



Influence of soil contamination with heavy metals on respiratory and enzymatic activity in natural soils and artificial substrates (on the example of the protected area "Yamskaya Steppe")

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The area "Yamskaya Steppe" of "Belogorye" preserve is located in Belgorod region near the concentration of mining factories: Lebedinskiy and Stoylenskiy mining and concentration complex (MCC), complexes of "KMA-ore" and Oskol metallurgical, TPP etc. With a strong wind, standing on its territory, you can observe dust clouds rising from the dumps of the enterprise. The wind rose shows that although the prevailing winds blow past the Yamskaya steppe, the winds of the South, South and South winds that capture the territory of the protected area make up about 40%, which is also quite a lot.

The aim is assessment of air pollution of soils and landscapes of the "Yamskaya Steppe" site of the "Belogorye" reserve with heavy metals and other trace elements, as well as their toxicity, based on the study of monitoring sites.

The objects:

1. Analysis of the levels of the content of chemical elements in the soils of the reserve and the identification of the main spatial regularities of the distribution of heavy metals in them;
2. Determination of the metabolic coefficient of QCO_2 as an integral characteristic of inhibition of microbocenotic communities of day and buried soils.
3. Analysis of respiratory activity in artificial substrates.
4. Analysis of enzymatic activity of soils.

Around the Yamskaya steppe in the Belgorod region in 2013-2016 create a network of monitoring sites or points of complex observation of the impact of the Lebedinsky GOK on the ecosystems of this protected area. From all monitoring sites samples were taken from a depth of 0-5 cm. The microbiological activity of soils (V_{basal}) was also measured by the intensity of CO_2 release, metabolic coefficient (qCO_2), activity of phosphatase, polyphenol oxidase, peroxidase. Additional simulation experiments were conducted with clean soil, calcined with clean soil, and dust from the workshops of the Gubkinsky Combine contaminated with HM.

The investigations of the native soils did not show the correlation of the basal respiration and the type of the soil. However weak and single case showed the correlation of basal respiration and the type land use.

At the same time, on some MS there are stressful conditions for the microbial community. For these sites, it was concluded that the activity of the microbial community increased and the rate of mineralization of organic carbon increased, as we thought, as a result of the accumulation of dust containing HM. Real measurements of the gross forms of heavy metals showed a relative (but not reaching the MAC) excess concentrations at these monitoring sites Cu, Zn, Zr, Sn, Pb, As.

Experiments with artificial mixtures confirmed this conclusion, since they allowed us to conclude that the addition of dust enriched with HM significantly affects the microbiological activity, causing an intensification of CO_2 emission, both in the case of basal and substrate-induced breathing measurements.

Further research has shown that heavy metal contamination has an effect on the enzymatic activity of soils, with most metals acting as inhibitors and the other part acting as catalysts for microbial communities.