Long Term Trend in the Aerosol Black Concentrations in the Arctic Region

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Introduction

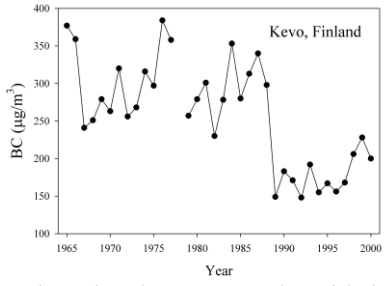
Carbon, primarily a byproduct of incomplete combustion of fossil fuel and biomass burning constitute only a few % of the total PM mass, but disproportionately affect the global climate by absorbing the incoming sunlight and directly warm the atmosphere. BC coated with sulfate is even more effective than externally mixed BC and SO4 particles. Recent studies have indicated that substantial radiative forcing in the Arctic is due to the indirect impact of BC on the albedo of snow and ice surfaces. We are determining the concentrations of BC, SO4, selected trace elements in weekly samples collected at Kevo, Finland, from 1964-2010 to assess the impact of aerosols on (1) radiative forcing, (2) source regions that have contributed to the burden of BC and SO4 in the Arctic region, and (3) how the regional emissions impacting Arctic have changed with time.

Methods

Samples were collected over 7 day periods beginning in October 1964 through the present in Kevo [1], Finland in an automated system to measure airborne radioactivity. These samples were analyzed using the approach developed by Husain et al. [2]. The light absorption of each new filter was measured with a Magee OT21 transmissometer.

Results and Conclusions

Figure 1 shows the annual average values for 1965 to 2000. The concentrations of BC aerosols during 1965 were 430 ng m^{-3}. From 1966 thru 1987 it varied from ~250 to 430 ng m^{-3}. Beginning in 1989, concentrations showed a systematic decrease to about 150 ng m^{-3}. From 1989 to 2002, the concentrations have remained between 150 and 230 ng m^{-3}. The data from 2003 to 2010 is not yet available.



These data show that there was a substantial decrease in BC concentrations around the time of the collapse of the Soviet Union and the change in political systems in eastern Europe. More detailed analyses will be performed in the future.

[1] Yli-Tuomi, T., et al., 2003. *Atmospheric Environ.* **37**, 2355-2364.

[2] Li, J., et al., 2002, *Atmospheric Environ*. **36**, 4699–4704.

Aluminium affecting copper speciation in Swedish freshwaters

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Abstract

Swedish fresh waters are often rich in aluminium depending on the underlying bedrock, water chemistry e.g. acidification status and TOC. Aluminium forms, present at circum neutral pH are not toxic to aquatic biota, but may however influence the bioavailability of other metals. This will occur due to competition of Al on organic carbon binding sites which will relese free metal ions affecting metal speciation (Fig.1) as well as toxicity. Measured free/labile Cu levels, using electro chemical detection - Anodic Stripping Voltammetry (ASV), combined with modeling (Visual minteq) showed that this occurs until a threshold level of Al in the water is reached. The concentration of free Cu increased and the organically complexed Cu (Cu-FA) decreased when Al was added (Fig. 1)

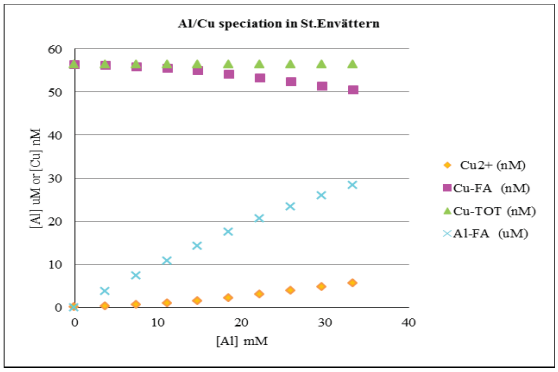

Figure 1: Cu-species at increased amount of Al added to water from Lake St. Envättern, Sweden. Cu-FA, Al-FA: metal complexes with humus.

These findings also have a marked influence on the Cu-toxicity to crustaceans (*Daphnia magna*) as shown by preliminary results from toxicity tests using lake waters in the presence of Al well below the toxic concentration of Al (Fig.2).

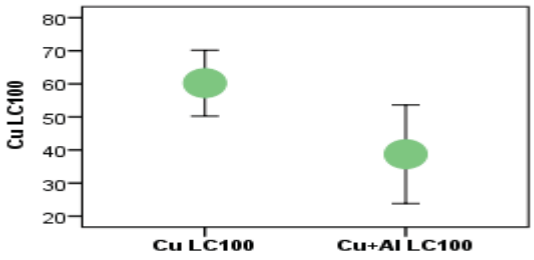

Figure 2: Cu LC_{100} values with and without Al addition (20 µg/L) for *D.magna*.

Conclusion

Aluminium, thou not bioavailable at circum neutral pH-values, can affect Cu speciation, toxicity and bioavailability in freshwaters already at moderately elevated Al-concentration.