



High concentrations of phosphate and ammonium in groundwater samples from low peat after decreasing the groundwater table

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Previous made investigations showed some uncommon high concentrations of phosphate and ammonium in groundwater samples from low peat, when the groundwater level was rapidly lowered at the end of summer [Sapek et al., 2005, 2006]. The presented investigations were extended to collecting the groundwater samples from the underlying mineral layer. The study area was the Peat Soil Experiential Farm of the Institute for Land Reclamation at Falenty established in 1954. Soils there are mainly moorsh-peat soil (80%) with moderate moorshification stage. They are established mainly from moderate and high-decomposed alder swamp and reed swamp peats of 1.0 to 1,5 m depth. The investigated soils are used as grassland base for the moderate intensive dairy production. The area was drained during 90 to 40 last years. The soil are poor in ash components ($<20\%$ of DM), but rich in nitrogen ($\sim 3\%$ of DM) and phosphorus ($1.5 \text{ mg P}_{tot} \text{ kg}^{-1}$ of DM). The aim of investigations was to recognize the reasons of the rapid increase the P- PO_4 and N- NH_4 concentrations at he end of summer and the coincidence between the high concentrations o both substances.

The samples of groundwater were taken from the peat horizon (S) and from the underlying mineral horizon (P) in monthly intervals. Perforated tube was used in the first case. It was installed only in organic layer. In the second case the ends of plastic tube was immersed in the underlying mineral horizon. Eight sampling locations were choose. The study were started in May 2001 and ended in June 2005. The concentrations of P- PO_4 (MRP – molybdenum reactive phosphate and N- NH_4 were determined

by means of Skalar SAN Segmental Flow Analyser.

The observed P-PO₄ and N-NH₄ concentrations differed much depending on the sampling location and depth. The highest mean P-PO₄ concentrations surpassed 1 mg P-dm⁻³ at samples from two locations and the mean N-NH₄ concentrations surpassed 12 mg N-dm⁻³ in sample from the same locations (Table 1). Therefore, the data from one of this point were more closely discussed. The extremely high P-PO₄ concentrations occurred only at some months, generally starting at the end of summer. The maxima of concentration in samples from mineral layer appeared at the same time or few latter. Similar picture was observed for the N-NH₄ concentrations in the both kinds of groundwater. The relationships of sharply increasing or decreasing the mentioned concentrations in both kind of water were observed in samples from all investigated locations.

Table 1. Concentrations of P-PO₄ and N-NH₄ (mg dm⁻³) in groundwater from peat layer and in groundwater from underlying mineral soil layer

	Sampling point							
	K1	K2	K4	K5	K7	K8	K9	UGT
Number of samples	47	72	46	45	50	48	49	122
P-PO ₄ in GW from peat layer	0.25	0.99	0.09	0.25	1.51	1.02	0.24	0.07
P-PO ₄ in GW from mineral layer	0.49	1.23	0.20	0.42	2.96	0.82	0.80	0.10
N-NH ₄ in GW from peat layer	2.1	4.1	0.90	10.2	23.2	17.8	1.2	0.24
N-NH ₄ in GW mineral layer	18.7	3.4	0.57	2.0	22.9	12.6	2.5	0.42

GW - groundwater

The drastic changes of P-PO₄ concentrations were accompanied with such changes of N-NH₄ concentrations in samples taken at the same time or belated one or two months. In spite of some delay in the appearing of higher N-NH₄ concentrations the Spearman rang order coefficients for the P-PO₄ and N-NH₄ concentrations in both kind of water were significant for samples taken from all investigated location (Table 2).

Table 2. Spearman rang order coefficients, significant at p<0,05, for the relationship between the concentrations of assessed substances in groundwater from peat layer and

in mineral soil layer

	Sampling point							
	K1	K2	K4	K5	K7	K8	K9	UGT
Number of samples	47	72	46	45	50	48	49	122
P-PO ₄ concentration in GW from peat vs mineral layer	0.70	0.30			0.51			0.40
P-PO ₄ concentration in GW from peat layer vs N-NH ₄ concentration	0.72	0.28	0.62	0.51	0.54	0.79	0.55	0.44
P-PO ₄ concentration in GW from mineral layer vs N-NH ₄ concentration	0.65	0.50	0.51	0.57	0.73	0.59	0.46	0.44

GW – groundwater

The prompt lowering of water table in peatlands results in an enormous concentration of soluble phosphate and ammonium in groundwater samples. The lowering of groundwater level is occurring generally in the summer months, when the increased phosphate and ammonium concentrations in groundwater samples from all three investigated objects were observed. Some assessed concentrations were extremely high and exceed 10 mg P dm⁻³ or 100 mg NH₄-N dm⁻³. The extremely high concentrations of phosphate (>4 mg P dm⁻³) samples were always connected with high concentrations of ammonium (>10 mg NH₄-N dm⁻³). Nevertheless, such high concentration of both compounds appeared only in samples from particular observation points and during some month.

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