



# **AlgenBiomasse-Verarbeitung: Herausforderungen einer jungen Industrie**

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# Topics



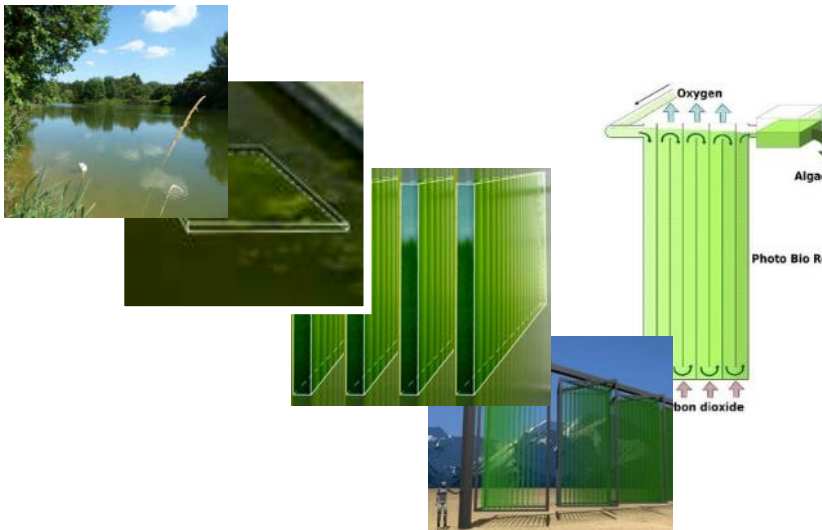
- Ecoduna Technology 2016
- R&D – which approach to choose
- Production & Downstream processing
- Challenges & prospects



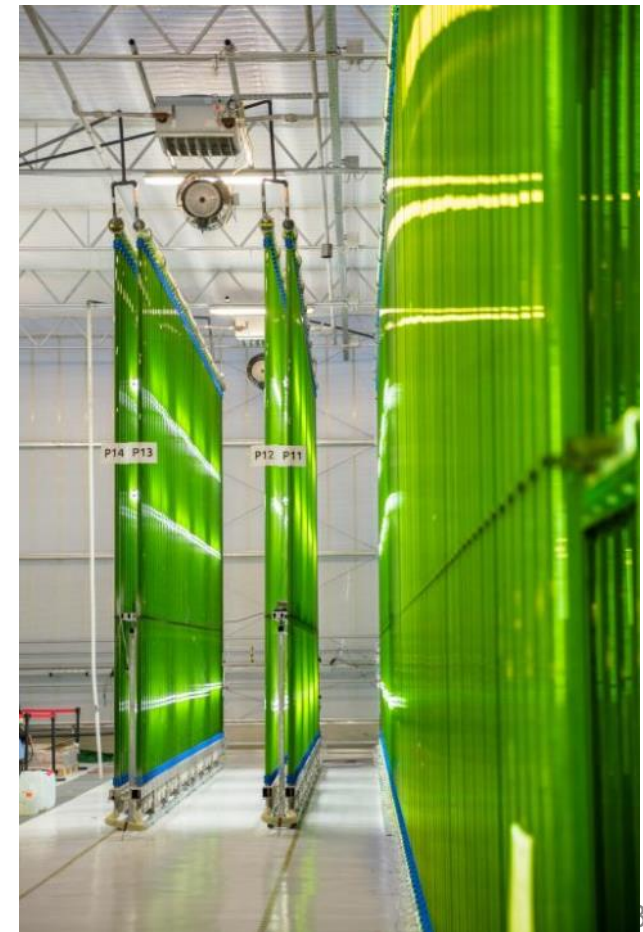
# The 'hanging garden Technology' 2016

Concept:

- mimicking nature – 3D structure to optimize light capture



2007-2015

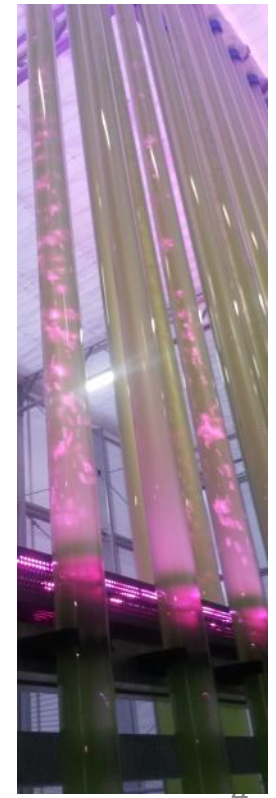


- Technology change: From Polycarbonate to Glass
- Bubble column reactor – 6m high



# Highly efficient light harvesting

- Optimal for higher latitudes
  - High percentage of light stays in the system due to reflections
  - ‚light sucking‘ effect
  - Gas bubble reflections



# R&D & production: the next step

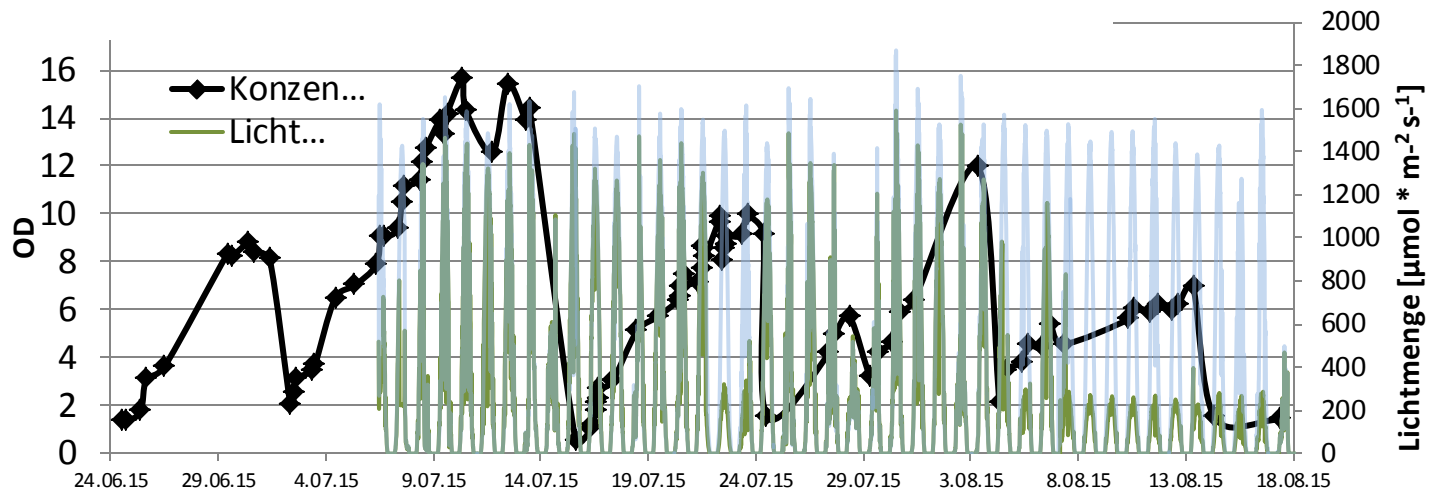
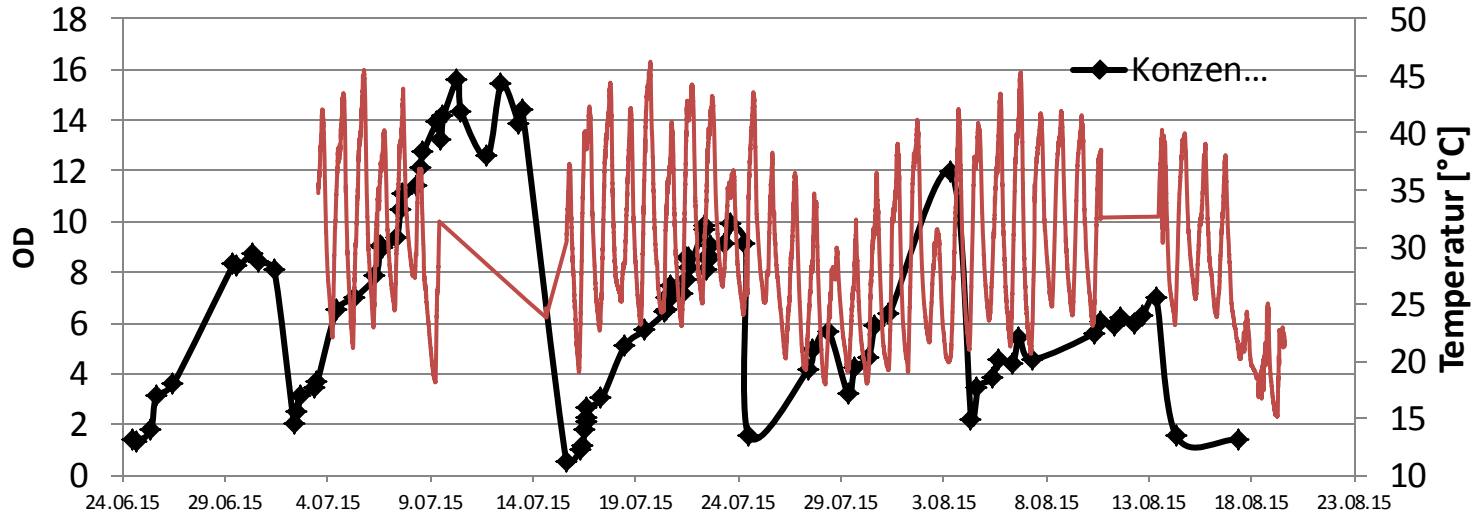
- 1ha
- Construction will start in Q4/2016
- First production summer 2017
- 1st step: 600m<sup>3</sup> photoactive volume with option to increase volume on the same footprint
- 100t/a biomass



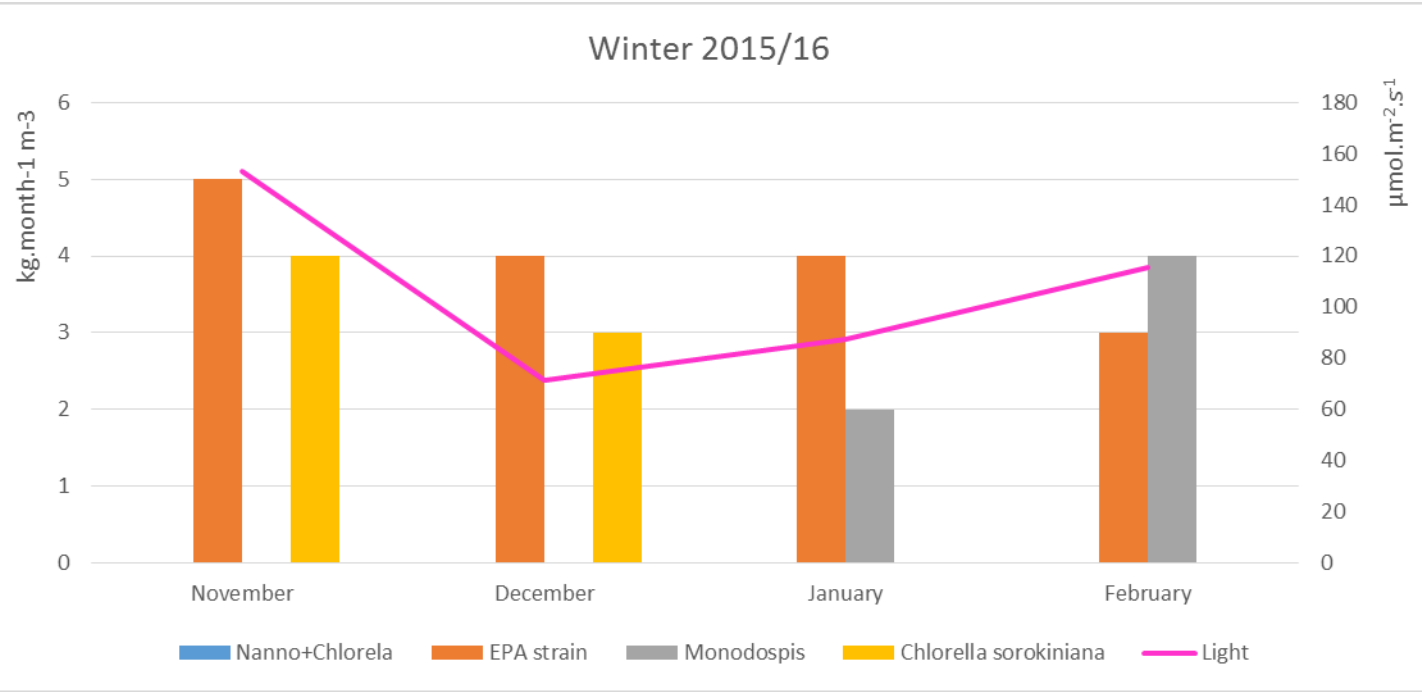
# Semi batch harvesting & continuous mode



12m Reaktor Wachstum vs. Temperatur. Mixed culture (Chlorella & Nanno + 1% NaCl)

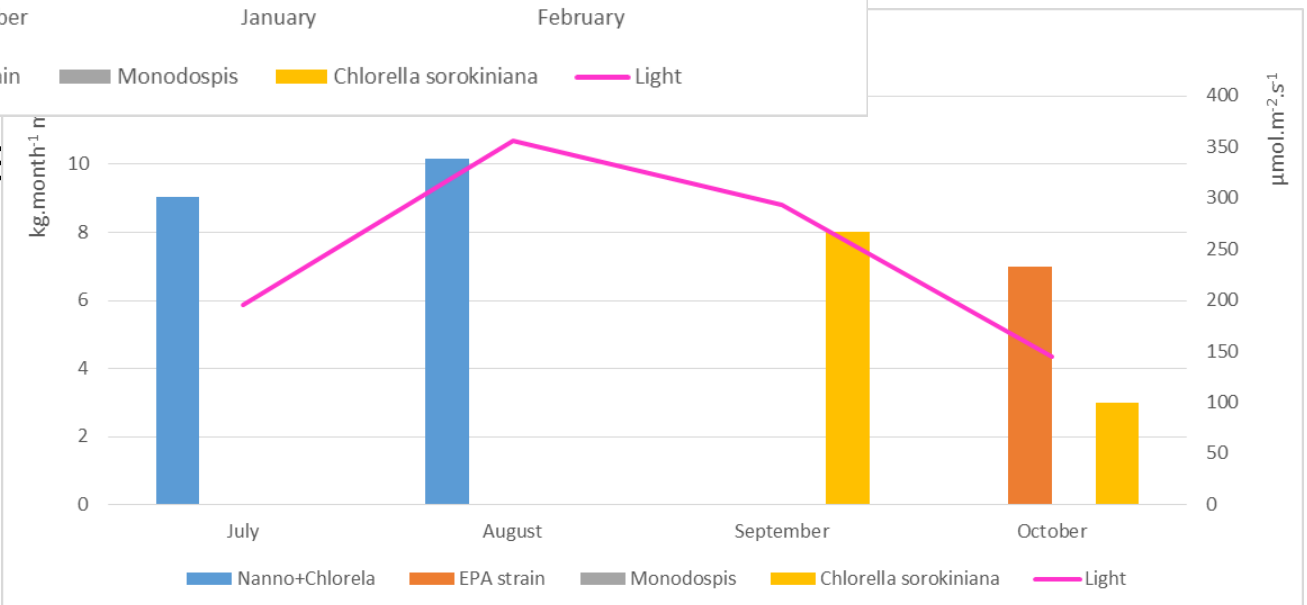


# Productivity



Semi batch harvesting

monitoring & harvesting



# Biomass processing

Areas that still are in their infancy

- Harvesting
- Drying
- Cell disruption
- Extractives





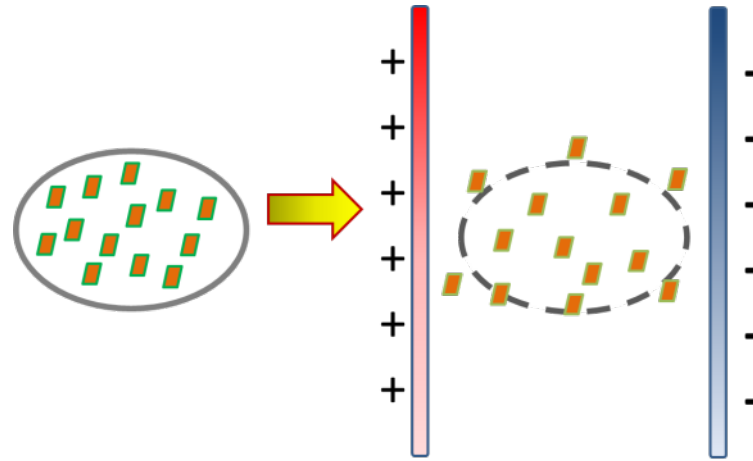
# Solar belt dryer



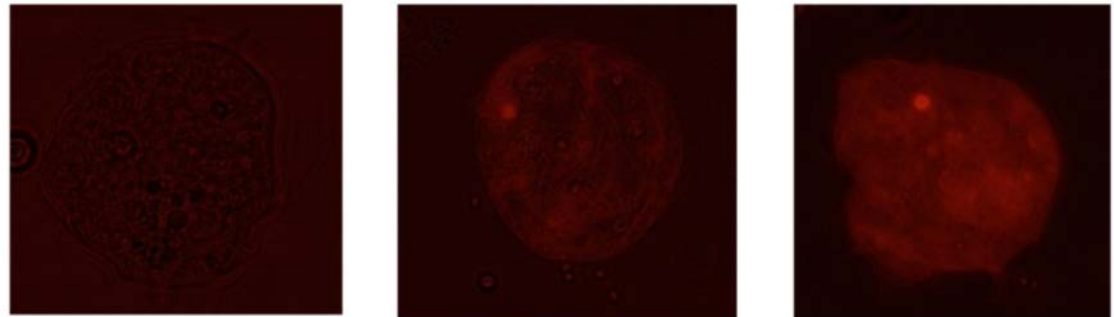
*,downstream use defines technology to be used'*

# Cell disruption

- PEF (pulsed electric field)
- Enzymatic
- Mechanic
  - Wet
  - Dry



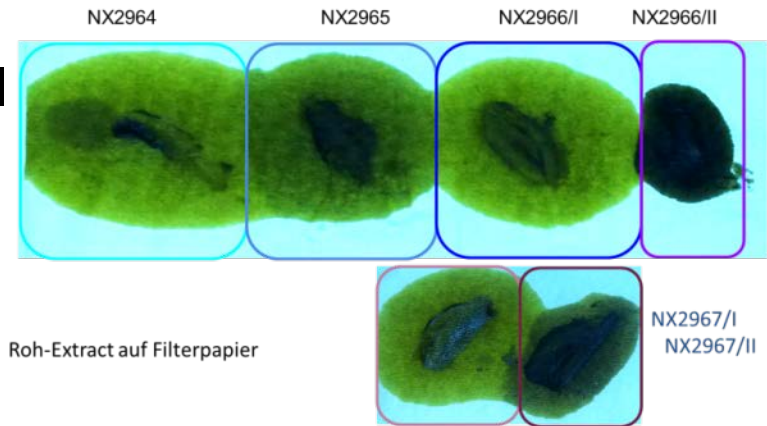
PEF: Pore formation due to impact of electrical field applied



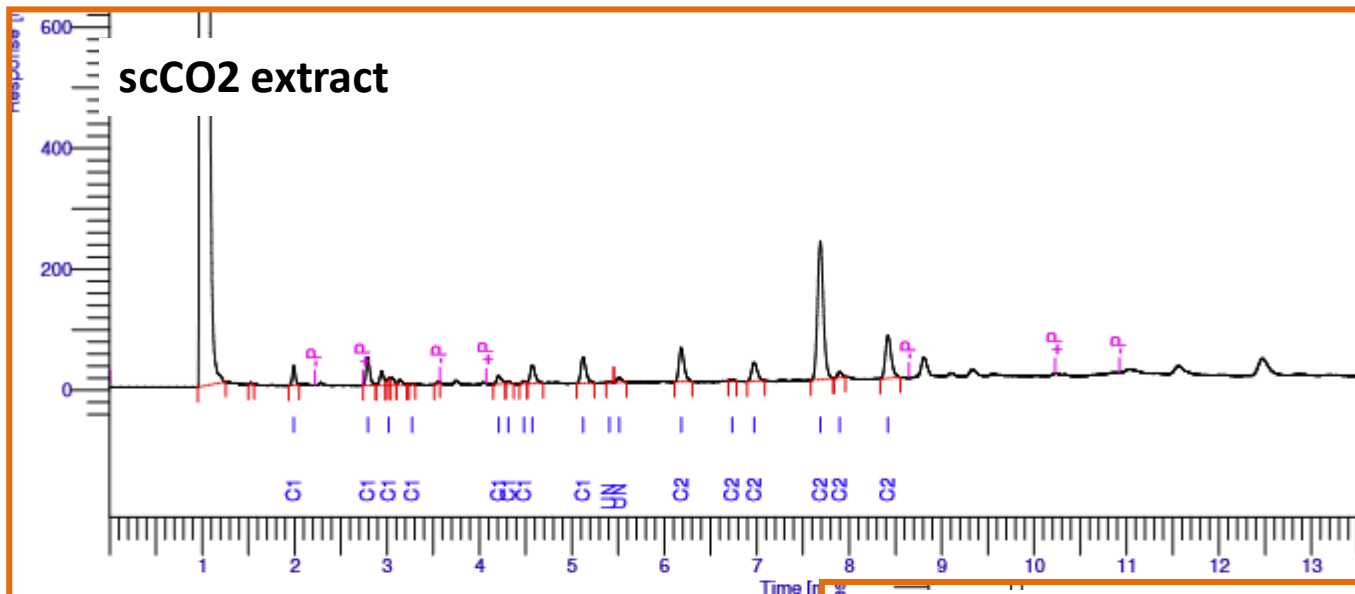
Energy input: 1.28, 8.24, 15.10 kJ/Kg

# Using spray dried Biomass for FA extraction

- Supercritical CO<sub>2</sub> extraction
  - Consistency of biomass is critical
  - Different additives
  - Assessment of product quality

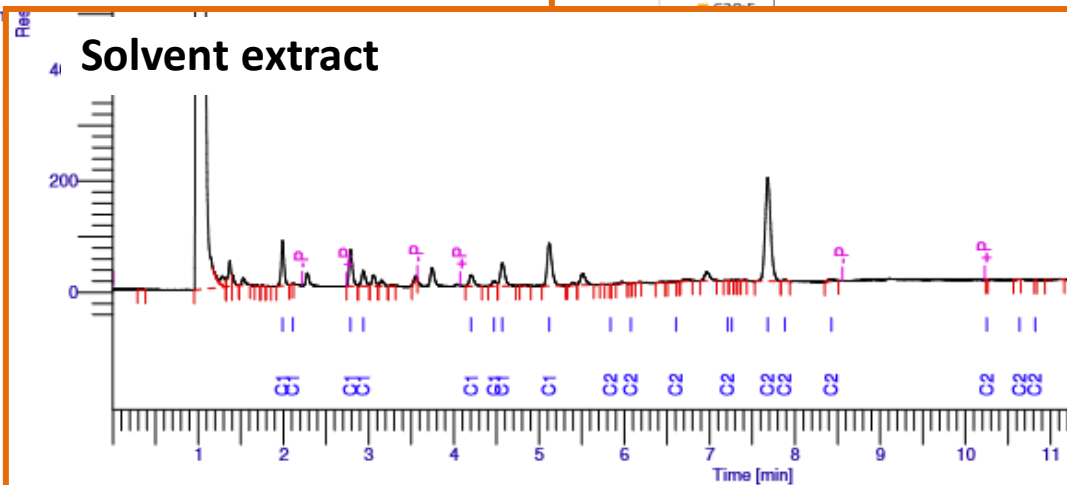


# FA analysis



## Ecoduna FAM

Peak #	Component Name	Time [min]	Area [uV*sec]	Adjusted Amount	Raw Amount	Amount [Norm. %]
3	C14:0	1,99	70452,70	24,1	24,1	3,34
4	C16:0	2,79	126733,03	48,9	48,9	6,78
6	C16:1	3,02	24943,57	9,0	9,0	1,24
9	C17:0	3,27	3588,47	-1,1	-1,1	-0,15
11	C18:0	4,21	51494,88	19,3	19,3	2,67
12	C18:1oleate	4,31	14972,52	19,2	19,2	2,67
13	C18:1vaccenate	4,48	14269,92	5,8	5,8	0,80
14	C18:2n6c	4,57	114787,20	33,9	33,9	4,69
15	C18:3n3	5,12	164959,82	48,2	48,2	6,67
16	unknown peak0	5,41	4359,97	0,0	0,0	0,00
17	unknown peak1	5,51	28581,21	0,0	0,0	0,00
18	C20:1n9	6,18	216717,53	68,9	68,9	9,54
19	C20:2n6	6,73	6599,52	3,1	3,1	0,43
20	C20:4n6	6,97	132539,41	39,7	39,7	5,50
21	C20:5n3	7,69	1013075,34	295,2	295,2	40,91
22	C22:0	7,90	30776,31	10,7	10,7	1,48
23	C22:1n9	8,42	311011,66	96,9	96,9	13,42

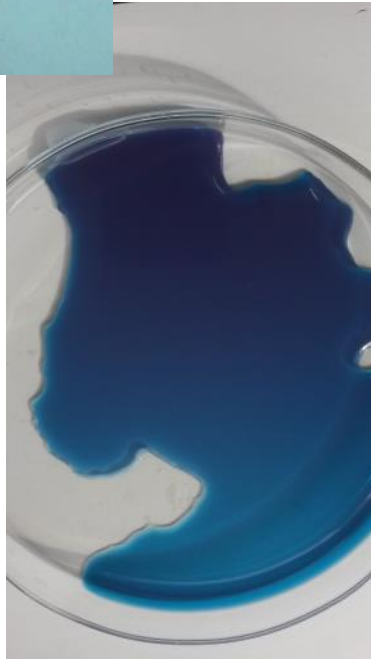
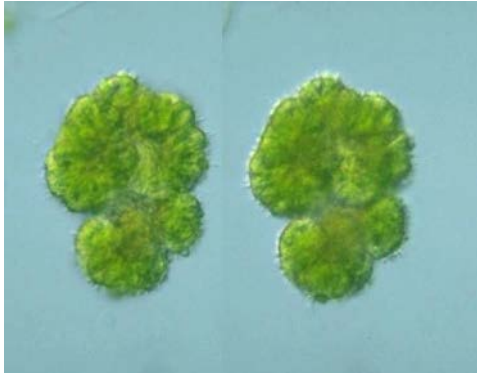


## Ecoduna FAME Report

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# Biomass or biorefinery?

## Monoculture or community approach?



- Large scale production today: monoculture
- Exposed to various threads
- Biomass or few established extractives

### Options

- -> flexibility of system allows economical stability and risk mitigation **Combinatorial strategy**
- -> **community approach:** (Botryococcus) working with nature

# Conclusions



## Challenges

- Development of industrialized downstream processes
- Market readiness – niche markets still need R&D
- There is no ‚golden standard‘ yet
- Combinatorial or community approach for risk mitigation

## Prospects

- Biological systems understanding will help development of the sector
- Strain improvement will improve productivity and stability
- New markets

# Thank you!

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