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Polycyclic aromatic hydrocarbons pollution effect on soil biological activity in the anthropogenic contaminated area

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Polycyclic aromatic hydrocarbons (PAHs) are one of the most significant environmental contaminants with mutagenic and carcinogenic properties to all living organisms. The changes in microbial community structure in technogenic polluted soil may be used as tools for predicting and monitoring natural degradation and for search the most effective and appropriate pathways of bioremediation.
The present study is aimed to research the biological activity of the soil in the emission zone of Novocherkassk Power station (NPs) (Russia) polluted by PAHs in 2015. The NPs is one of the largest thermal power stations in the south of Russia burning low-quality coal appurtenant the enterprises of I hazardous class. Monitoring plots were located on virgin or no-till fallow areas and not subject to the sanitary-protection zone of the NPs. Soil samples were taken from a depth of 0- to 20-cm, because the major part of PAHs are accumulated in the surface soil layer. The soils of the plots mainly include Chernozems Calcic (plots 1, 4, 5, 7, 9 and 10), Phaeozems Haplic (plots 3, 6, 8 and 11) Fluvisols Umbric (plots 2 and 12).
In the soil of 12 monitoring plots located around NPs there were determined the main enzymes, abundance of soil bacteria and 17 priority PAHs. PAHs extraction from soil was performed by new developed ecologically clean method of subcritical water extraction without organic solvents (Sushkova et al., 2015).
The level of PAHs around NPs is high at the nearest to factory monitoring plots situated at distance 1,0-1,2 km and reaches from 1600,1±14,7 up to 373,6±7,1 mkg/kg in the 20-cm soil layer. Gradually decrease of PAHs contamination is observed while increasing the distance from the NPs. The level of highmolecular PAHs (4-6 aromatic rings) exceeds the level of lowmolecular (2-3 aromatic rings) PAHs in all monitoring plots situated though the prevailing wind direction from NPs.
The close correlations were found between PAHs content and biological activity parameters in the monitoring plots situated through the prevailing wind direction from NPs. Level of dehydrogenases has high positive correlation with technogenic accumulated biphenyl, acenaphthene and negative correlation with anthracene content in studied soil. The lowmolecular PAHs content of soil influenced activity of dehydrogenases positively.
Urease activity of monitoring plots has a high positive correlation with 12 PAHs exclude biphenyl, benzo(a)anthracene, naphthalene. Negative dependence of urease activity was observed for lowmolecular PAHs.
The abundance of soil bacteria has a negative correlation with PAHs level. Anthracene has no correlations with abundance of soil bacteria and negatively influences on dehydrogenase, urease.
Thus, the most subjected to technogenic pollution in 2015 were monitoring plots situated through the prevailing wind direction from NPs. It was established that ratio of low- and highmolecular PAHs content in soils of monitoring plots is the indicator of technogenic pollution soils. Contamination by PAHs in the affected zone has negative influence at the abundance of soil bacteria. The most number of PAHs has positive correlation with biological activity parameters of soil.
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