotoxicity, very strong pollution (14.1% of petroleum products in the soil). This well has been in operation for the longest time (since 1971), is located near the road, and receives additional impact from vehicles. Well No. 65 – high level of toxicity, heavy soil contamination, the content of petroleum products reached 9.2 %. Well No.76 – the level of phytotoxicity is above average, petroleum product contamination is 5.4 %.

Conclusions

Based on the conducted studies we can conclude that the soil in the region requires measures that would improve its quality, in particular, determining the optimal conditions for phytoremediation.

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