



Introduction to CyberColloids Seaweed Research

April 2018



Our interest in seaweeds



- CyberColloids been working with seaweed derived ingredients for many years.
- As experts in the hydrocolloids world – routinely working with agar, carrageenan and alginate.
- Combined experience spans the entire value chain from raw material to end use.
- Hydrocolloids industry traditionally wasteful - based on mass extraction of one component.
- We realise that seaweeds have far more to offer than just the hydrocolloid components.
- In 2005 started to look at seaweeds differently.



A new “seaweed for health” focus

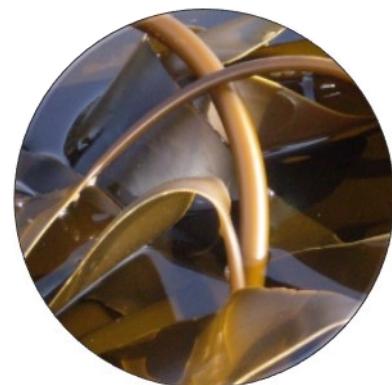
- Through Irish national funding and EU funded FP7 projects we have built a knowledge platform on:
 - nutritional benefits of edible seaweeds;
 - bioactives from edible seaweeds;
 - different processing approaches;
 - market for seaweed derived functional foods;
 - application in food and drink products.
- Overall aims to:
 - maximise the use of the whole biomass;
 - multi-stream processing;
 - improved palatability/inclusion for ingredient development.



Building a knowledge base



- Early projects focussed on developing a better understanding of the potential use of seaweed ingredients for health & nutrition.
- In particular issues re. use of edible seaweeds & seaweed derived ingredients :
 - industry & consumer perception;
 - fundamental requirement of palatability (taste);
 - how processing can affect/modify palatability;
 - commercially sustainable sources;
 - regulatory restrictions re. processing – use of kitchen science and approved food use processes.



Our seaweed focussed research

- InterTrade Ireland funded project (2005/7): investigating the nutritional potential of edible seaweeds for the development of ingredients for functional foods. For more detail see: MacArtain et al. (2007) DOI: 10.1301/nr.2007.dee.535-543 and www.intertradeireland.com/innovate/casestudies/name,711,en.html.
- Irish Marine Institute Industry Led Award (2008/9): investigating the flavouring and taste components of Irish seaweeds for use in reduced salt products. For more detail see: <http://www.cybercolloids.net/news/seaweed-flavour-report>.
- InterTrade Ireland funded project (2010/11): developing extraction and characterisation techniques for the production of seaweed extracts with anti-cancer potential. For more detail see: Murphy, C., Hotchkiss, S., Worthington, J. & McKeown, S. (2014). The potential of seaweed as a source of drugs for use in cancer chemotherapy. Journal of Applied Phycology, February 2014. 10.1007/s10811-014-0245-2.



Functional fibres for digestive health



HYFFI Project (2008-2011):

- To produce a range of LMW alginates and agars through controlled depolymerisation.
- To assess and compare the prebiotic potential of these substrates with Inulin – the standard industry prebiotic.

Key findings:

- No evidence for prebiotic potential *in vivo*.
- Prebiotic potential of LMW *Gelidium* – *in vitro*.
- Increases in SCFA production *in vitro* & *in vivo* – evidence that seaweed derived fibres being fermented.
- LMW alginate had significant effect on post-prandial glucose response.



MARIGOT
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SWAFAX Project (2010-2013):

- Investigated the antioxidant and anti-inflammatory potential of phlorotannin rich extracts from *Ascophyllum nodosum*.

Key objectives:

- to develop methodologies for phlorotannin rich extracts from *Ascophyllum nodosum*;
- to screen these *in vitro* for potential antioxidant and anti-inflammatory benefits;
- to evaluate the bioavailability of the phlorotannins *in vivo*;
- to evaluate antioxidant & anti-inflammatory biological activity *in vivo*.



Key findings *in vivo* bioavailability study*

- A variety of metabolites were detected in the urine and plasma of 15/24 human volunteers after the ingestion of a seaweed.
- First evidence that seaweed derived polyphenols actually metabolised.
- Some metabolism at 0-8hr after ingestion but most at 8-24hr.

Key findings *in vivo* intervention study**

- No significant changes in any of the parameters for the study population as a whole – not really surprising.
- Subset of subjects who were obese (n=36/80) a number of significant differences in antioxidant status after an 8 week intervention.
 - differences in peroxide levels; reduction in basal DNA damage
 - 28% reduction in the acute inflammatory marker CRP – n.s.

• Corona et al (2011) and Corona et al (2012).

• Corona et al (2016) accepted for publication by British Journal of Nutrition.

** Baldrick et al (2015) - to be submitted to the American Journal of Clinical Nutrition.

Unlocking the flavour of seaweed



The TASTE project (2012-2014):

- Aim to develop new healthy flavour ingredients from edible seaweeds with the potential to replace sodium in food products that traditionally contain high levels of NaCl.
- Focussing on 3 commercial viable species:
 - *Ascophyllum nodosum*;
 - *Fucus vesiculosus*;
 - *Saccharina latissima*.
- Using a combination of physical & enzymatic processing to “unlock” the important flavour components.
 - physical pre-processing to open up seaweed structure;
 - enzymatic hydrolysis using commercially available enzymes and seaweed specific enzymes from partner Prokazyme.



Unlocking the flavour of seaweed

- Wanted to explore use of whole seaweed;
 - issues with colour, odour and taste;
 - non-specificity of commercial enzymes limited the release of taste enhancing compounds;
 - protein rich extracts – better results but not cost attractive - NaCl extremely cheap ingredient.
- Novel enzyme combination successful.
 - for use on whole seaweed;
 - no odour issues, umami like taste with mouthfeel;
 - limited sensory evaluation;
 - definitely a longer-term commercial opportunity.



Seaweed biorefinery for added value



The SEAREFINERY project (ongoing)

- Started November 2015 for 3 years.
- Aims is to develop eco-friendly chemical and enzymatic processing technologies to extract and valorise high value-added components such as antioxidants, antimicrobial components and hydrocolloids from cultivated seaweed species in an integrated biorefinery.
- Utilising cultivated brown seaweed species:
 - *Saccharina latissima*;
 - *Alaria esculenta*.
- CyberColloids responsible for developing and optimising extraction protocols for various polysaccharides and antioxidants and their evaluation in different food & cosmetic end products.



References



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For more information about our research activities see -

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