LIGHT, GROWTH DILUTION, AND PERIPHYTON METAL CONTENT[1]

Walter Hill and Lauren Larsen
Environmental Sciences Division
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, Tennessee 37831-6030

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The concentrations of trace metals in microalgae are determined by the rate of metal uptake divided by the rate of growth. Environmental factors may differentially affect these rates. We performed a field experiment in a metal-rich stream that tested the effect of light on metal concentrations in periphyton. Transparent plexiglas panels (60 x 40 cm) were suspended a few cm over the stream surface: four panels were covered with multiple layers of window screen that reduced PAR to less than 5% of ambient, and four panels were not covered. After four weeks, periphyton growing on artificial substrata below the panels was brought into the laboratory for measurements of metal and carbon uptake at different light intensities. The ratio of metal uptake to carbon uptake decreased with increasing light intensity, suggesting growth dilution of metal concentrations would increase with increasing light. This prediction was borne out by ICP/MS analyses of periphyton from the field experiment: unshaded periphyton had zinc, cadmium, total mercury, and methylmercury concentrations (ug/g AFDM) that were only 30%, 50%, 25%, and 33%, respectively, as high as concentrations of these metals in shaded periphyton. These results have important implications for the biomagnification of contaminants in aquatic food webs.