



Danish Agency for Higher
Education and Science



Food & Bio Cluster
Denmark

Conference on

Healthy, Safe and Sustainable Foods of the Future

13 October



Can we make new healthy foods out of starfish and other underutilized marine raw materials?

Charlotte Jacobsen, Professor and Head of
Research group for Bioactives – Analysis and Application
DTU National Food Institute
chja@food.dtu.dk

Blue biomasses and healthy foods



- Globally 211 million tons blue biomass/year
- Up to 70 % of currently harvested blue biomasses are wasted or end up as low value products
- Some biomasses are still underexploited



Extraction of healthy omega-3 oils from starfish powder

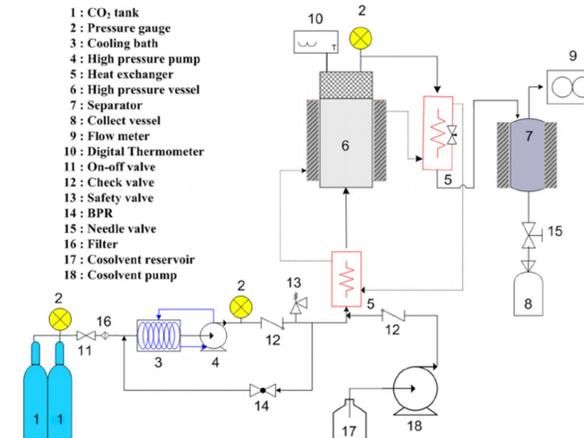
Production of Omega-3 oil from starfish meal

- Benefits the mussel industry
- New highly available and sustainable source of Omega-3 fatty acids
- **Value creation** from **underutilized** biomass
- Use of **green extraction** technology

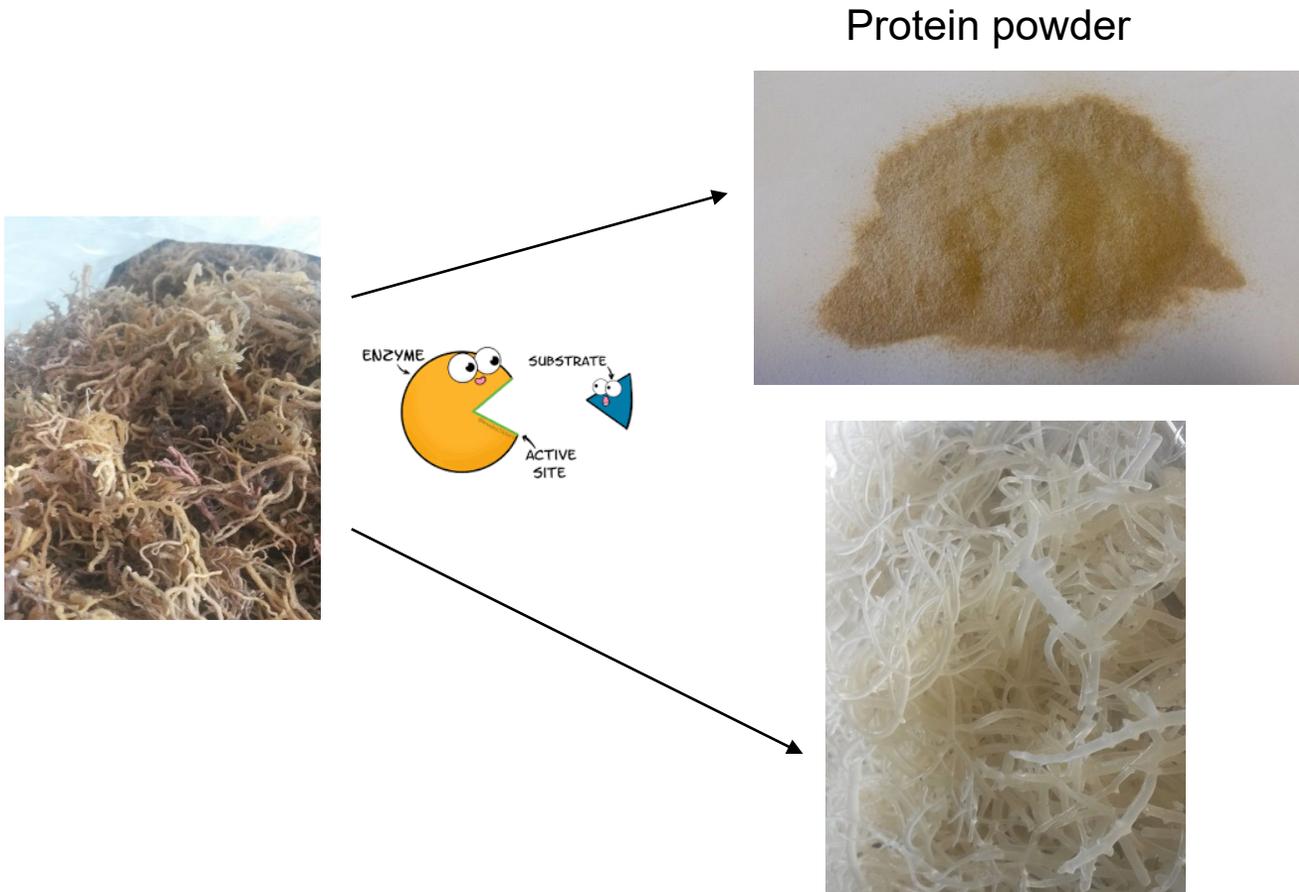


	Krill oil	Cod liver oil	Concentrated fish oil	Starfish oil
EPA (% of fatty acids)	15,3	9,6	33	5,1-8,1
DHA (% of fatty acids)	8,4	11,4	22	3,7-4,8
Phospholipids (g/100 g)	48	0	0	Ca. 30 %
Astaxanthin	Yes	No	No	Yes
Total vitamin E (ug/g)	760	350	Yes, added	24- 45

Supercritical CO₂ extraction



Extraction of proteins from red seaweed



Highest protein extraction efficiencies

- ☐ Alcalase® 0.2% w/w ~ **60%**
- ☐ Viscozymes® 0.2% w/w ~ **50%**

Rich in branched chain amino acids (isoleucine, leucine and valine): 23 % of the amino acid content



Carrageenan rich seaweed after protein extraction

Production of vitamin D, proteins and omega-3 PUFA in microalgae



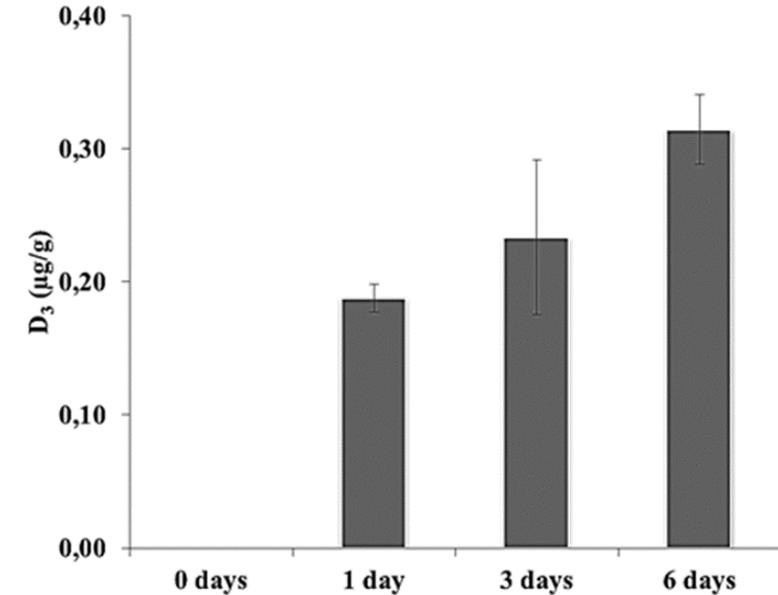
- *Chlorella minutissima*
- *Nannochloropsis oceanica*
- *Arthrospira maxima*
- *Rhodomonas salina*



Exposure to artificial UVB 280-315 nm

UVB dose:
 0 kJ/m²/day
 3 kJ/m²/day
 6 kJ/m²/day
 16 kJ/m²/day
 22 kJ/m²/day

Harvest
 Freeze drying



Nannochloropsis oceanica:
 Omega-3 PUFA content: Ca. 21 mg/g dry matter
 Vit D₃ content: Ca. 285 ng/g dry matter

Some challenges

Extraction and production technologies

- Low growth rates and yield (microalgae)
- Lack of optimal enzymes for blue biomasses
- Non-sustainable processing technologies
- Poor understanding of integration of enzymatic and green extraction technologies



Odour removal

- Undesired off-odours and flavours in blue side-streams and biomasses
- Lack of efficient odour&flavour removal technologies



Translation and scalability

- Poor understanding of techno-economic feasibility and environmental benefits of new extraction principles



Acknowledgements

- Alireza Naseri
- Susan L Holdt
- Anita Ljubic
- Jette Jakobsen
- Ann-Dorit M. Sørensen
- Adane T. Getachew
- Riuyinosa Igbinovia
- Inge Holmberg
- Trang Vu
- Lis Berner



**KARL PEDERSEN
& HISTRUS INDUSTRIFOND**

