

# Conducting LCAs of 3 Macroalgae-based Products and a Comparison with Land-based Alternatives

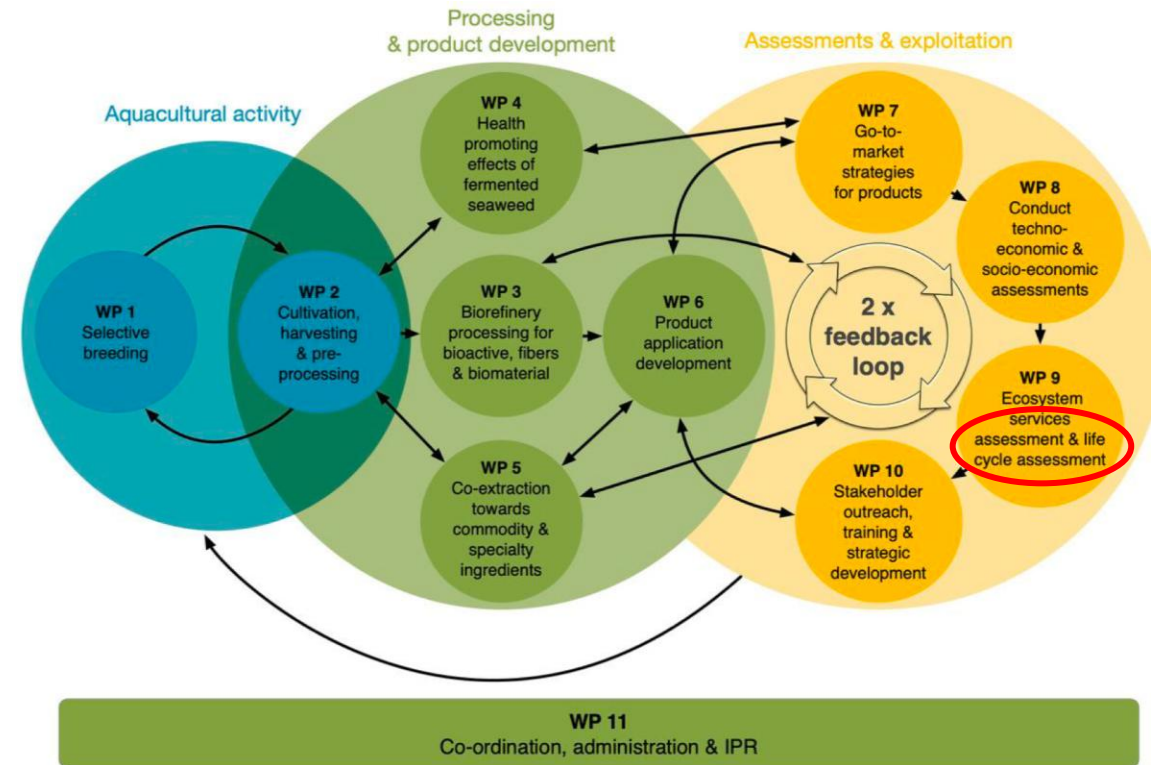
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# Scope of the project



- "Making the most out of macroalgae"
  - Objectives:
    1. To leverage the potential of macroalgae as an industrial feedstock
    2. Provide market knowledge
    3. Strengthen the competitiveness of the European blue bioeconomy
    4. Provide scientific evidence on environmental benefits [...] and on risks [...].
- ➔ Deliver a comparison between the environmental footprint of algae-based products and their land based counterparts.
- Main (LCA related) stakeholders involved: Ocean Rainforest, Oceanium, Fermentation Experts, Algaia



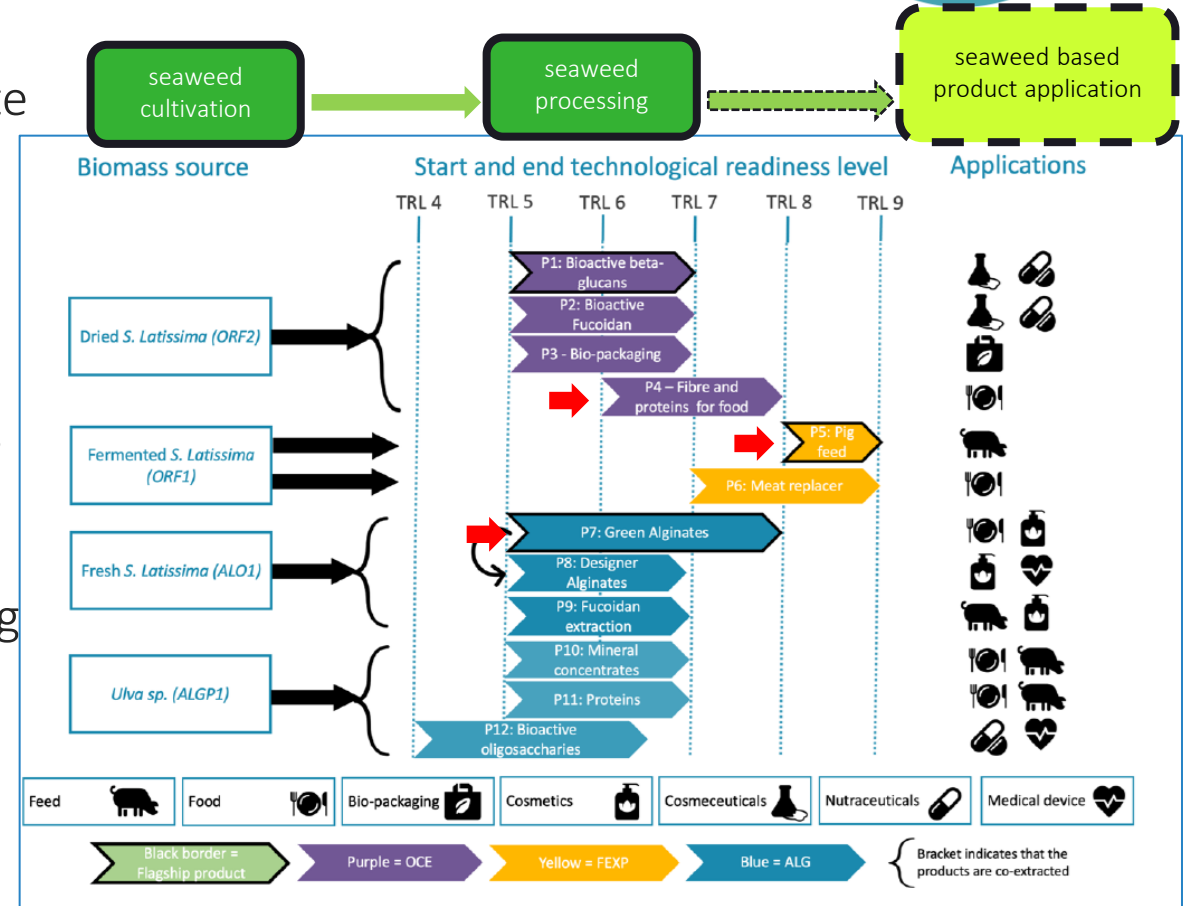
# Value chain(s) analysed



- Seaweed Fibre (P4): cradle-to-processing facility gate *dry seaweed fibre powder compared to fructo- and galacto-oligosaccharides*

- Sow feed additive (P5): cradle-to-piglet farm gate *piglet leaving farm where sows are fed with additive compared to piglet leaving farm with sows NOT fed with additive*

- Green Alginates (P7): cradle-to- cradle-to-processing facility gate *green alginate production compared to conventional alginate production*



# Methodology



Attributional approach,

4 steps:

- Goal and scope: Comparison of environmental footprint of 3 (most promising) algae-based products with land-based alternatives, now and in future
- LCI: currently running – 4 partners involved, received about half of the data yet, deadline February 2025 (green alginates is delayed to March)
- LCIA: not yet defined
- Interpretation: Planned: at least sensitivity analysis on economic and mass allocation



# Results



- We are currently in data collection stage, so no results yet
- Main challenges:
  - Data collection always takes time
  - Data based on pilots of green alginates is currently delayed
  - Modelling of processes (next step)



# Results



## Challenges on chemical inputs needed for seaweed cultivation

Are other studies including seedling production? (<3% impact)

Which processes in LCA databases to select as proxies?

### Bio-binder:

- Binders allow the seeds to attach to the growth lines
- Composition differs
- Conventional fossil based binders use epoxy
- New bio-binders contain a very small amount (<3-5%) of epoxy

### Nutrient medium/Growth medium

- Standard media for algae growth
- Composition differs
- Contains necessary trace elements and minerals



Binder solution being mixed for use in direct seeding (Tillin et al. 2021)

# Results



## Challenges on industrial equipment

Are other studies including manufacture impacts of equipment? (<3% impact)  
Which processes in LCA databases to select as proxies?

### For seaweed processing

- Drying machines

### For fibre processing:

- Decanter, reactor, etc.

### For alginate extraction

- Blender, filter press, dryer



# Results



## Challenges on bacteria for fermentation processes

Which processes in LCA databases to select as proxies? Or exclude? (Most studies <3%)











- Bacteria needed for fermentation, for example, lactic acid bacteria
- Data could be derived from scientific literature (e.g., Pénicaud et al. 2018 -> impact depending on storage time) or Agribalyse (lactic bacteria process, does not include Q)

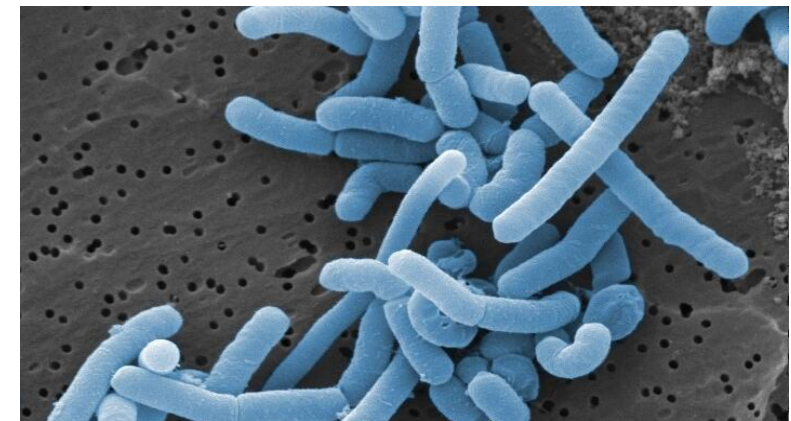


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Life cycle assessment of the production of stabilized lactic acid bacteria for the environmentally-friendly preservation of living cells

Caroline Pénicaud <sup>1</sup>  , Vincent Monclus <sup>1</sup>  , Bruno Perret  , Stéphanie Passot  ,  
Fernanda Fonseca  





# Conclusions & main messages



- Harmonization on selection of processes and proxies from LCA databases would be very helpful to come to comparable LCA results
- Beside process selection, harmonization should also be developed on methodological choices, e.g.:
  - *System boundaries (e.g. incl/exl capital goods/procssing equipment)*
  - *Requirements on primary data collection and what default values for secondary data*
  - *Allocation (economic, mass, ...?); especially in case of innovative products (low TRL yet)*
  - *LCIA method*

So, we are very happy about the algae LCA community and looking forward to come to a harmonized LCA standard for algae based products



# Thank you for your attention!

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Harmonising Algae-Based LCAs: Selecting Systems and Data Providers

Webinar, 4<sup>th</sup> February 2025