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Biochemical activity and the content of chemical compounds in peats of the Great Vasyugan Mire

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Mires, or peatlands are wetlands ecosystems where carbon is bound in primary production and deposited as peat in water saturated, anoxic conditions. In those conditions, the rate of the supply of new organic matter has exceeded that the decomposition, resulting in carbon accumulation. Marsh ecosystems of Western Siberia, being by the basis accumulator of carbon of a planet, are very various on ability of such accumulation. This is particularly true for West Siberia mires which account for up to a quarter of all the world's mires as well as for 60% of the Russia stock and 30% of the world's stock of peat. While it is know that mires play an important role in global carbon balance by acting as a significant store, sink, and source of carbon, the current scientific knowledge on them is still inadequate.

The process of peat formation goes on a top layer. Several investigations have dealt with biologically active only top layer of peat deposit. Some researches revealed, that native of peat ground (in particular fens) have potential biological activity on all peat thicker, and organic matter transformation process covers all peat deposit. The intensity and character of the biochemical processes are determined by the botanical composition of the peat.

The aim of this study was to estimate the content of chemical compounds of two peat soils as well as variability in their biochemical properties.

The samples of peats were taken from two places (P2 and P3), both from the depth

0-75 cm of the great Vasyugan Mire in September 2007. These materials represent (P2) Sphagnum fuscum peat (ash content ranged from 10.8 to 15.1%), but samples P3 belong to low-moor sedge peat (ash content ranged from 4.5-4.8%). Samples were air dried and crushed to pass a 1 mm-mesh sieve, dissolved organic carbon (DOC), total organic carbon (TOC), the contents of Fe^{+2} andFe^{+3}, and the concentrations of phytohormone indole-3-acetic acids as well as the activities of 3 enzymes: xanthine oxidase, peroxidase, and urease were determined.

The contents of TOC in (P2) Sphagnum fuscum peat ranged from 412,2 to 447,1 g kg^{-1} of d.m of soil, but in (P3) low-moor sedge peat the concentrations of TOC were lower and ranged from 394,5 to 395,5 g kg^{-1} of d.m of soil. It was observed in both kinds of peat the decrease of the amounts TOC with increase of deep of sampling. The concentrations of DOC in (P2) Sphagnum fuscum peat ranged from 7,75 to 14.36 (g·kg d.m of soil), but in (P3) low-moor sedge peat ranged from 10,55 to 11,81 (g·kg d.m of soil). In both kinds of peat higher contents of DOC were determined in the highest layers of peats, indicating higher microbiological activity of these layers.

The activity of xanthine axidase in sphagnum fuscum peat ranged from 14,74 to 19,13 μmol·uric acids $1h^{-1}$·g s. dry mass of soil but in low-moor sedge peat were higher and ranged from 48,23 to 51,61 μmol·uric acids $1h^{-1}$·g s. dry mass of soil. The activity of this enzyme decreased with an increase of the depth of sampling. Xanthine oxidase oxidizes oxypurines (hypoxanthine and xanthine) to uric acid in the purine catabolic pathway. It participates in the cycle of nitrogen in soils. Therefore higher activity of this enzyme in the top layers of two investigated profiles, indicates higher processes of the degradation of purine basis and peptides in these layers.

Different trends were shown for the activity of peroxidase in both profiles. This enzyme catalysis the oxidation of phenols and aromatic amines in the presence of H_2O_2. It was observed decrease of activity peroxidase with increase of depth of sampling in samples from Sphagnum fuscum peat. However contrary directions of the changes of this enzyme in samples from low-moor sedge peat were estimated.

The study revealed in both kinds of peats, the increase of two forms of iron (Fe^{+2} and Fe^{+3}) with increase of the depth of sampling. However, the changes of the ratio Fe^{+2}/Fe^{+3} with increase of sampling for both kind of peat were different. This observation agreed with the changes of the activity of peroxidase. It demonstrates in both kinds of peats different direction of the chemical and biochemical processes and mechanisms with increase of the depth.

No significant activity of urease with increase of depth of sampling in both kinds of peats was measured.

The investigation revealed in low-moor sedge peat higher activity of xanthine oxidase, peroxidase, urease, both forms of iron, indole-3-acetic acid but lower TOC concentration than in Sphagnum fuscum peat, indicating different intensity and character of the biochemical processes and mechanisms in both kinds of peat.