

Harvesting *Isochrysis Galbana* with an Evodos 25 Dynamic settler



Introduction

It's known that some algal strains are shear sensitive and cells might be damaged during harvesting by centrifugation. *Isochrysis galbana* is one of these shear sensitive strains, due to the lack of a cell wall.

To test whether *Isochrysis galbana* cells remain alive after harvesting with an Evodos 25 dynamic settler, centrifugation tests were performed.

Together with a product specialist and a technical engineer of Evodos, two different settings for the centrifuge were tested. First the optimized settings (RPM 3800, product flow 500 l/h) for shear sensitive algae was tested. In addition, a test with the default settings (RPM 4200, product flow 800 l/h) was performed. After these tests, the harvested biomass was sampled and visually assessed under a microscope. With the harvested biomass also a re-growth experiment, with fresh media, was carried out.

Method

1300 Liter of *Isochrysis galbana* biomass, with a dry weight of 1.9 g/l, was produced in a LGem photobioreactor especially for this experiment. The biomass was transferred to a harvest vessel and stored in the dark overnight. The next day the biomass was pumped to the Evodos 25 dynamic settler.

Samples (100 ml) were taken from the ingoing product, the fresh algal culture (exp1_{in}), and from the harvested pellet (concentrated biomass) of experiment 1 (exp1_{out}) and experiment 2 (exp2_{out}). Samples of the pellet were diluted, with fresh media, to about the same concentration as the ingoing biomass. These samples were checked under a microscope and incubated in an orbital shaker at 25°C, constant light (150 μmol) and CO₂ flow (2%). Regrowth of the harvested biomass was followed by measuring optical density (measure of biomass concentration) of these cultures after 0, 6 and 14 days.

Results

Harvest

During the first experiment the centrifuge was run for 30 minutes with a rotation speed of 2800 rpm and a product flow of 500 l/h. In these 30 minutes about 1 kg of paste, with a dry weight of 15.4%, was produced.

The rest of the fresh culture was centrifuged with the default settings, rotation speed 4200 rpm and product flow 800 l/h, resulting in 6.1 kg paste with a dry weight of 14.2%.



Picture 1: Photo of the concentrated Isochrysis galbana paste after centrifugation in an Evodos 25 dynamic settler

Microscope

The ingoing product (fresh algal culture), the re-diluted paste of experiment 1, and the re-diluted paste of experiment 2 were checked under a microscope to check whether the *Isochrysis galbana* cells are still intact. As it can be seen in figure 2, 3 and 4 the cells of *Isochrysis galbana* survived the centrifugation process.

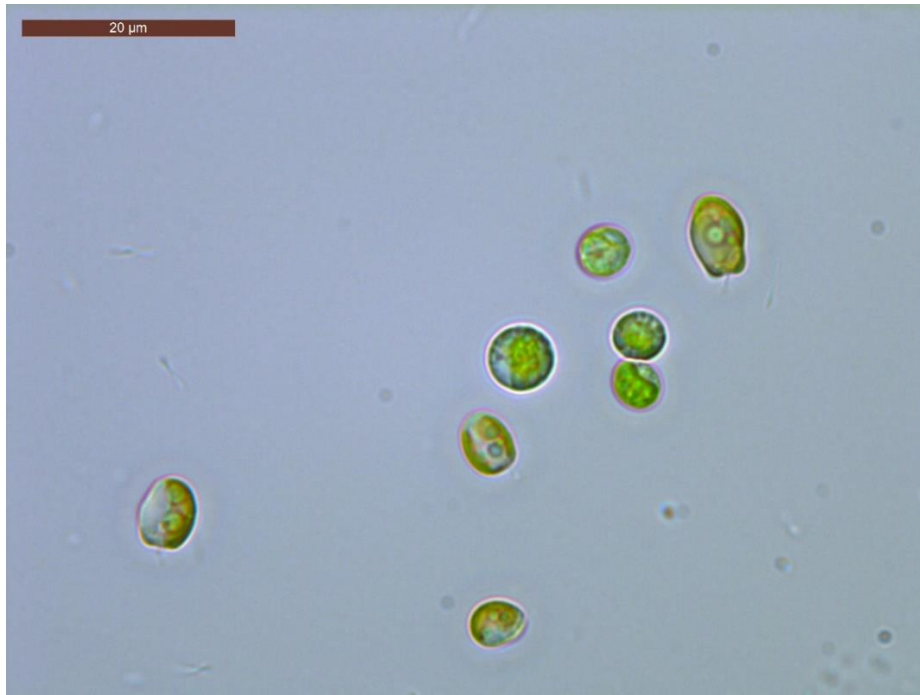


Figure 2: Photo of the ingoing product, *Isochrysis galbana* cells, before centrifugation

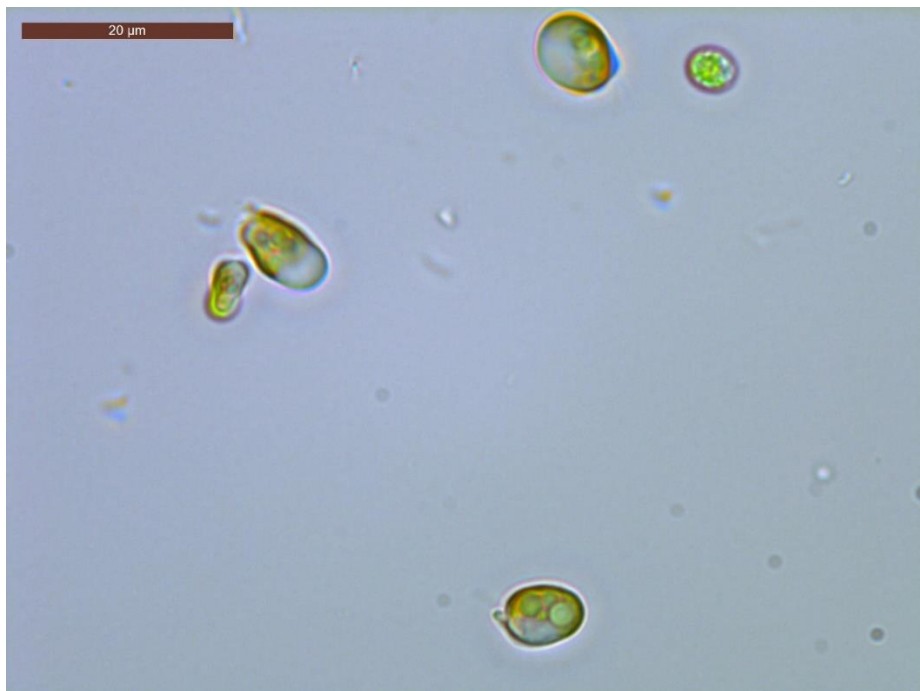


Figure 3: Photo of the (re-diluted) paste, Isochrysis galbana cells, after centrifugation experiment 1 (3800 rpm, 500 l/h)

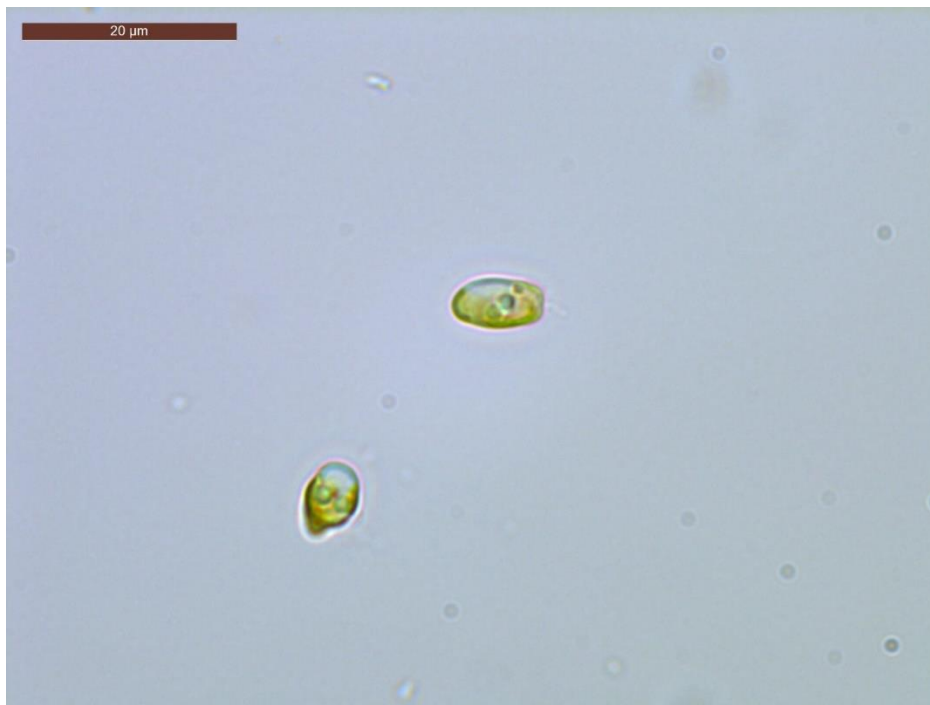


Figure 4: Photo of the (diluted) paste, Isochrysis galbana cells, after centrifugation experiment 2 (4200 rpm, 800 l/h)

Regrowth

To check if the *Isochrysis galbana* cells are still viable after centrifugation, a regrowth experiment was performed with the centrifuged paste.

The original ingoing fresh algal culture was diluted with fresh medium to a concentration of $OD_{75} = 0.23$. The centrifuged paste, of experiment 1 and 2, was also diluted with fresh medium to about the same concentration ($D_{750} = 0.3$). The three obtained cultures were grown in an incubator as described under material and methods. Biomass concentration (OD_{750}) was measured after 0, 6 and 14 days. As it can be seen in figure 5, the centrifuged *Isochrysis galbana* cells were able to grow. Even the cells, centrifuged with the default settings, 4200 rpm and product flow 800 l/h, were able to grow.

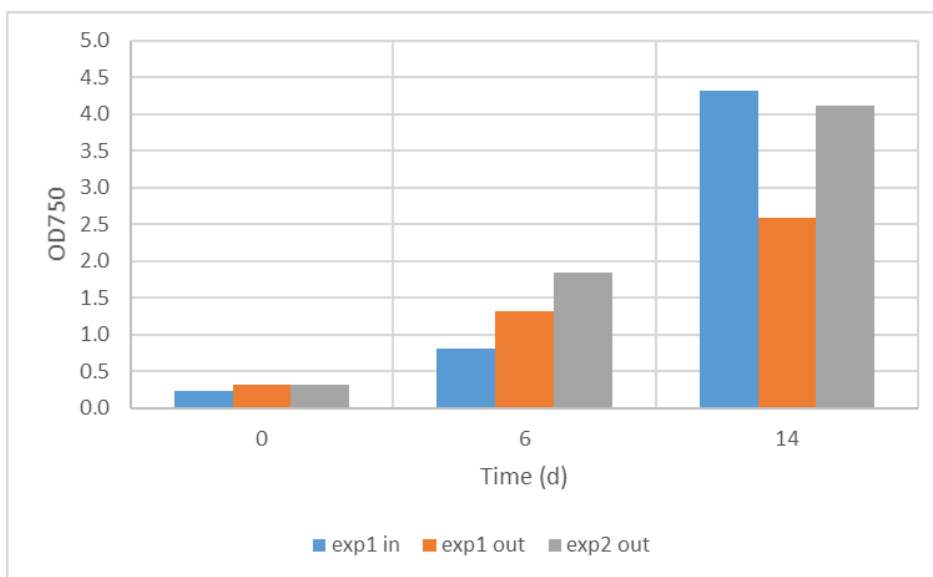


Figure 5: Optical density (OD_{750}) during the regrowth experiment, before (in) centrifugation, and after (out) centrifugation measured after 0, 6 and 14 days.

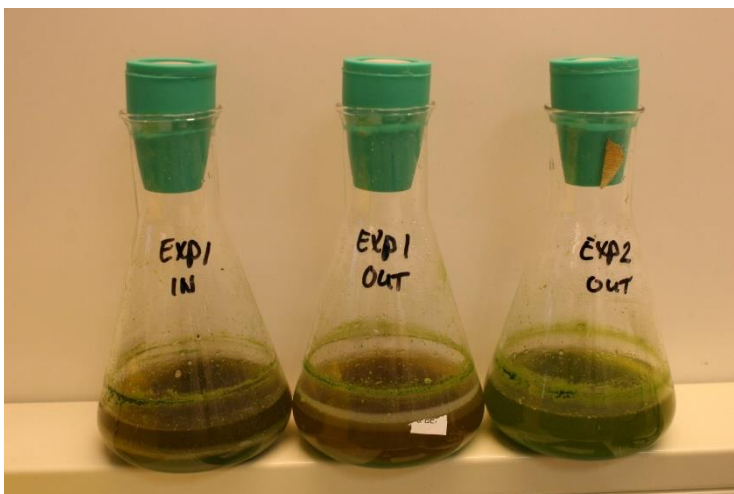


Figure 6: Photo of the *Isochrysis galbana* cultures of the regrowth experiment, before (in) centrifugation, and after (out) centrifugation after 14 days.

And also during another re-growth experiment, for a different project, and with a different centrifuge (4000rpm), with sample tubes (50 ml), *Isochrysis galbana* cells could recover and grow after centrifugation and dilution with fresh media.

Conclusion

Centrifugation of *Isochrysis galbana* cells with an Evodos 25 dynamic settler, with a rotation speed of 3800 rpm and a product flow of 500 l/h, will not lead to significant cell damage.