

Geochemical characterization of trace elements and stable isotopes of carbon and nitrogen in water, sediment and water moss *Fontinalis antipyretica*

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Polluted waters recharging from agriculture water systems into watersheds have influence on water quality and living habitat. Stable isotopes of carbon and nitrogen in combination with other heavy metals are used to trace biogeochemical processes and contamination of water systems. The research is focused on agricultural areas, from where carbon, nitrogen and selenium (added to the feed stuff) as well as other metals are leached from terrestrial to water system. Therefore, 10 locations in Notranjska region, Slovenia, with different land use in the catchment (inputs and outputs of Cerknjško Lake and some tributaries of the Sava River watershed), including reference point considered as non-polluted site, were sampled. Samples of water, sediment and widely distributed water moss *Fontinalis antipyretica* were taken in all four seasons during years 2010 and 2011. The water chemistry of investigated locations is dominated by HCO_3^- - Ca^{2+} - Mg^{2+} , concentrations of NO_3^- seasonally range from 2.07 mg/l to 6.4 mg/l and at reference site does not exceed 1.3 mg/l. Total alkalinity of water at investigated locations ranges from 2.9 to 6.02 mM. The pH of investigated water range from 7.2 to 8.5, waters are saturated with oxygen (up to 134%) and conductivity ranges from 295

to 525 $\mu\text{S}/\text{cm}$, while at reference site conductivity is up to 180 $\mu\text{S}/\text{cm}$. At the reference point average measured $\delta^{13}\text{C}_{\text{DIC}}$ value is -2.7‰ which confirmed that this is a non-polluted site. $\delta^{13}\text{C}_{\text{plant}}$ values of *F. antipyretica* seasonally ranges from -45 to -32.9‰ and $\delta^{15}\text{N}$ from -0.2‰ to 6.5‰ , respectively. In comparison to C3 terrestrial plants *F. antipyretica* has more negative $\delta^{13}\text{C}$ value, which is probably related with the difference in CO_2 plant fixation and depends on $\delta^{13}\text{C}_{\text{DIC}}$ in water, which is primarily controlled by geological composition and soil thickness in the watershed. Higher $\delta^{15}\text{N}$ value found in *F. antipyretica* is related to agricultural activity in watershed, while at the reference site measured $\delta^{15}\text{N}$ value is -4.1‰ . From this study it is evident that isotopic composition of carbon and nitrogen is useful tracer of natural and anthropogenic inputs from terrestrial (fertilizing, sewage sludge) to water system.

The concentration of Se in water from all locations did not exceed $0.2\ \mu\text{g Se L}^{-1}$, while tissues of *F. antipyretica* contained from 343 to 3039 ng Se g⁻¹ on dry matter basis. The concentration of some other selected elements (Zn, Cu, Pb, Cd, Cr) in the moss and sediment will be discussed.

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