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Effects of aquatic macrophytes on concentrations of contaminants in mesocosms

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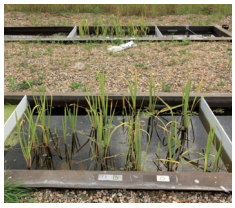
Background and aim

Aquatic macrophytes play important structural and functional roles in aquatic ecosystems. E.g., they influence pH, dissolved organic carbon (DOC) levels and take in and adsorb chemicals. This poster specifically focuses on aquatic macrophytes influencing the physico-chemical environment, thereby affecting both concentration and speciation of contaminants in aquatic ecosystems. The research aim is to determine the magnitude of those changes at laboratory, mesocosm and field scale.

Experimental set-up

Effects of macrophyte growth form and macrophyte biomass on concentration and speciation of contaminants were studied on laboratory- and field-scale.

Laboratory test vessels.

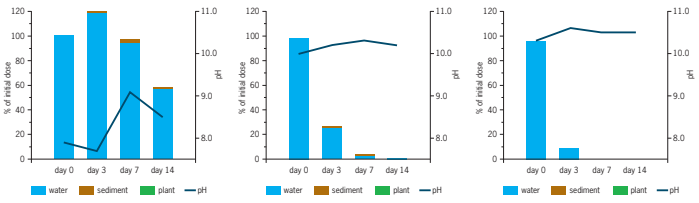


Mesocosms.

Experimental ditches.

Indirect effects via pH in laboratory test systems

In freshwater ecosystems, macrophytes can transform CO_2 (HCO_3^-) into energy and oxygen, thereby increasing pH in the water layer. This pH-shift may cause a rapid hydrolysis of pH-sensitive pesticides.

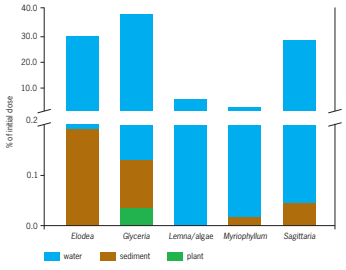


Sediment and no macrophytes. | Sediment and low macrophyte biomass (2 shoots/test vessel). | Sediment and high macrophyte biomass (5 shoots/test vessel).

Effects of macrophyte biomass on dimethoate concentrations in laboratory test vessels.

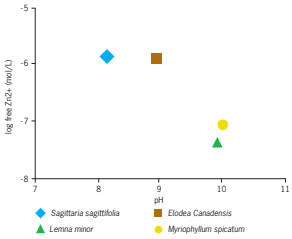
Indirect effects via pH in mesocosms

Decrease of dimethoate concentrations is high in *Lemna*/algae and *Myriophyllum* mesocosms and lower in mesocosms with emergent macrophytes (*Glyceria* and *Sagittaria*). The pH-level may be one of the crucial variables, being one or two orders of magnitude higher in the *Lemna*/algae and *Myriophyllum* mesocosms than in the mesocosms with emergent macrophytes.



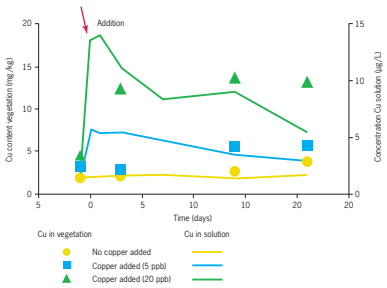
Concentrations of dimethoate in mesocosms characterized by different macrophyte growth forms (on day 14).

Plant species influenced the pH and the free zinc concentrations in the water layer. Increasing pH resulted in lower free zinc concentrations.



Effect of plant species on pH and zinc speciation in the mesocosm study for equal initial total concentrations of zinc.

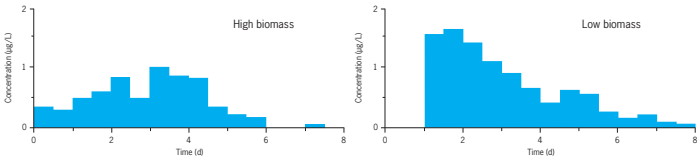
Uptake of contaminants by aquatic macrophytes



Uptake of copper by Lemna resulted in a reduction of the initial dissolved copper levels in the water layer of mesocosms.

Retention of pesticides in experimental ditches

Concentrations of dimethoate (applied at 0–10 m) are higher in low-biomass ditches and discharge is a few days later than in high-biomass ditches (flow velocity ca. 10 m/d).



Concentrations of dimethoate at the end of 40-m vegetated ditches.

Conclusions

- Submerged aquatic macrophytes (especially *Myriophyllum*) and mixed *Lemna*/algae layers have a higher stimulating impact on pH-level than emergent macrophytes. This results in rapid hydrolysis of pH-sensitive pesticides and in lower free zinc concentrations in these submerged and mixed floating vegetations.
- Uptake of copper by *Lemna* resulted in a reduction of the initial dissolved copper levels in the water layer of mesocosms.
- In vegetated ditches retention of pesticides is biomass and density dependent.

Acknowledgements

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