

TURNING CONTAMINATION INTO OPPORTUNITY: Combining low-cost harvesting (flocculation) of microalgae with green NADES extraction methods



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GENERAL OVERVIEW

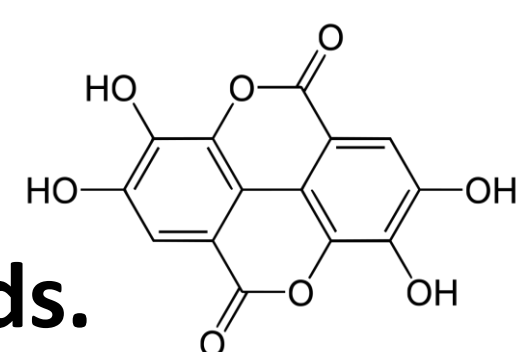
Cultivation



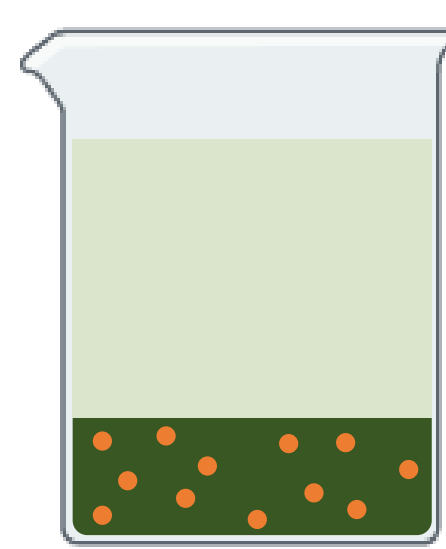
Algae produce different compounds during the cultivation cycle:

- Reaction to surroundings (stress)
- Metabolic functions

Interested in the **(poly-)phenolic compounds**.



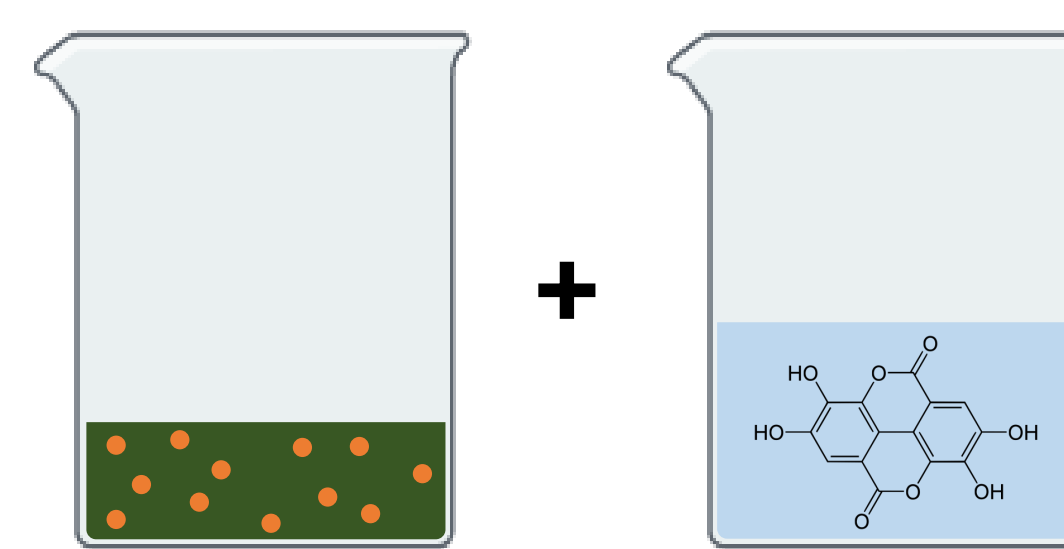
Harvesting



Flocculation by adding a coagulant to microalgae to make them stick together and sediment in solution.

Using **metal salts** as coagulant, as this can be used in industrial microalgal production.

(Poly-)phenolics extraction



Solvents with specific properties:

- Break open the microalgae cells
- Capture desired compound

For phenolic compounds a **polar solvent** is chosen, like ethanol or methanol.

TODAY

Phenolic production **not fully understood**:

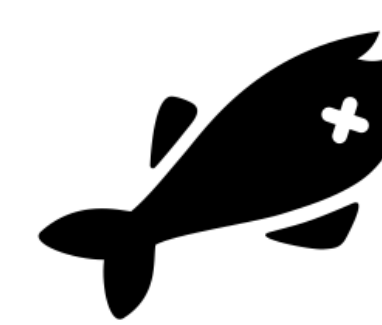
- metabolic function or stress-induced
- exponential or stationary phase



Harvesting with metal salts is cheap, but results in a **metal-polluted residual biomass**.



Extraction solvents are often **harmful to the environment**.



TOMORROW

Investigate factors for high phenolic production¹

- **exponential phase**
- cultivation in **N-replete medium**



Phenolic compounds produced by microalgae *Chlorella sp.* are:

- quercetin
- p-hydroxybenzoic acid
- gallic acid
- p-coumaric acid
- ferulic acid
- caffeic acid

Developing **metal-doped specialty biochars and activated carbons** from contaminated biomass.



Turn undesired metal contaminations into opportunities with further downstream applications.

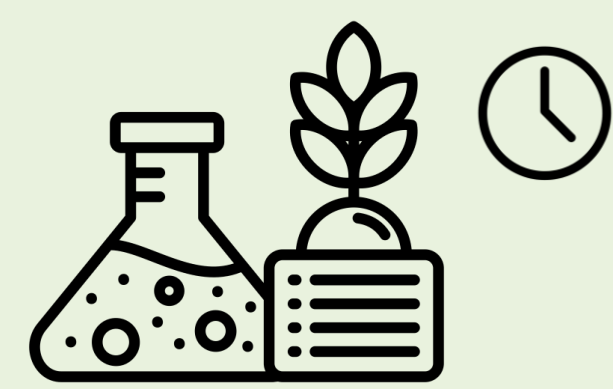
Solvents with sustainable properties as a green extraction method:

natural deep eutectic solvents (NADES)

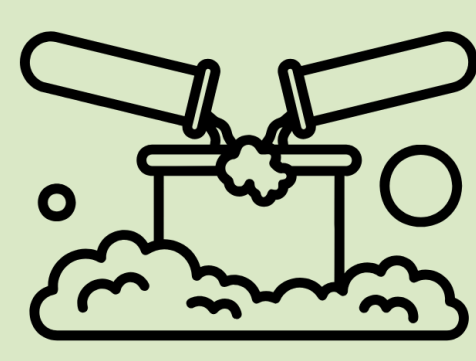


NADES are mixtures of solid hydrogen bond donor and acceptor components, to create a liquid end product with new properties.

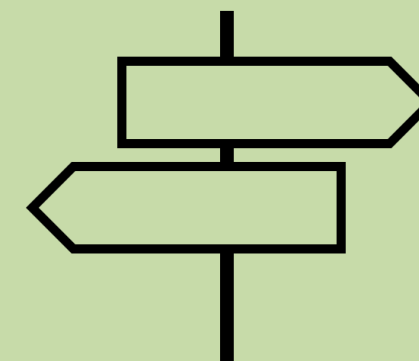
BATTLE PLAN



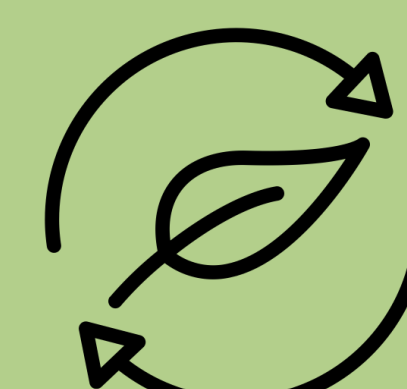
Test phenolic production conditions within *Chlorella sp.* with HPLC method



Find correct NADES formulation to maximize extraction of phenolic compounds



Control metal distribution in a microalgae/NADES extraction system & maximizing phenol yield



Investigate and improve different pyrolysis techniques for conversion biomass to biochar

OUTLOOK

- We apply the framework of circular chemistry to explore, from a diverse set of angles, how we can make the microalgae biorefinery process more sustainable and commercially attractive.
- Such fundamental knowledge will be indispensable to speed up the transition towards a more sustainable future.

ACKNOWLEDGEMENTS

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