



Extraction of bioactives from seaweed with pulsed electric field

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Innovation Center
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TARAMAR



Laminaria digitata Oarweed - hrossapari

- Brown seaweed
- Grows down to 10 m below sea level
- Up to 3 m long
- Rich in
 - Polysaccharides
 - Polyphenols (phlorotannins)
 - Pigments...
 - Bioactivity: Antioxidatives, dietary fibers, anti-inflammatory



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Holdt, S. L. and S. Kraan (2011). "Bioactive compounds in seaweed: functional food applications and legislation." *Journal of Applied Phycology* 23(3): 543-597.



Food Biophysics (2016) 11:417–428
DOI 10.1007/s11483-016-9456-1



ORIGINAL ARTICLE

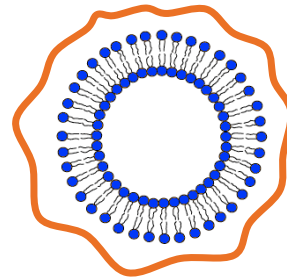
Osmotic Dehydration of Liposomal Dispersions: Influence of Particle Size and Electrostatic Deposition of Cold Water Fish Skin Gelatin

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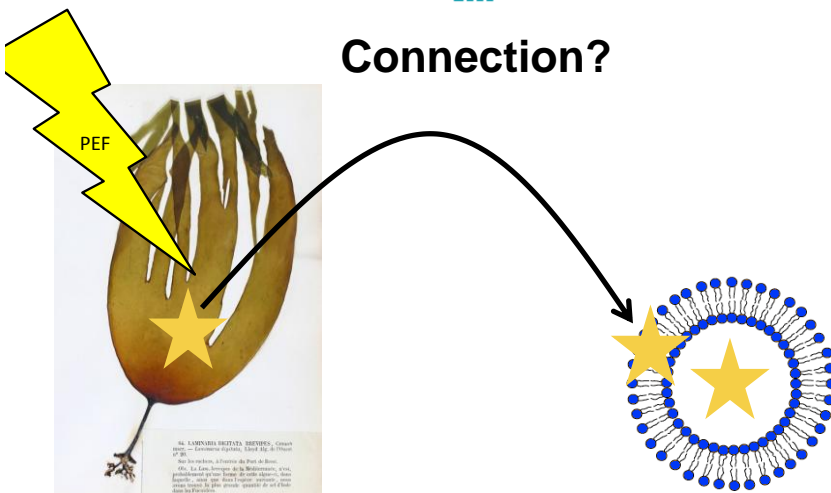
Received: 28 April 2016 / Accepted: 26 September 2016 / Published online: 5 October 2016
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Connection?



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TARASÓL

- Problem: active ingredients in sun screens
 - E.g. Zinc Oxide, Avobenzone
 - Health risks, possible tissue damage and hormone disruption
- **Purpose:** Develop a safe alternative solution based on natural compounds isolated from seaweeds.
- For protection and extended shelf-life, these bioactive compounds will be encapsulated into delivery systems.



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- Hágrýtingarverðlaun Háskóla Íslands



Extraction of bioactives from seaweeds

- Mass transfer through cell membrane and wall
 - Increase yield
 - Higher quality of products
- Most efficient extraction methods for bioactives from seaweed
 - organic solvents
 - heat



What other methods?



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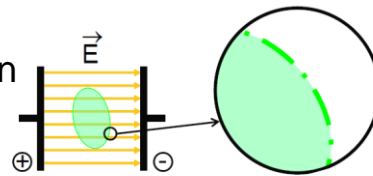
Wang, R., Jonsdottir and G. Olafsdottir, "Total phenolic compounds, radical scavenging and metal chelation of extracts from Icelandic seaweeds," *Food Chemistry*, vol. 116(1), pp. 240-248, 2009.
https://commons.wikimedia.org/wiki/File:Eukaryota_cell_structure.PNG



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Pulsed Electric Field

- Non thermal method
- Sample goes through a series of short duration pulses in high electric field strength
- Electroporation
- Charging and polarization of cell membrane
- Pore formation



Current use in Food Technology

- Food preservation
 - Microbial inactivation
 - Mass transfer
 - Extraction
 - Drying
 - Changing texture
 - Part of processing
 - Hurdle technology
- Wine production
 - Olive oil extraction
 - Tomato extraction
 - Fruit juices
 - French fries
 - ...



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Optimization of Pulsed Electric Field Extraction of Bioactives from *Laminaria digitata*:

Influence of Treatment Time, Temperature and Biomass Concentration



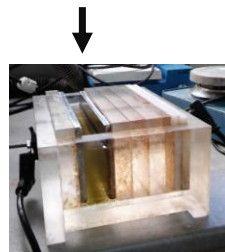
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Pulse generator

F.u.G.HCK-200-2000 capacitor (F.u.G. Elektronik GmbH, Rosenheim, Germany) and spark gap (18.5 kV OG75, Perkin-Elmer Optoelectronics)
8 kV/cm electric field
1.2 Hz electric field

Treatment Chamber



Plexiglass,
20 × 8 × 2.5 cm

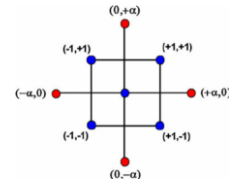


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Design of experiment

- central composite design
- three factors
 - PEF treatment time (1, 2, 3 minutes)
 - temperature (20°C, 30°C and 40°C)
 - biomass concentration (0.9%, 1.7% 2.6% dryweight/weight water)



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Preliminary results

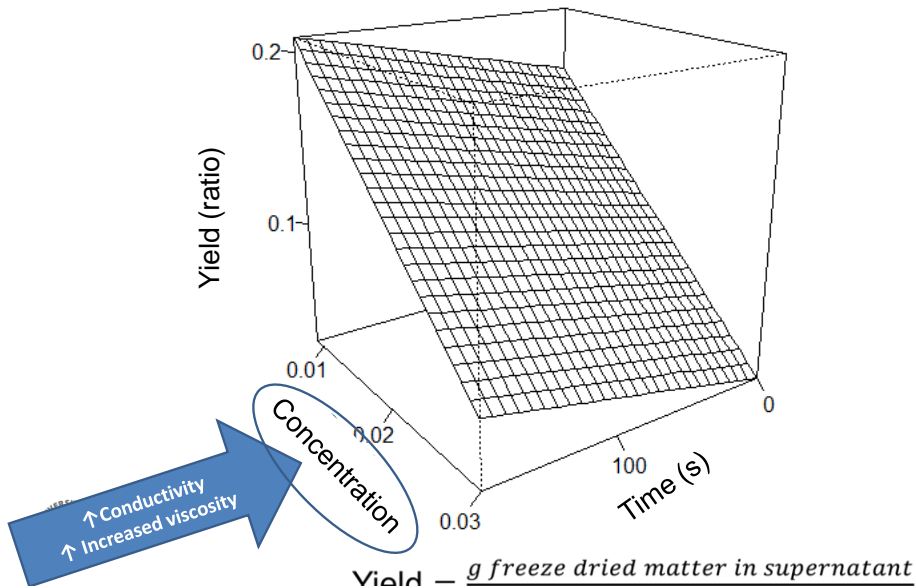


The leaves take up 8.3 ± 1.4 times of its initial weight in water.



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Preliminary Results



Further work

- Analysis of components
 - Total carbohydrate and polyphenol content
 - Antioxidant activity
 - DPPH and FRAP
- Optimized parameters
- Further analysis of bioactives with regards to Sun Protective Factor
- Loaded delivery system





THANK YOU



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