



An Approach to Integrated Multiproduct Algae Biorefineries

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Background

Bioprocessing of microalgae has a significant potential to become a sustainable source of numerous products for industrial applications. Products of interest range from simple biomass to energy, lipids for fuel, fine organic chemicals and nutraceuticals. The successful realization of microalgae processes depends on its economic feasibility and thus, efforts in strain development and bioreactor engineering must be complemented with breakthroughs in downstream processing [1].

Objective

- To investigate the biorefinery of microalgae, within the framework of integration of unit operations, recycle of raw materials and enhanced multiproduct recovery and functionality.

Approach

Disruption

- Release of intracellular components into the bulk medium [2].
- Fractionation of cell wall, cell structures and organelles.

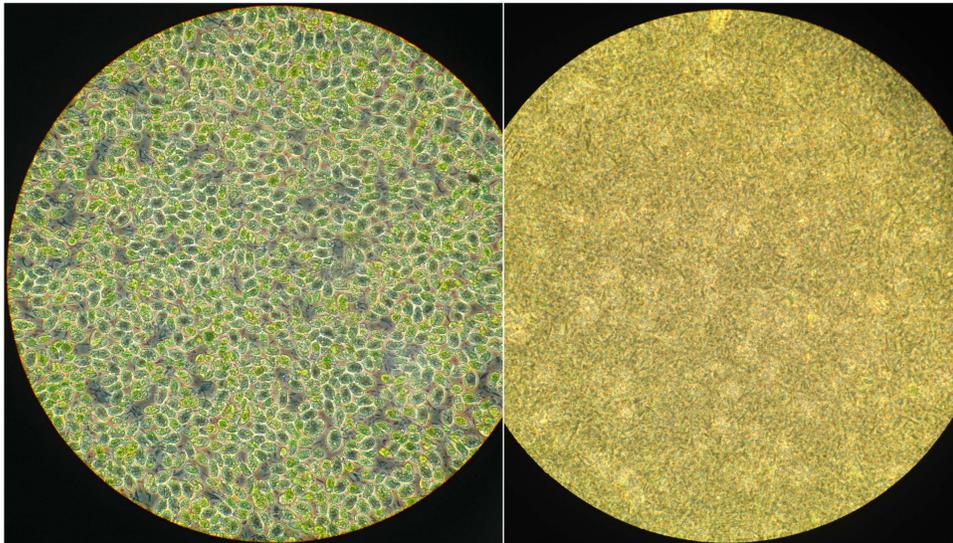


Figure 1. View of fresh (left) and bead mill - disrupted (right) microalgae.

Liquid Extraction

- Aqueous two phase extraction.
- Ionic liquids used as promising green solvents.
- Two phases are formed, in which several components are extracted and concentrated [3].

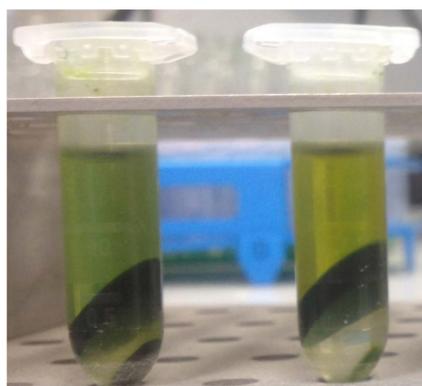


Figure 2. Aqueous two phase extraction.

Process Integration

- Disruption and *in situ* extraction [4].
- Reduction of capital and operational costs.
- Multiple products can be obtained.
- Product functionality is maintained and potentially enhanced.

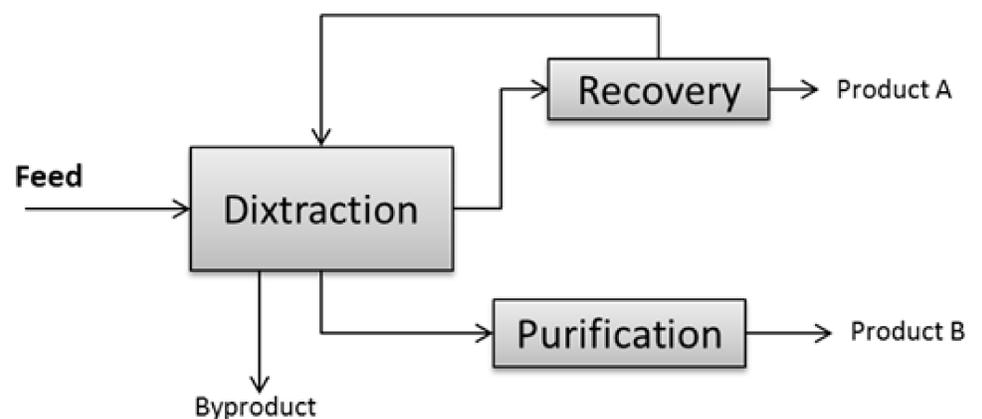


Figure 3. Process overview of the integrated biorefinery of microalgae.

Project Highlights

- ✓ Fundamental research on kinetics and equilibrium.
- ✓ Characterization and techno functional properties of the extracts and link to market applications.
- ✓ Byproducts valorization and recycle of raw materials.
- ✓ Techno economical evaluation of process cases.

Outlook

- The studies to be conducted in this project should lead to a superior understanding of the mechanisms behind an *in situ* disruption-extraction process and should provide a solid base for a better optimization/design of downstream processes for complex bio-feeds.

References

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- [2] Kleinegris D., Janssen M., Brandenburg W., Wijffels R., Two-phase systems: Potential for *in situ* extraction of microalgal products. *Biotechnology Advances* 29 (2011) 502–507.
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- [4] Rito-Palomares M., Lyddiatt A. Process integration using aqueous two-phase partition for the recovery of intracellular proteins. *Chemical Engineering Journal* 87 (2002) 313–319.

Acknowledgements

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