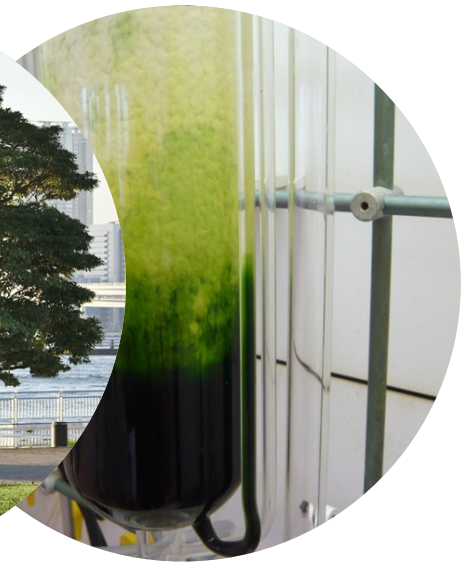
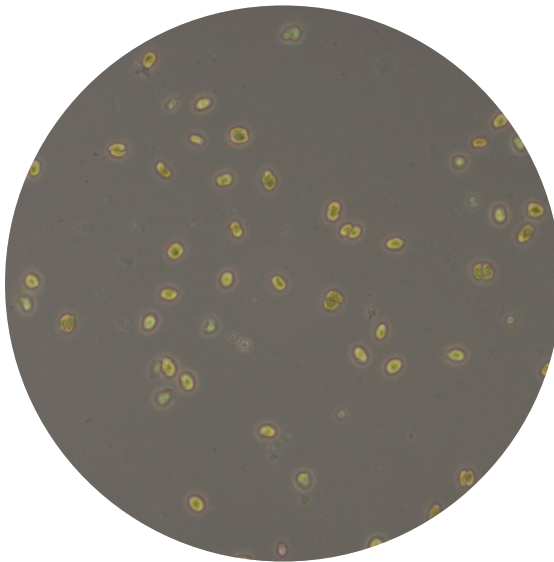


Algae biorefinery: proteins for technical applications

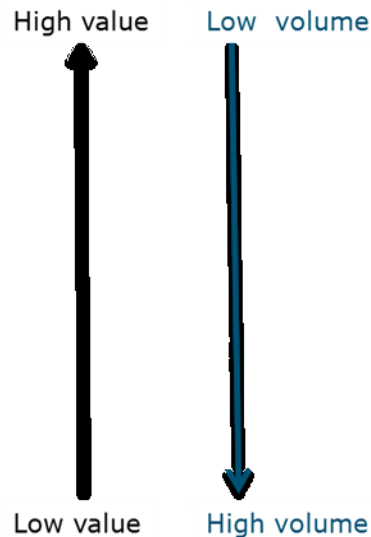
Lambertus van den Broek, Carl Safi, Wim Mulder and
Lolke Sijtsma

February 18th, Wageningen



Introduction

- Biorefinery: a facility that integrates biomass conversion processes and equipment to produce fuels, power, heat, and value-added chemicals from biomass



pharma / flavors / fragrances /

food (/ feed)

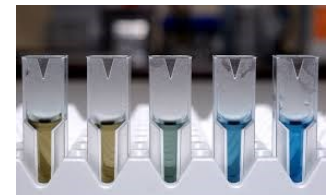
fine chemicals / functional
materials

feedstock chemicals / fibers

fuel / fertilizer

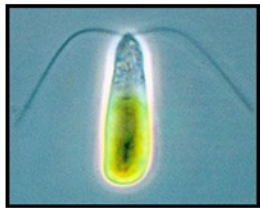
Protein analysis

- Non-stressed micro algae contain 30-60% (w/v dm) protein
- Protein content can be determined by the total amino acid content
- Total protein: Kjeldahl or DUMAS (N-to-protein factor)
- Soluble protein: Lowry, BCA, Sedmak, Bradford etc.

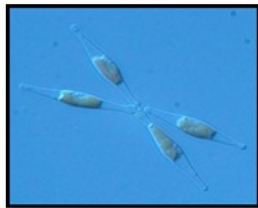


Micro algae

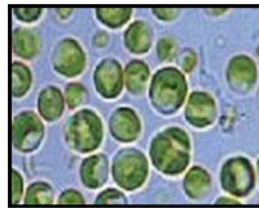
- Different algae needs different biorefinery approaches



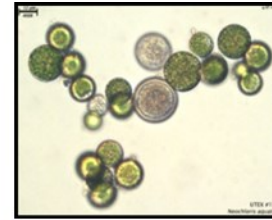
Dunaliella



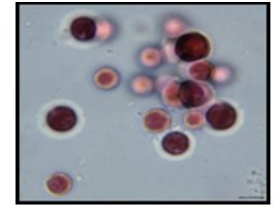
Phaeodactylum



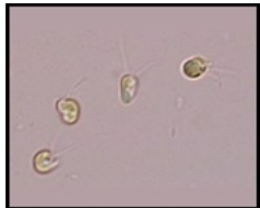
Nannochloropsis



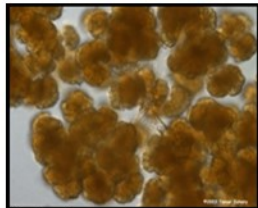
Neochloris



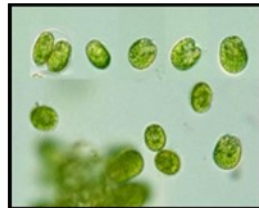
Porphyridium



Isochrysis



Botryococcus



Tetraselmis

Microalgae production
and harvesting

Cell disruption

Extraction/Fractionation

Hydrophilic
components

Hydrophobic
components

Cell disruption

- Mechanical disruption techniques



- Bead mill

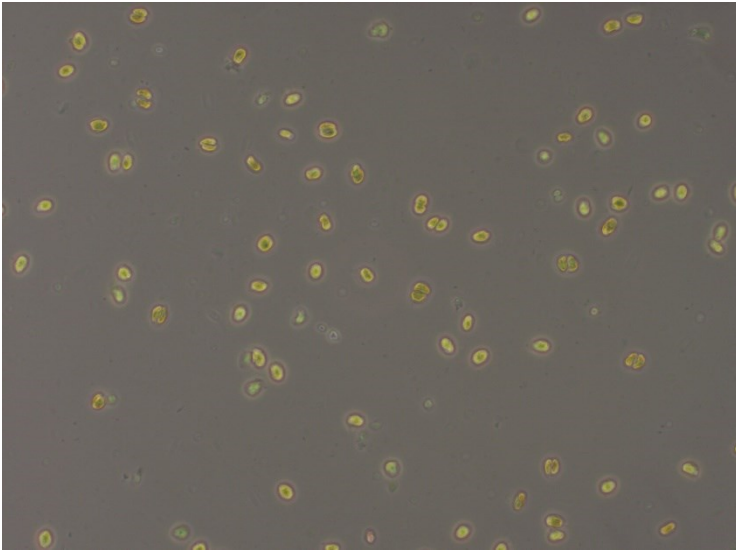


High Pressure homogenisator

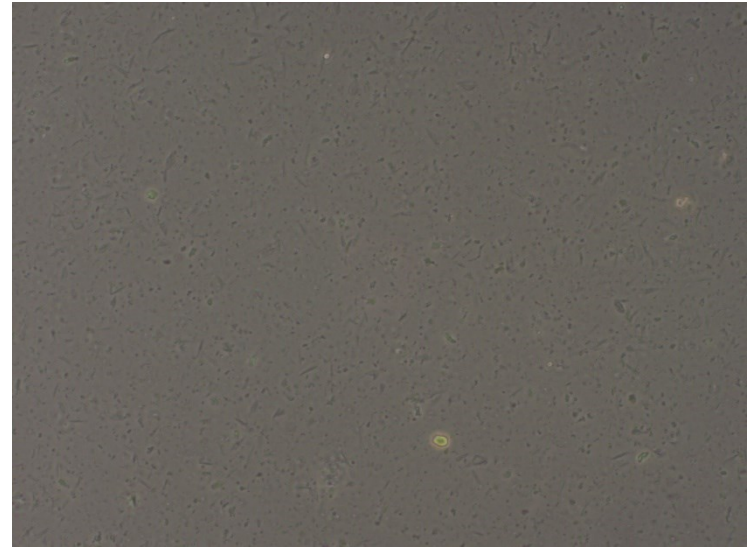


Cell disruption

Cells before bead milling

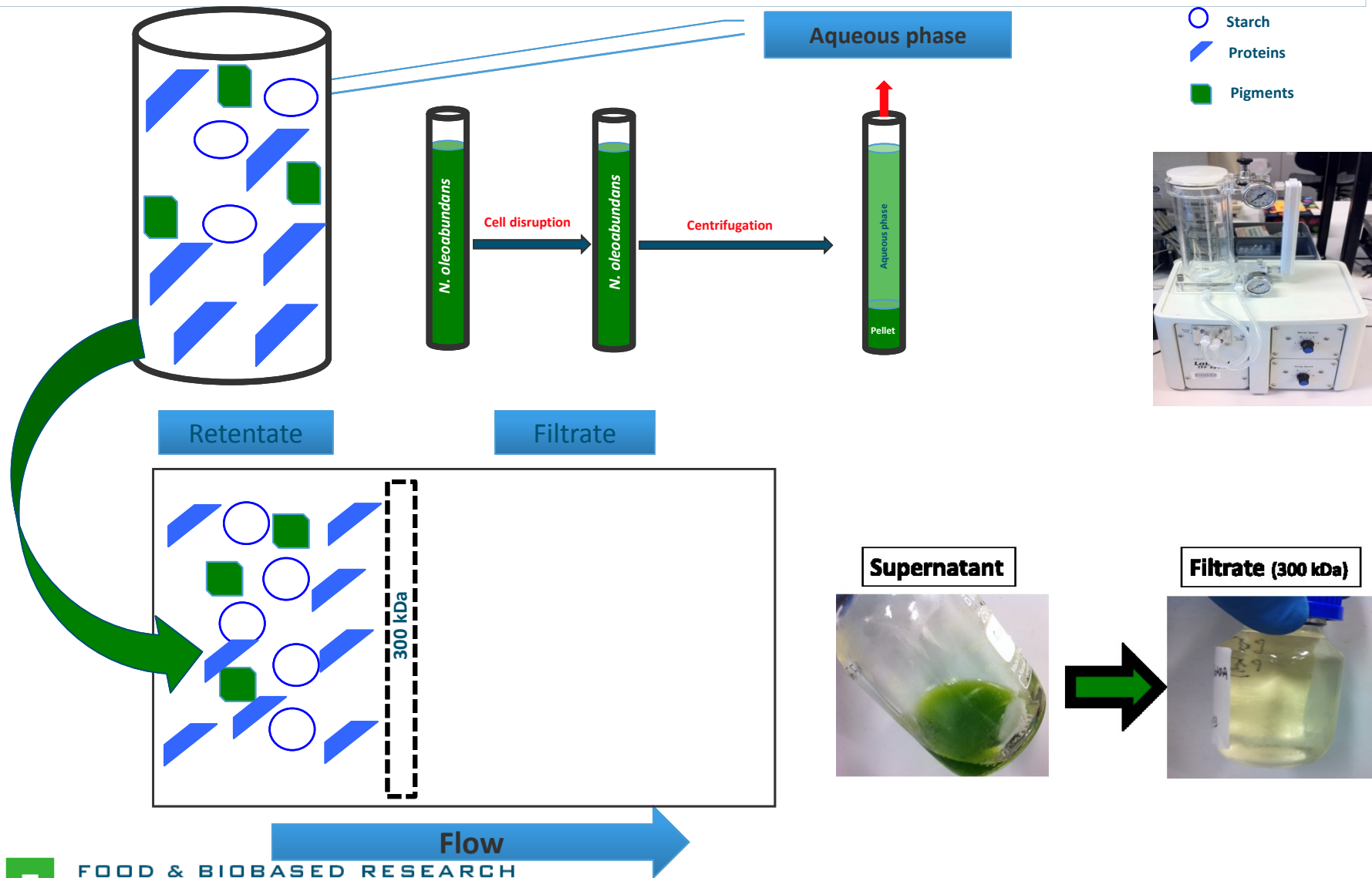


Cells after bead milling



- Material is centrifuged for filtration

Filtration

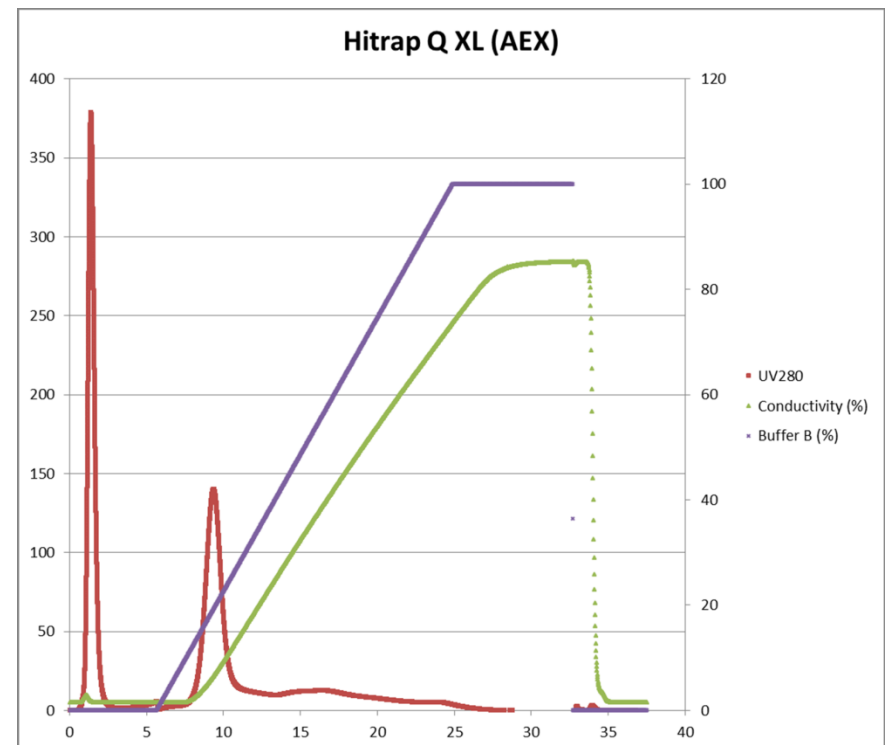


Fractionation

- Column chromatography
 - anion exchange
 - hydrophobic interaction
 - gel permeation



Anion exchange chromatography



Functional properties

■ Techno-functional properties

- Solubility
- Emulsification
- Foam stability
- Surfactant
- Gelation
- Bio-assays for peptides

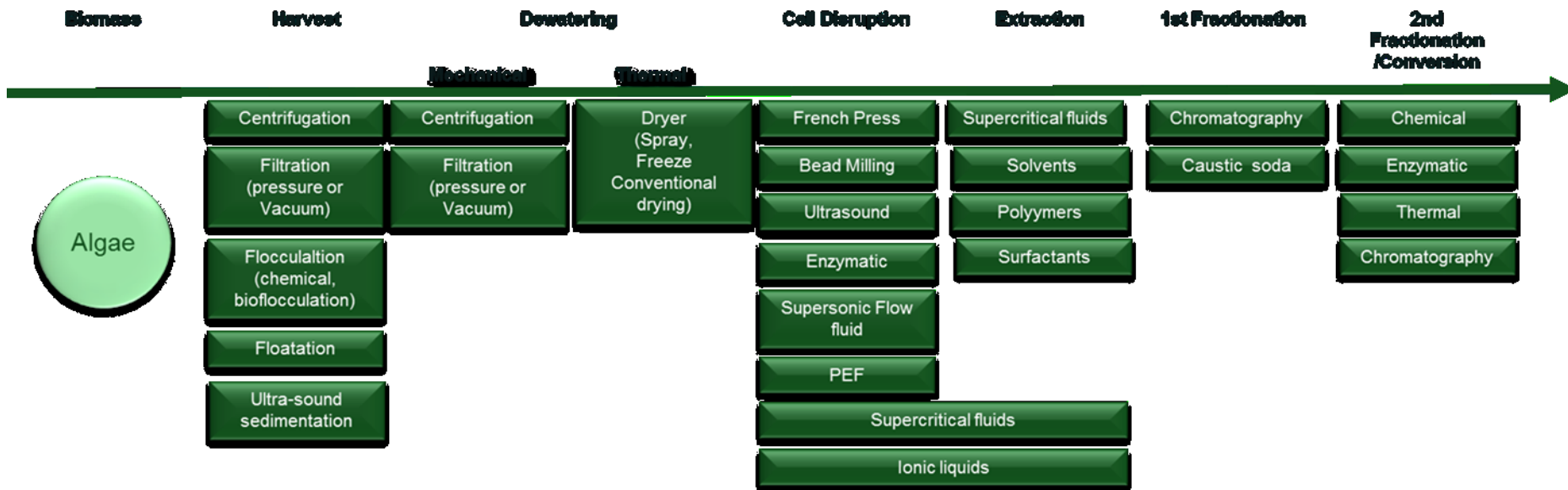
■ Applications

- Paints
- Surfactants
- Anti-microbial
- Coatings
- Adhesives

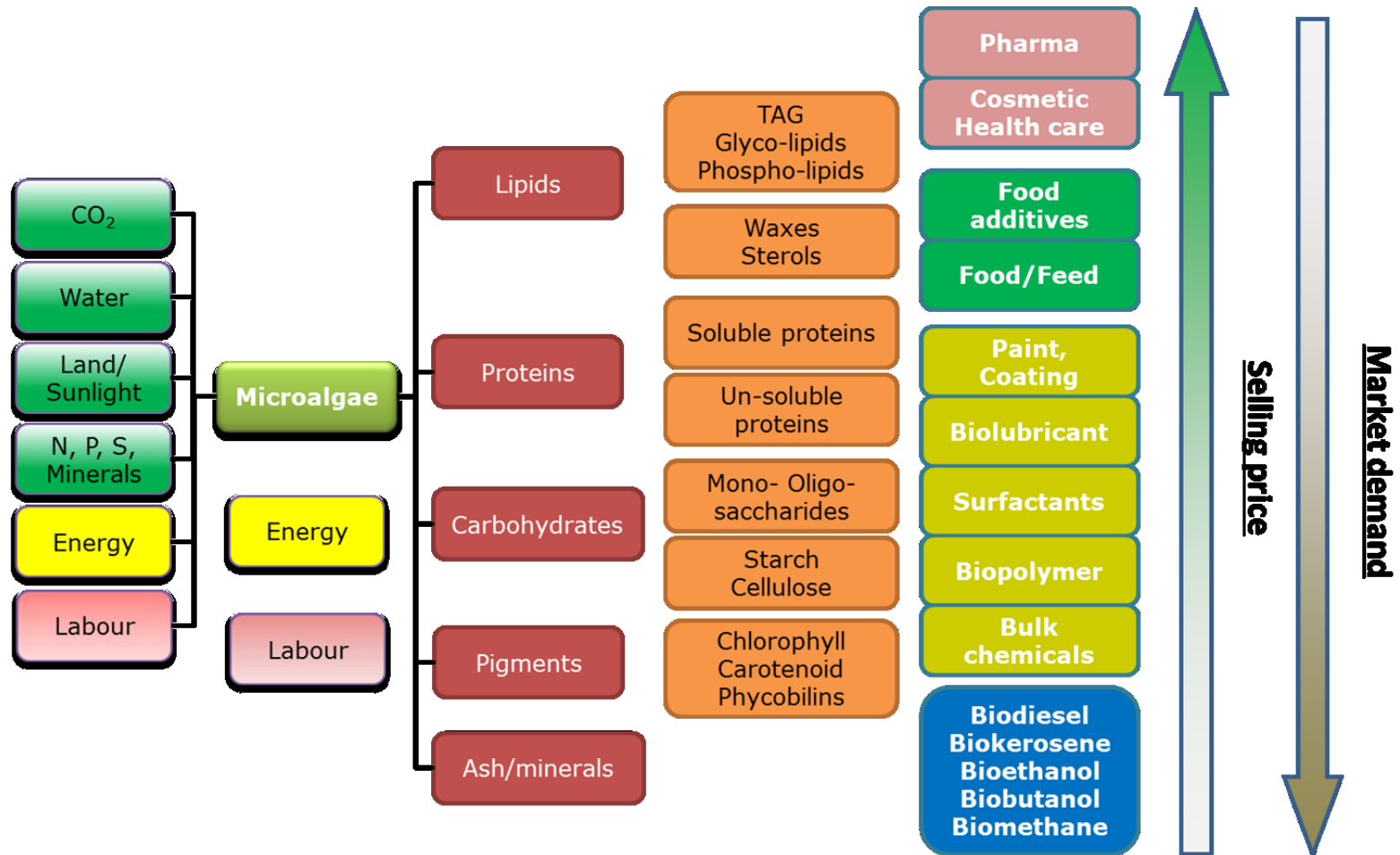


Conclusions

- Depending on
 - the algae species
 - growing condition
- different approaches have to be used



Future



Acknowledgements

Nicole Engelen

Jelle van Leeuwen

EU MIRACLES

STW AlgaePro4You

Climatic KIC MAB2.0

TKI AlgaePARC biorefinery

