Molecular composition of humic acids in the permafrost peatlands of the zonal series of soils as paleorecord of climatic change

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High latitude peat ecosystems of the Arctic are especially sensitive to climate change. The composition of peatlands organic matter serves as a characteristic measure reflecting climatic conditions of its formation period. It is connected with the content of botanic and palynological material in the Holocene periods. The study was conducted in key testing areas of five large clusters of the Arctic wetland ecosystems from the Far North Taiga to Northern Tundra on two soil types – Hemic Folic Cryic Histosol and Hemic Folic Cryic Histosol (Turbic). A quantitative assessment of the content of functional groups and molecular fragments of studied humic acids (HAs) (¹³C-NMR CP/MAS data) indicates the difference in their molecular composition both in seasonal thawed (STL) and permafrost layers of peat, and in the zonal series of soils. The structural and functional parameters of HAs in the peatlands under study are determined through a combination of natural selection of aromatic structures in the humification process, species composition and decomposition degree of peat, and hydrological conditions, which reflect the peat-forming climatic conditions in the Holocene. The climatic parameters of the Atlantic period shaped the character of the vegetation composition, with sedge and tree communities – consequently HA precursors with higher lignin content – dominating. Present-day peat deposits formed in the Mid and Late Holocene mainly out of bryophyte residues contain HAs with a significant share of carbohydrate and paraffin structures. A certain trend towards decreased concentration of aromatic (*fa*) and higher content of unoxidised aliphatic fragments in HAs from STL in high latitude peatlands is observed, which is related to values of bioactive temperatures of soils (Figure).

Figure. Content of HA aromatic (I) and C,H-Alkyl fragments (II) from seasonal thawed layers of Hemic Folic Cryic Histosol (1) and Hemic Folic Cryic Histosol (Turbic) (2): A – the far north taiga; B – the forest-tundra; C – the south tundra; D – the ecotone south tundra and north tundra; E – the north tundra (Barents Sea coast).

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