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Effects of cobalt on river biofilms: colonization kinetics and biofilm structure

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Over the past decade, the use of cobalt (Co) has increased by 95%. Due to its high toxicity and increasingly use, Co concentrations in the environment should be monitored in order to prevent or identify environmental contamination. Aquatic microorganisms can be negatively affected by Co and, as a result, the functionality of river ecosystems. Biofilms are ubiquitous microorganism communities (bacteria, algae, fungi and meiofauna) living on river substrata, and sensitive to contaminants, including metals. The aim of the present study is to evaluate the effects of Co on biofilm structure and functions as a function of colonization kinetics, and thereby provides some insights into the Co impact on the broader river-based ecosystem.

Glass slides were exposed to increasing concentrations of Co (6, 30 and 60 $\mu g.L^{-1}$) in outdoor artificial streams for 28 days. The main physical and chemical parameters such as pH, metals and dissolved organic matter concentrations were monitored in the water during the experiment. Growing biofilms were sampled after 7, 14, 21 and 28 days of exposure to measure Co bioaccumulation and its effect on the biofilms' biological organization and functions. The abundance of microalgal and prokaryotic communities and diversity were determined during the biofilm formation by qPCR and metabarcoding.

Cobalt bioaccumulation was correlated (*Spearman correlation coefficient* ≥ 0.86) with the Co exposure concentrations. Most of the accumulated Co (81 ± 18%) was found to be internalized. The highest amount of fresh biofilm biomass was measured with 60 $\mu g.L^{-1}$ Co exposure at D21 and D28. This was accompanied with a 12-fold increase in microalgal abundance as compared to the control at D28 whereas their chlorophyll content was lowered at D21 with a decrease in chlorophyll-a (76 %) and chlorophyll-c (62 %) concentrations. Increases in prokaryotic abundances were also observed with 30 and 60 $\mu g.L^{-1}$ Co exposure at D21, and with 30 $\mu g.L^{-1}$ at D28. At this concentration, *Alphaproteobacteria* and *Planctomycetes* classes lowered whereas *Bacteroidia* were more abundant with Co exposure at each exposure time. These results highlight the Co impacts on the studied microbial communities. Future analyses will examine Co effects on microbial interactions and biofilms' functional potential.