Impact of medium recycling on growth of N. gaditana from labscale to pilotscale

Rut Vleugels¹, Isabelle Noyens¹, Joris Doumen¹, Liesbeth Vogels¹, Leen Bastiaens², Sabine Van Miert¹

¹ Thomas More University of Applied Sciences, Agro- and Biotechnology Department, RADIUS Research group, Belgium
² VITO N.V., Sustainable Chemistry Department, Renewable Chemicals group, Belgium

RESEARCH AIMS

Microalgae provide excellent opportunities to overcome future food challenges and for sustainable production of raw materials. However, it remains a challenge to cultivate microalgae on a large scale efficiently. Our research focusses on creating more sustainable and economically feasible cultivation processes that can be readily implemented on large scale, especially in horticulture.

In the described research we examined the effect of the reuse of water and fertilizers on the growth of Nannochloropsis gaditana. Effective recycling would mean cost savings and a reduced environmental impact of microalgae production.

EXPERIMENT FROM LAB SCALE TO PILOT SCALE

The growth experiments with N. gaditana were performed on lab scale in 1L flasks, and on pilot scale in closed, tubular photobioreactors from 300L and 1500L. These SUNBUILT photobioreactors are installed in a greenhouse with climate control.

Cultures of N. gaditana were harvested several consecutive times in semi-batch, i.e. one-third 1 to 2 times per week. The remaining cultures were supplemented with the same volume of the complete fertilizer mix (control) or recycled medium (recycle). For this, two different harvest/recycling technologies are used: centrifugation followed by cross flow filtration and membrane-based filtration (Poster VITO). This study examined which nutrient should be supplemented during every recycling round and whether there are interfering substances.

EFFECT OF MEDIUM RECYCLING ON GROWTH ON PILOT SCALE

Lab experiments showed no growth delays over more than two months when nitrogen, phosphorous and small amounts of complete fertilizer mix are added along with the recycled medium. Samples of the filtrate after harvesting indicate very low amounts of N and P. There seem to be no interfering substances impacting the algae growth. Similar results were obtained in the photobioreactors.

The graphs below show growth during multiple harvested/recycling rounds, wherein the recycled medium is supplemented with nitrate, phosphate and small amounts of complete medium.

<table>
<thead>
<tr>
<th>Recycling via centrifugation + cross flow filtration (1L)</th>
<th>Recycling via centrifugation + cross flow filtration (300L)</th>
<th>Recycling via membrane algae filtration (1500L)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Graph 1" /></td>
<td><img src="image2.png" alt="Graph 2" /></td>
<td><img src="image3.png" alt="Graph 3" /></td>
</tr>
</tbody>
</table>

The medium recycling research was carried out within the EU MIRACLES project (www.miraclesproject.eu) and has received funding from the European Union’s Seventh Framework under grant agreement No 613588. Microalgal cultivation was performed as part of the Interreg EnOp project. Installation of the SUNBUILT photobioreactors, harvesting and processing units was realized within an European regional development fund project (ERDF/EFRO) and several cofinanciers.