



biochemistry

Inspired by nature
— realized by science





biochemistry

Produktion hochwertiger Inhaltsstoffe in sterilen Schneeealgen-Kulturen

D-A-CH Algen Summit 2021

Bernhard Henes



Snow Algae Powder

Key to skin's longevity



The secret of the red snow



- Sometimes a red colour in the snow can be discovered
- Mainly in summer, sun exposed snow slopes can show a redish colour
- Colour comes from spores of snow algae
- The red colour protects the algae against extreme UV-radiation
- Today about 350 species of snow algae are known.

Snow algae - Life cycle with two phases



In spring

Snow algae are buried under the snow and appear green (chlorophyll pigments to produce energy)

- movement to snow surface (flagella)
- snow algae propagate



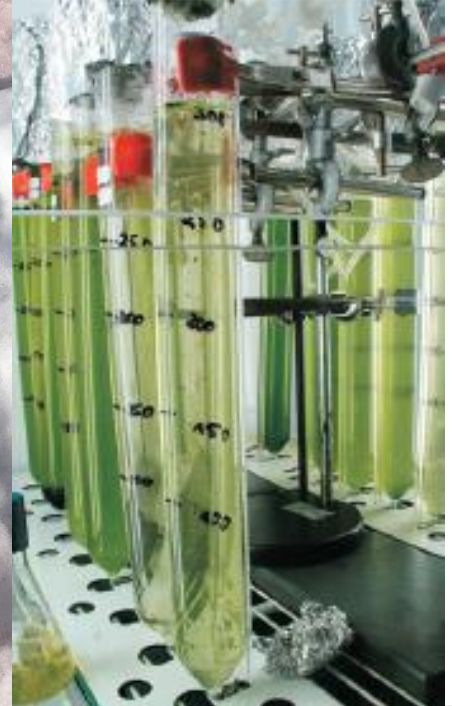
Early summer

Snow algae reach the surface

- strong UV light, low nutrients
- algae turn red (spores)

In the form of spores, the snow algae survive under a blanket of snow until next spring.

Harvesting of snow algae, cultivation in the lab and biomass production



Green- and red life cycle of snow algae



Growth and reproduction stage

- Chlorophyll (photosynthesis → energy)
- Flagella



Stress:
UV, lack of nutrients

Dormant stage (spores)

- Carotenoids
- Antioxidants
- Polyphenols
- Biopolymers (gallerten)
- Antifreeze glycoproteins (AFGPs)
- Osmotically active aminoacids and sugars

→ Interesting metabolites

Production of Snow Algae Powder



Favourable conditions

- High nutrition
- Light

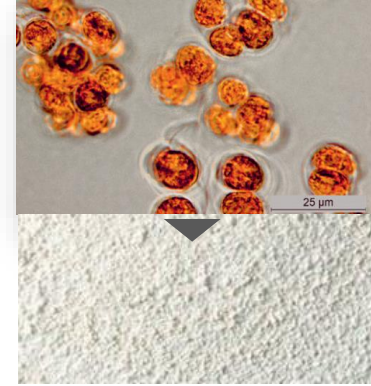
Algae are green (chlorophyll) and propagate



Changing the conditions

- Nutrients are reduced
- Light is strongly increased

Algae produce carotenoids to protect against light, cells stop growing



Harvesting

Opening of the cell walls, encapsulation of cell fragments and content into liposomes.

Spraying on a powder based on maltodextrin.

Previous setup



- Difficult to clean
- Difficult to sterilize
- Difficult sterile handling
- limited gas exchange

Why developing an axenic process?

- No (endo-)toxins, no allergens from contaminations
- Better reproducibility
- Better storability
- No separation necessary
- Selling argument – high level competition
- Cosmetic market can be emotional, sometimes not rational at all
- Regulations still far away from pharma, but requirements increase!

Axenic photobioreactors, a niche

GREENOVATION
Biopharmaceuticals

Therapeutics for orphan diseases



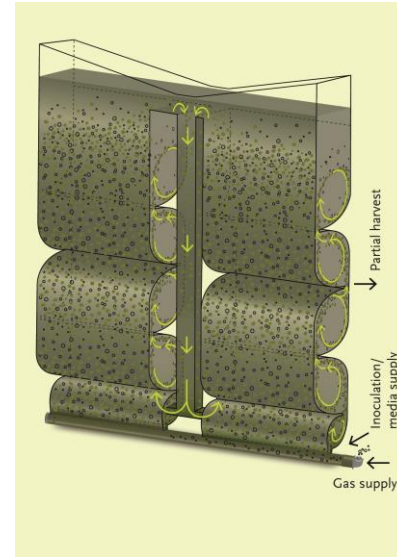
- Volume to surface ratio
- Sterile handling



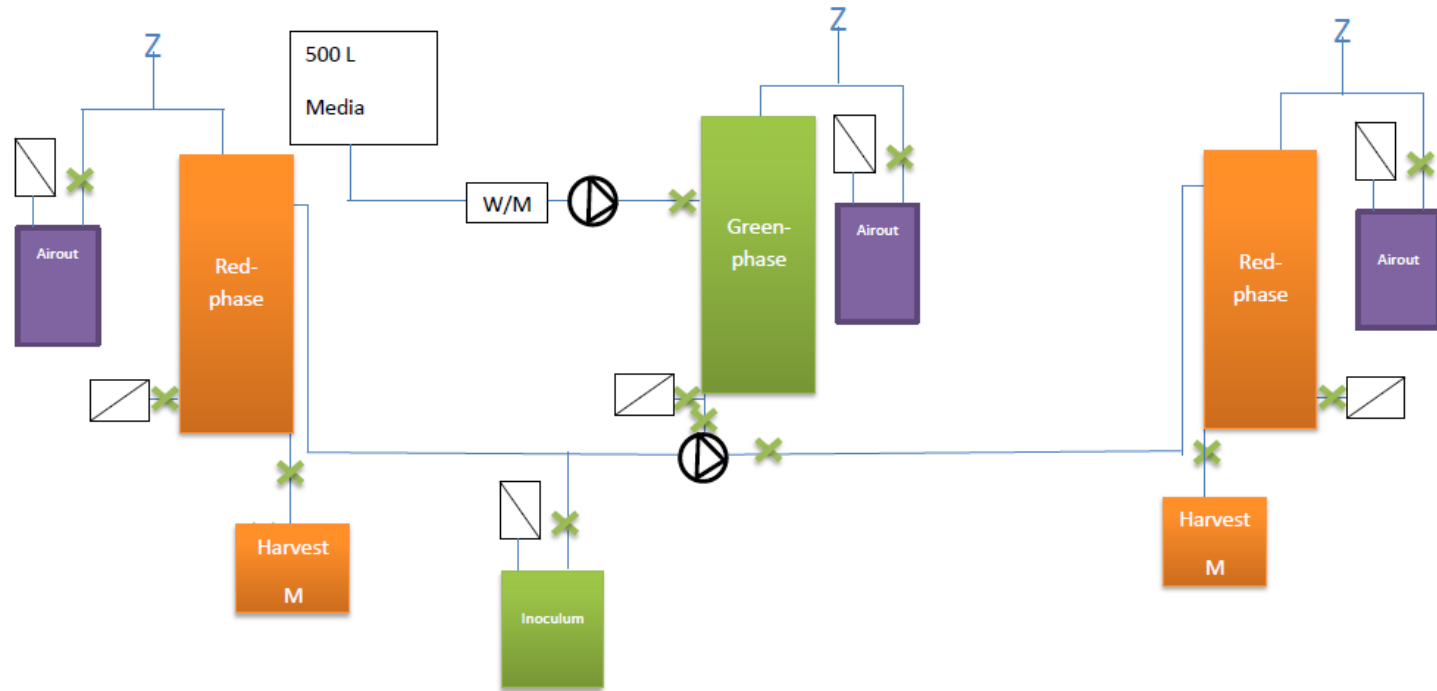
Subitec GmbH



- Difficult to clean → just don't
- Difficult to sterilize → find a way
- Difficult sterile handling → question of setup
- Good gas exchange
- Good volume/surface ratio

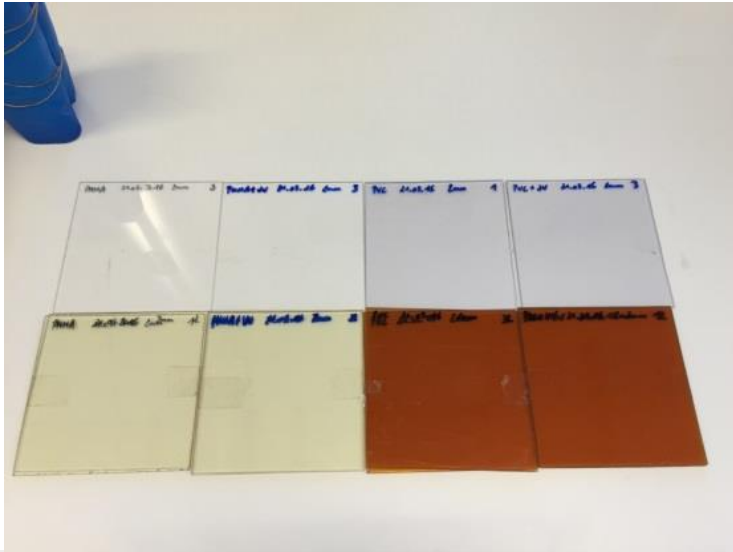


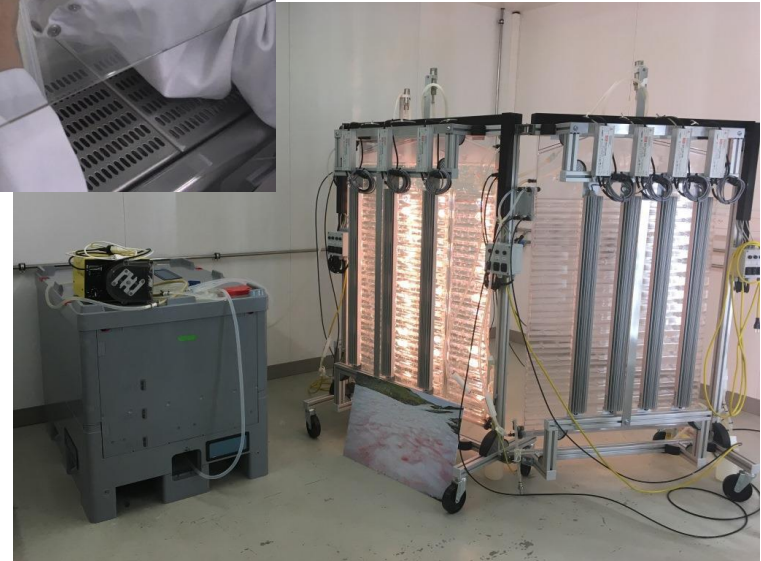
Single-use concept of a 2-phase process – repetitive batch mode

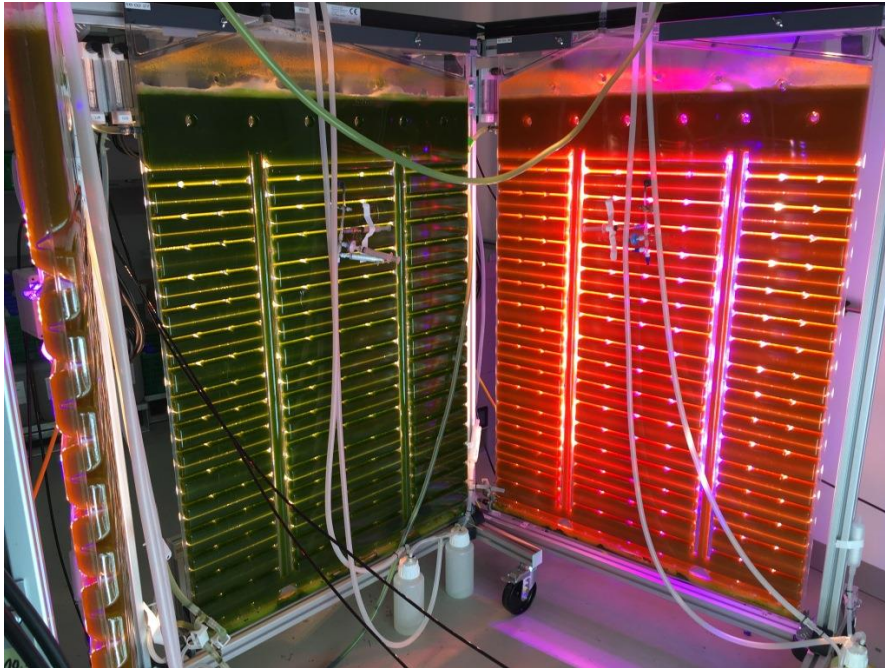


Sterilization of the bioreactors

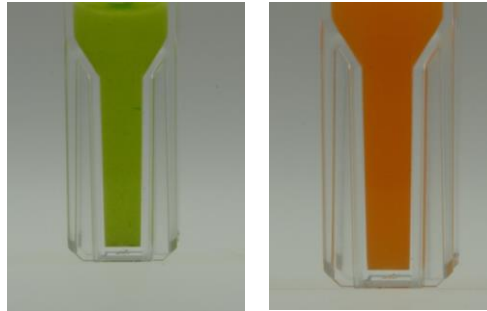
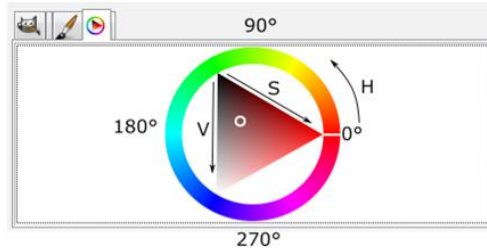
X-Ray, 8 – 15 kGy



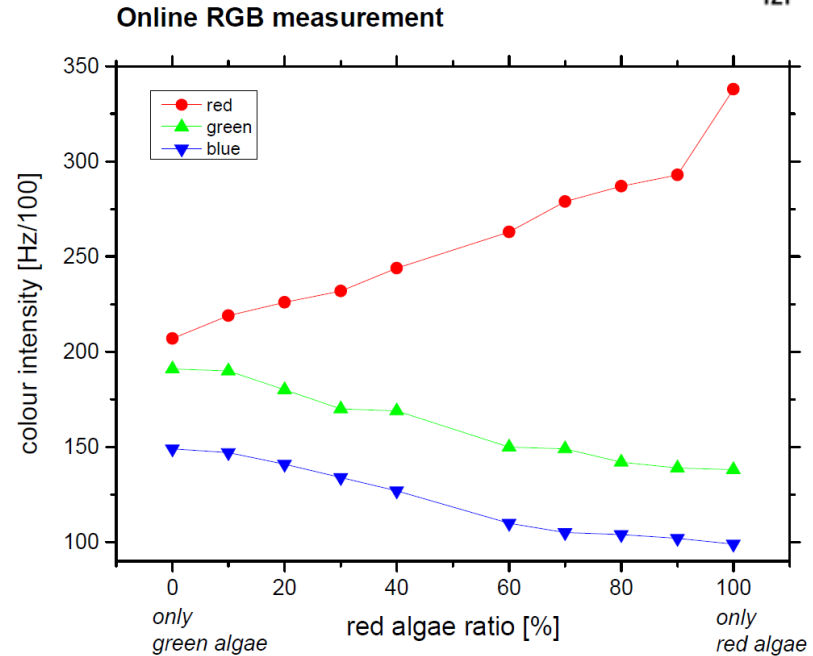




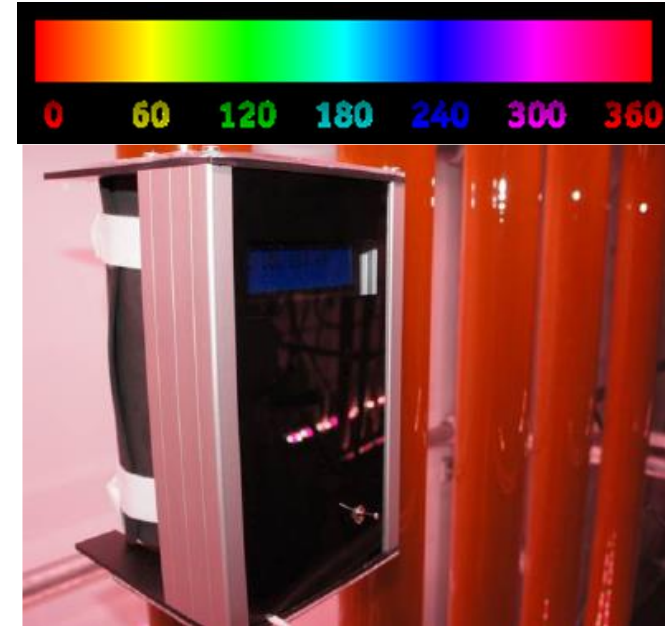
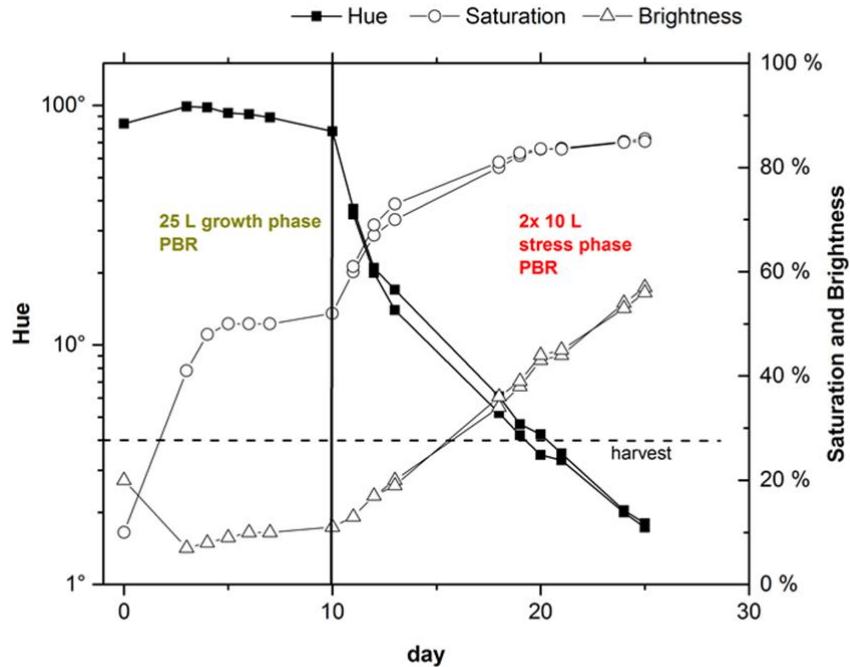
Harvesting when product-time yield is optimal – How to control?



No correlation with UV/VIS-Spectroscopy

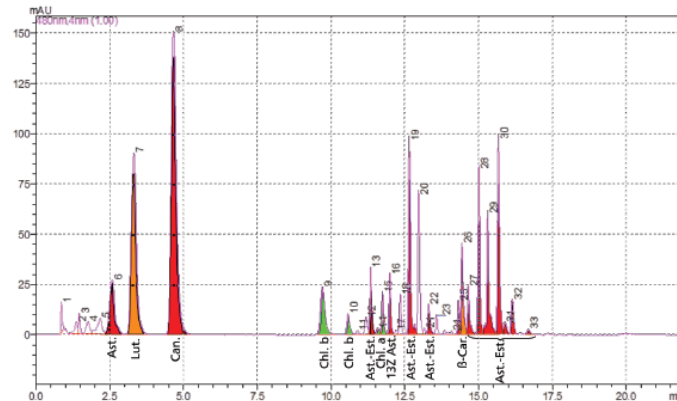
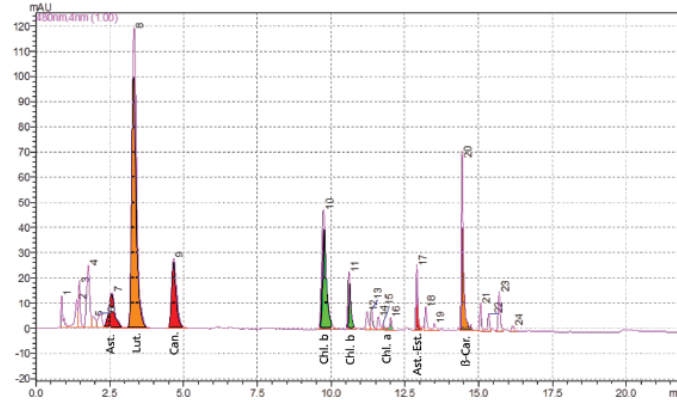
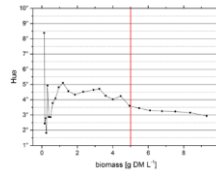
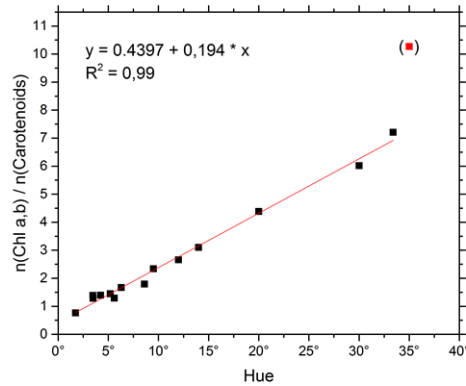


Optical non-contact online sensor in real time

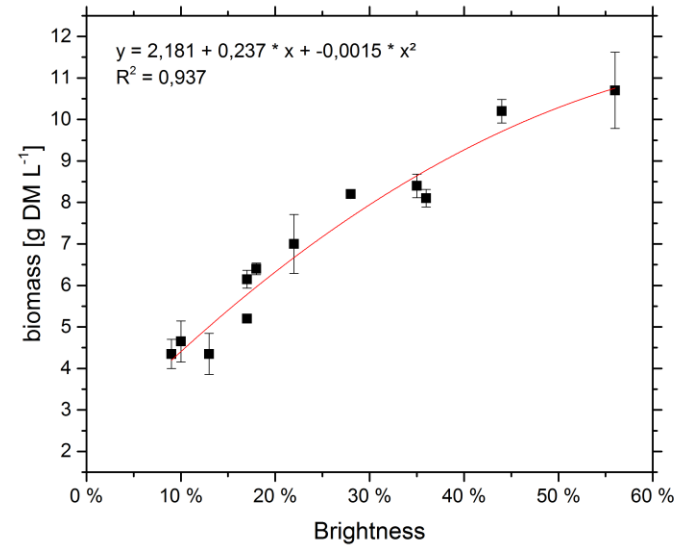
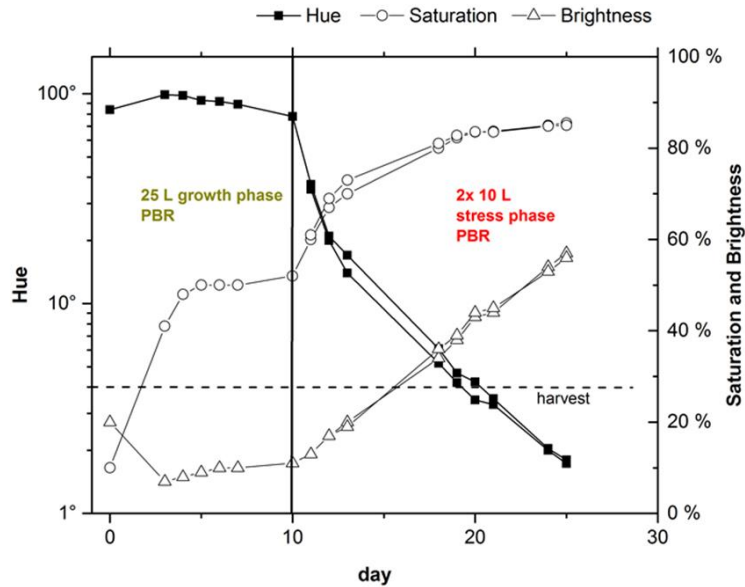


Correlation!

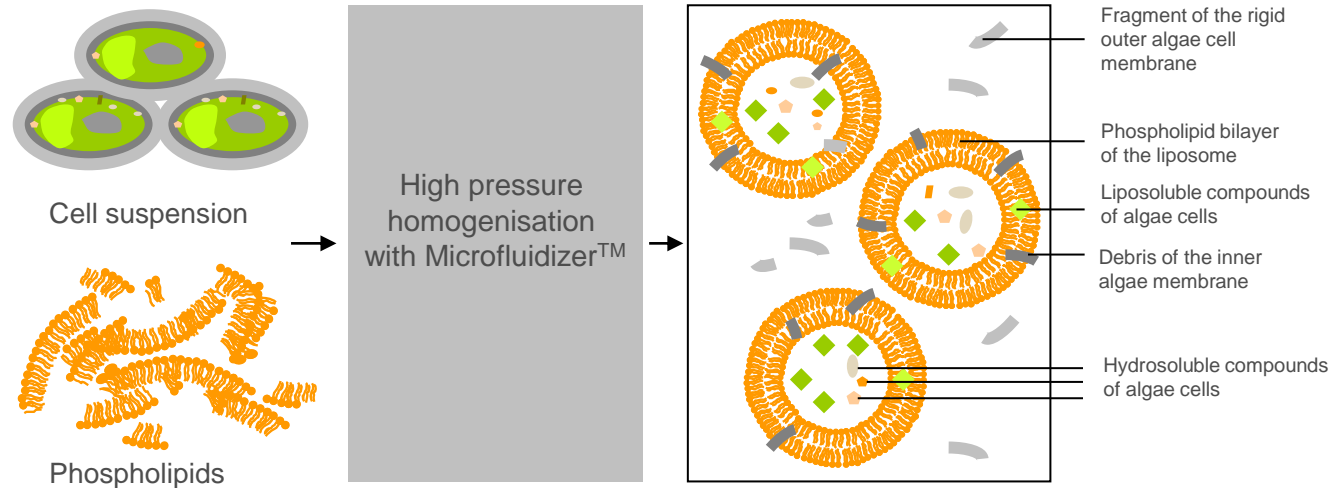
		[g mol ⁻¹]	
Chlorophyll a	Chl a	893,51	Chlorophylle
Chlorophyll b	Chl b	907,49	
Lutein	Lut	568,87	primäre Carotinoide
beta-Carotin	β-Car	536,89	
all-trans-Astaxanthin	Ast	596,84	sekundäre Carotinoide
all-trans-Astaxanthinester	Ast-E	-	
Canthaxanthin	Can	564,82	

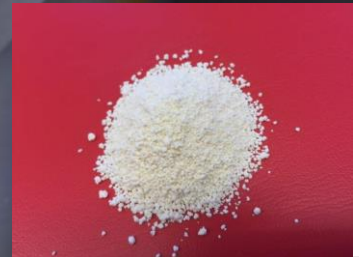
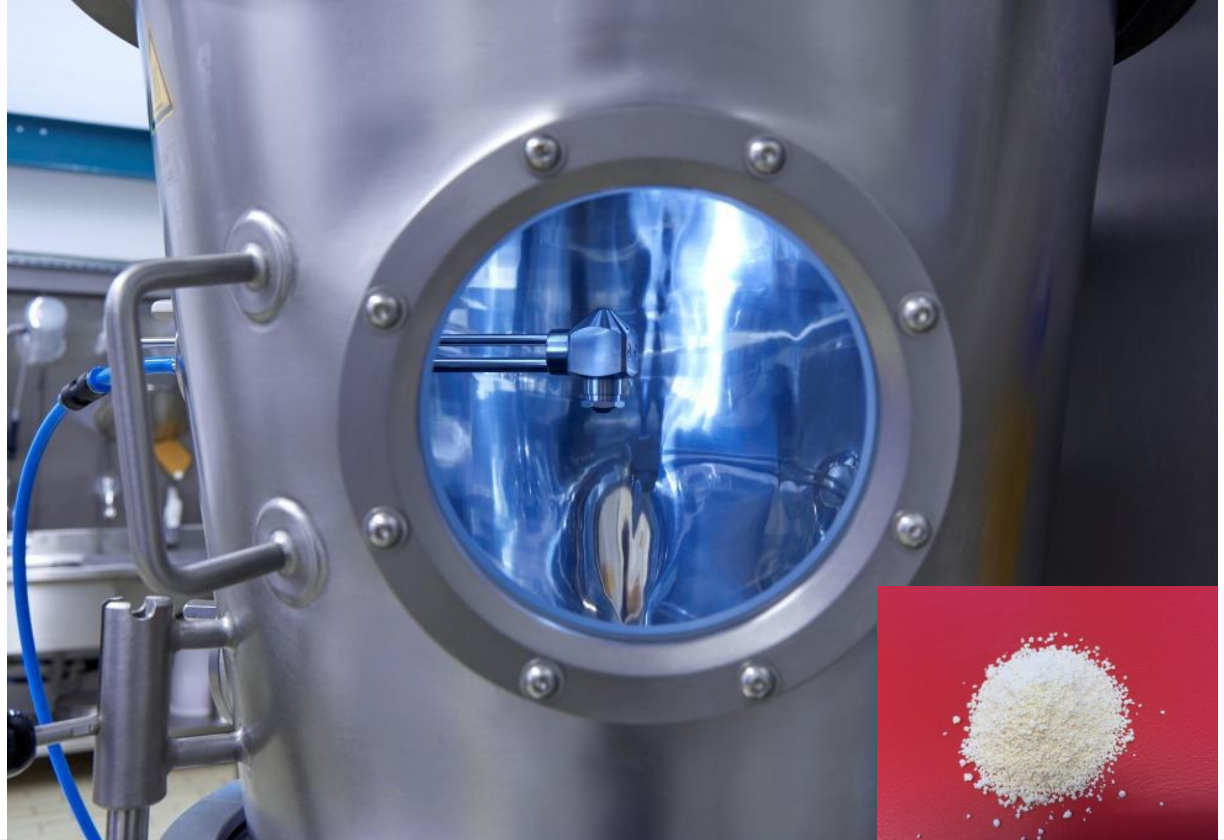


Biomass approximation



Schematic production procedure of Snow Algae Powder





Snow Algae Powder

A new cosmetic ingredient

- Unique source
- Produced by sustainable biotechnology
- With a novel activity:

→ Caloric restriction mimetic anti-aging

<http://www.snow-algae.com/>



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