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136. Generating of humic acids during bioremediation of soil contaminated by petroleum hydrocarbons

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ABSTRACT:
Petroleum and its derivatives are key sources of energy and raw materials for production, and are used in vast quantities in all domains of life and work. Accidental spillage during exploitation, transport, processing, storage and use of petroleum and its derivatives leads to pollution of soils and waters. The toxic effects of petroleum hydrocarbons are cumulative, while some are carcinogenic, mutagenic or teratogenic, so they therefore can endanger the health of future generations.
One of the technologies that has made a remarkable success worldwide in the area of remediation of pollutions caused by petroleum is bioremediation. Bioremediation is the process by which pollutants are transformed by biological methods into non-toxic compounds, or are completely degraded to carbon dioxide and water. Microorganisms are most often used as biological agents, since they possess the natural capacity for disintegration and transformation of pollutants (bioremediation potential), thanks to the unsurmised diversity of their metabolism and genetic changeability.
There is extensive literature about humification processes in soil, composts, ground water and river water. However, there is a shortage of information on humification processes during bioremediation and the effect of bioremediation treatment technology on these processes.
This study was focused on investingating researching humification process during the ex situ experiment of bioremediation of soil contaminated with petroleum and its products from the Refinery Pančevo, Serbia. During the five-months experiment, with biostimulation and bioventilation, the concentration of the total petroleum hydrocarbons was reduced from 23 to 2 g/kg (91.3%).An increase of the content of humic acids from 1.9% to 2.7% was observed during the bioremediation process.The FT-IR spectra and C/H ratio of humic acids extracted at the beginning and the end of the process indicate structural changes during the bioremediation process. The groups containing aromatic and carboxylic carbon increased, resulting in humic acids structures of higher aromaticity.
The results obtained show that humification occurs during the bioremediation. It is probably a result of the fact that organic compounds wnich are the most resistant to biodegradation can be transformed and incorporate into materials analogous to humic substances. It is believed, that residual materials, after the process of biodegradation of petroleum and its derivatives, are not a serious danger for environment, on the contrary, the humic acids formed generally contribute to improvement of the environment.

Keywords: Bioremediation, microorganisms, petroleum, humification, humic acids.

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