

CASCADING FRACTIONATION OF ALGAE BIOMASS AT LAB AND PILOT SCALE

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Introduction

Algae biomass processing and/or fractionation, is an activity that bridges algae biomass production and algae biomass use. During this step, the biomass is tailored towards specific applications, like cosmetics, feed and food.

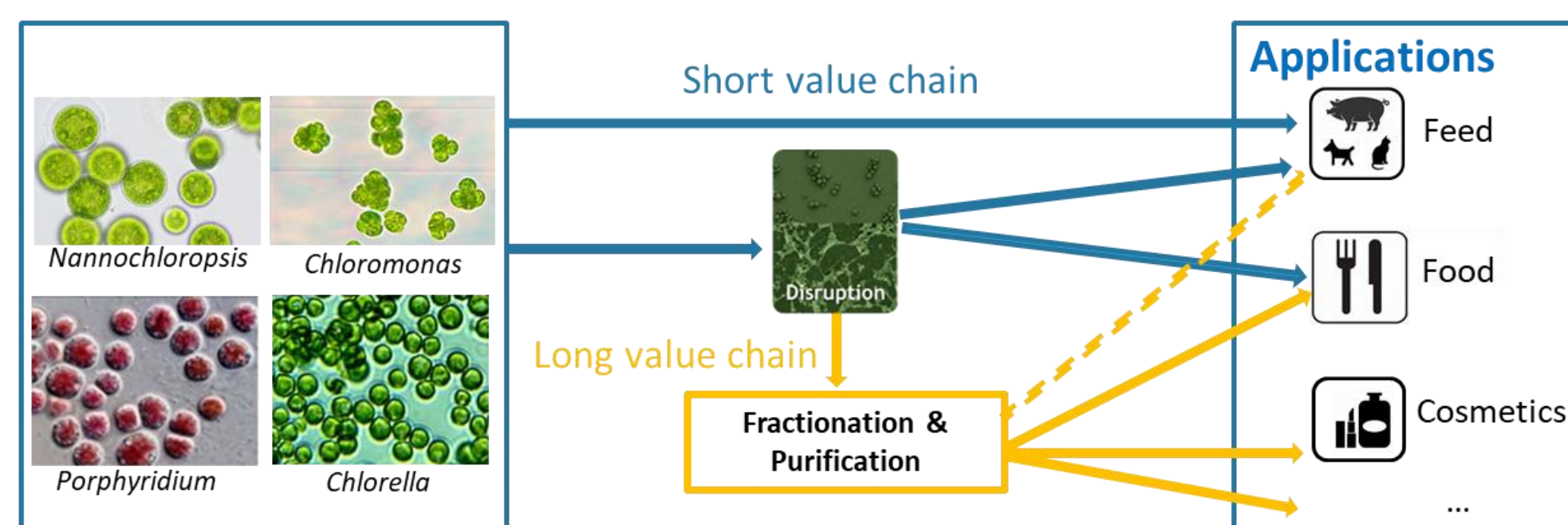


Figure 1: Algae processing and fractionation with algae value chains.

Aim: To elaborate cascading fractionation approaches for the algae species *Porphyridium purpureum*, *Chloromonas typhlos*, *Nannochloropsis* sp. and *Chlorella* sp.

Conclusions

- For all algae species, a cascading fractionation was elaborated → main focus on simple approaches resulting in an algae oil for cosmetic applications and a remaining fraction for feed applications.
- Also other cascading fractionation processes were considered, targeting fractions enriched in sugars, proteins, colorants.
- Algae oils with suitable fatty acid compositions and acceptable color and odor were produced for cosmetic applications - lab scale & upscaling to pilot scale.
- Besides nutritional feed ingredients, mainly bioactive ingredients were targeted because of their higher value and lower dosing %.
- Salt concentrations in algae = major point of attention for feed applications. Salt should be reduced as much as possible (< 5-10 % on dry matter basis), which requires actions already at harvest time.
- Multiple algae biomass were produced for in vitro & in vivo application trials.

Overview of cascading fractionating approaches

The technologies used comprise beadmilling, solvent extraction, supercritical extraction, water based precipitation reactions, enzymatic conversions, centrifugation, filtration, sorption and (freeze)drying.

Feedstock	Harvesting		Desalting	Cell disruption	Fractionation	Products	Drying	Application fields envisioned in IDEA		
<i>Porphyridium purpureum</i>	Centrifuge	Algae paste	optional	Freezing (& freeze drying)	Yes	Sugar enriched fraction	Freeze drying	Food, pet food, feed, cosmetics		
						Protein enriched fraction	Freeze drying	Food, feed, pet food		
					No	PE (= colorant)	Freeze drying	Food, niche lab wholesalers		
		Centrate			No	Disrupted (desalted) <i>Porphyridium</i>	Freeze drying	Feed/pet food		
					Yes	Lipid extract	na	Cosmetics		
						Defatted fraction	(freeze drying)	Fed/pet food		
<i>Chloromonas typhlos</i>	MAF - centrifuge	Algae paste		Beadmill	No	Disrupted <i>Chloromonas</i>	Freeze drying	Pet food		
						lipid extract	na	Cosmetics		
					Yes	Defatted fraction	(freeze drying)	Fed/pet food		
		Filtrate							Medium re-use	
									Medium re-use	
									Medium re-use	
<i>Nannochloropsis</i>	MAF + centrifuge	Algae paste	Yes	Beadmill	Yes	Lipid extract	na	Cosmetics		
						Residual fraction	Freeze drying	Feed, pet food		
					No	Disrupted (desalted) <i>Nannochloropsis</i>	Freeze drying	Feed, pet food		
		Filtrate			No	Whole cells	yes and no	Aquaculture feed		
									Medium re-use	
									Medium re-use	
<i>Chlorella</i> sp.	MAF - centrifuge	Algae paste	Optional	Beadmill	No	Disrupted (desalted) <i>Chlorella</i>	Freeze drying	Pet food		
					Yes	Lipid extract	na	Cosmetics		
		Filtrate							(freeze drying)	Medium re-use
									Medium re-use	

Processing & fractionation of algae biomass

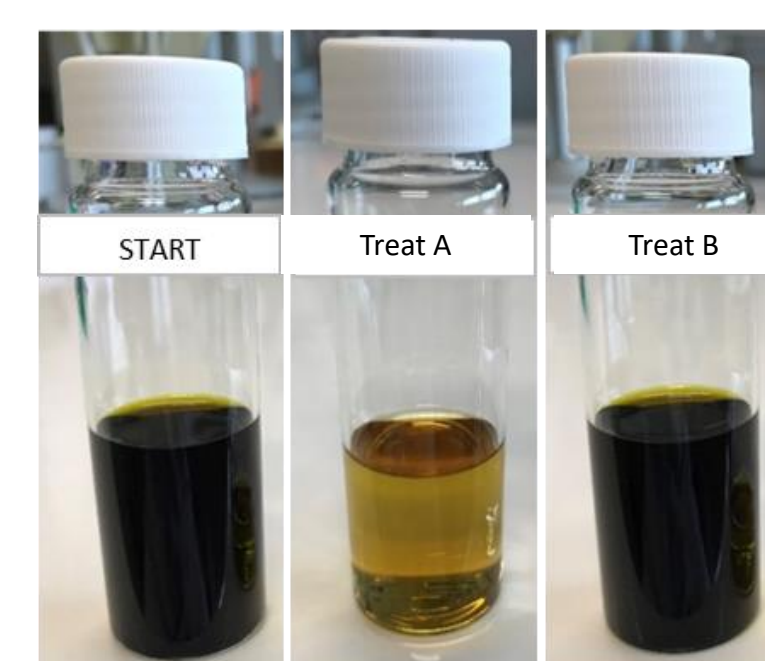
Algae oil as ingredient for cosmetics

Cosmetics = a higher value application

- Small amounts of biomass required to start a commercial application
- Specific requirements related to odor, color and composition.

Techniques used:

- Solvent extraction and supercritical fluid extraction (SFE)
- Precipitation and sorption reactions



Lab scale algae oil extracts



Pilot scale extractions

