Assessing Auto flocculation of Microalgae in Wastewater Treatment

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Background

- Green unicellular microalgae have been identified as a possible source of fuel due to their ability to provide substantial amounts of biomass and lipids that can be transformed into biodiesel.
- Due to algae being a small free floating organism in water, the algae must be concentrated into a denser volume in order to be useful in biofuel production. The most common methods currently are collecting algae by gravity sedimentation, concentrating by centrifugation, or filtration, which are typically proceeded by a flocculating step (Pittman et al, 2011).
- The goal of this study is to determine if a large auto flocculating algae S. dimorphus can be used to increase harvest efficiency and settling times in Chlorella vulgaris in differing wastewater conditions.

Materials and Methods

- Each species of algae was maintained in proteose media and then inoculated into flasks containing artificial wastewater. The concentration of wastewater was varied during the experiment. For each concentration, there was a flask of C. vulgaris, S. dimorphus, and a flask inoculated with both species.
- The algae was then allowed to grow in this media, with the growth measured with absorbance every day with the use of a spectrophotometer. Once the absorbance of the algae decreased, the algae was harvested for the rest of the measurements.
- The chlorophyll level was found using microplate reader as well as lipid content using Nile Red fluorescence.
- The total solids in the solution was found through drying a known volume of synthetic wastewater in an oven to subtract the weight of the container from the weight out of the oven.
- In order to determine if the addition of S. dimorphus increases harvest efficiency, the absorbance was measured over a period of 8-9.25 hours using the spectrophotometer with readings taking place every 15 minutes. The following equation was used to determine the amount of algae harvested compared to grown (Salim, Bosma, Vermuë, 2011).

\[
\text{Recovery}\% = \frac{OD_{620}(t_e) - OD_{620}(t_o)}{OD_{620}(t_e)}  \times 100
\]

Results and Discussions cont.

Sedimentation of Algae

- Overall, the graphs shown about the same amount of time to reach a stable absorbance, with each algae and wastewater concentration reach approximately the same steady state value.

![Figure 1. Absorbance values over sedimentation period.](image1.png)

Recovery percentage

- More tests need to be performed, since in one case recovery percentage is increased with the addition of S. dimorphus while it decreases in 2X concentration.

<table>
<thead>
<tr>
<th>Sample</th>
<th>C. vulgaris</th>
<th>S. dimorphus</th>
<th>Both Species 2X</th>
<th>S. dimorphus 1X WW</th>
<th>Both Species 2X Syn WW</th>
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<tbody>
<tr>
<td>C. vulgaris 3X Syn WW</td>
<td>67.6</td>
<td>58.0</td>
<td>70.8</td>
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![Figure 3. Total solid measurements.](image3.png)

Chlorophyll and Lipid content

- The readings show that when inoculated with both species, its chlorophyll and lipid readings are much closer to C. vulgaris than S. dimorphus.

![Figure 4. Chlorophyll and lipid readings from the microplate reader.](image4.png)

Conclusion & Ongoing Research

- More research needs to be done to further assess is S. dimorphus helps to increase harvest of C. vulgaris. More tests are being done as part of this project.
- The data shows that if it increases harvesting, it will retain the valuable biofuel production characteristics of C. vulgaris.
- Future studies could be used to determine if using both algae has an effect on its ability to remove nutrients from the wastewater.

Acknowledgements

- The authors would like to thanks the Arkansas Department of Higher Education to provide funding for this SURF project.
- The authors would also like to thank Connie Walden and Will Richardson for their assistance in the lab.

References
