

A SHORT NOTE ON NUTRIENT LIMITATIONS FOR BIOFILMS

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Measurements of bacterial activities by means of tritium thymidine incorporation have shown that the bacteria use the thymidine also as supplementary DOC and N source (Kasimir 1991). This indicates that biofilms attached to particles are limited by nutrients in the hyporheal of the Ritrodat study area. Aquatic ecosystems are generally nutrient limited if the ratios C: N and C: P exceed 9 and 50, respectively (Characklis and Marshall 1989).

According to our own DOC measurements and data of Bretschko (1991) these ratios amount for C: N = 1 to 5 and for C: P = 100 to 500 in the sediment water of the Ritrodat study area. To test the effect of DOC and nutrients to biofilm growth and productivity we conducted simple laboratory experiments. We filled 800 g of stream sediment (grain size: 0.25 –

6.3 mm) in plastic columns and pumped 4 litres of stream water with a peristaltic pump with a rate of 4 litres per hour from an aquarium through the column and back to the aquarium. The water in the aquarium was aerated, the experiment was done in the dark at a constant temperature of 10 °C.

Two of these experimental setups ran simultaneously. We added 50 mg l⁻¹ Glucose to one aquarium and 50 mg l⁻¹ Glucose, 5 mg l⁻¹ N (potassium nitrate) and 1 mg l⁻¹ P (sodium phosphate) to the other aquarium. During the experiment we measured the DOC concentrations in the aquaria daily with a Shimadzu TOC-5000 analyser.

The experiment started for one day with stream water, then we exchanged the solution and added the DOC and nutrients. After two days we replaced the solution with untreated stream water for one day. This procedure was

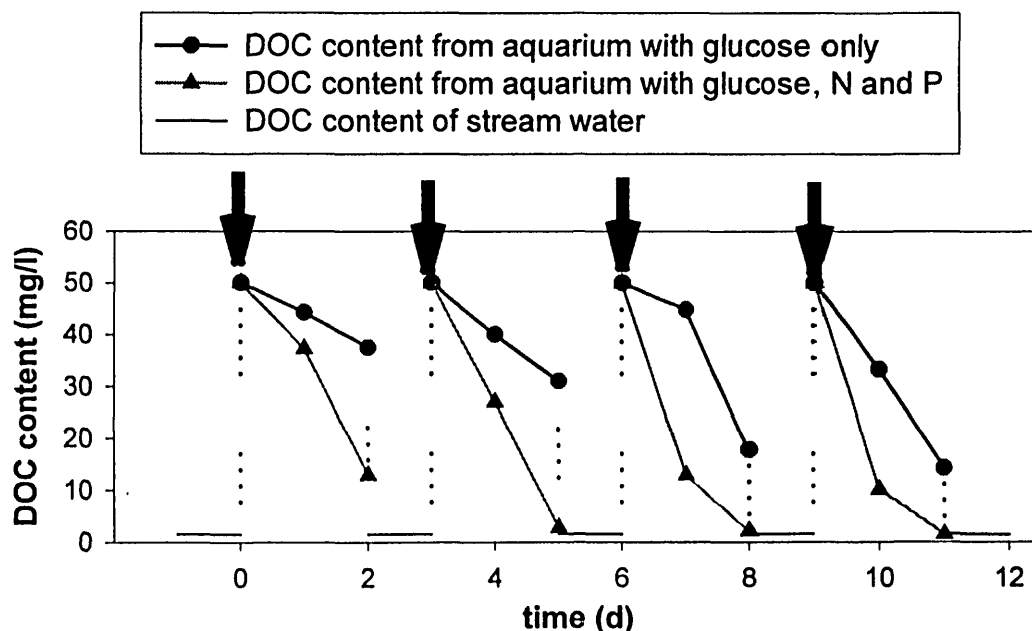


Fig. 1: The decrease of the DOC-concentration in the aquaria after addition of glucose, N and P, dissolved in stream water. Arrows indicate renewals of the nutrient solutions.

repeated 3 times. The uptake of DOC within two days was higher when the biofilms were provided with additional N and P (Fig. 1). Under both experimental circumstances the biofilms adapted to the DOC source, which is shown by the increasing DOC uptake with the repeated nutrient additions (Fig. 1). Under natural conditions the growth and activity of biofilms may be limited by phosphorus. Further experiments should show

whether the biofilms adapt differently to specific DOC sources (e.g. sugars, amino acids).

References:

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Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Jahresbericht der Biologischen Station Lunz](#)

Jahr/Year: 1999

Band/Volume: [1995-98_016](#)

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Artikel/Article: [A short note on nutrient limitations for biofilms. 35-36](#)