Insect frass as a fertilizer for the cultivation of protein-rich *Chlorella vulgaris*

P. Steinrücken[*,1], O. Müller[2], H. Böpple[1] and D.M.M. Kleinegris[1,2]

[1] *NORCE Climate & Environment - NORCE Norwegian Research Centre AS, Bergen*

[2] *Department of Biological Sciences, University of Bergen, Bergen, Norway*

* e-mail: pias@norceresearch.no

Replacing the large amounts of chemical fertilizer with nutrients from waste streams is an important factor to make microalgal production more sustainable, resource-efficient, and cost-effective. Within the EU project ProFuture, we examined the potential of insect frass as a nutrient source for microalgal cultivation, and its effect on the protein content of the microalgae *Chlorella vulgaris*. Insect frass is a by-product of insect production and consists of solid excreta and exoskeletons from the larvae. In the first step, the insect frass was mixed with water to extract the nutrients, and solid particles were removed by centrifugation. In a second step, a batch experiment in 300 mL bubble columns was performed to compare the growth and protein content of cultures grown in insect frass-based medium to those grown in conventional growth medium. During the experiment, media nutrient concentrations and utilization (N, P, DOC) and the bacterial abundance and community composition were analyzed. *C. vulgaris* grew equally well on insect frass extracts and maintained the same high protein content (40% of the dry weight) as when grown in the artificial control medium. The nitrogen in the frass media consisted predominantly of organic nitrogen compounds, of which 71-78% were converted to ammonium and could be consumed by the microalgae. The presence of dissolved organic carbon in the insect frass media promoted the growth of algae-associated bacteria, which however did not affect microalgal performance. Our study is the first to show that insect frass is suitable as a growth medium for microalgal cultivation, providing all essential nutrients including nitrogen and phosphorous.