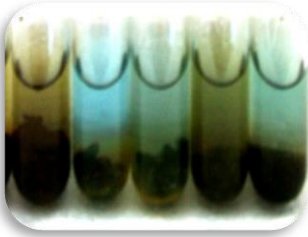


Seaweed Research Activities at CyberColloids



CyberColloids Ltd.
Unit 4a, Site 13,
Carrigaline Industrial
Estate, Carrigaline, Co.
Cork, Ireland
+353 (0) 214375773
info@cybercolloids.net
www.cybercolloids.net



CyberColloids is a private R&D company that provides innovative technical and business solutions for raw material suppliers, processors and users of hydrocolloids at a global level – including the seaweed derived hydrocolloids; alginate, agar and carrageenan.

The combined technical and commercial expertise and experience within the international CyberColloids' team enables the company to offer a unique range of services that include research, outsourcing strategies, and process/product development.

Based in Co. Cork, Ireland, the company plays an active role in the Irish Seaweed industry but has also developed strong links with harvesters and processors in UK, Europe, SE Asia and Central America. From 2003 to 2008, the company hosted the ISIO (Irish Seaweed Industry Organisation) and was instrumental in bringing together key stakeholders from industry and academia in a number of initiatives.

Collectively, the team has years of experience in the global seaweed industry. Experience that encompasses a fundamental knowledge of seaweed biology and ecology; farming of carrageenophyte seaweeds (Namibia, Philippines, Indonesia, Malaysia & Panama); and technical and operational support for the subsequent seaweed processing activities in these countries; extensive experience and expertise in the seaweed derived hydrocolloids industries, in particular alginate and carrageenan; development of innovative modification and extraction techniques for value added markets

Hydrocolloid and polysaccharide chemistry has been the primary research focus for CyberColloids since its conception in 2002 and indeed it is by this reputation that the company has developed into a recognised centre of excellence. However, in 2005 the company developed a new core discipline and has established itself as a recognised research provider in the "seaweeds for health" space.

CyberColloids have been engaged in a number of research projects in recent years that are exploring the nutritional and health potential of seaweeds. At an EU framework level, CyberColloids is a recognised research provider and ranks alongside third level research institutions but we believe that our success in securing funding is a result of being firmly rooted in the commercial world.

Seaweed for Health

Looking beyond the interesting textural properties of seaweed derived hydrocolloids, CyberColloids have been active in research activities aimed at discovering the nutritional and health potential of a wide variety of plant and seaweed derived polysaccharides and bioactives. The following are examples of EU and Irish funded research projects:

EU funded TASTE Project (2012/14): developing natural flavour ingredients from edible seaweeds with the potential to replace sodium in food products. For more detail see: www.tasteproject.net.

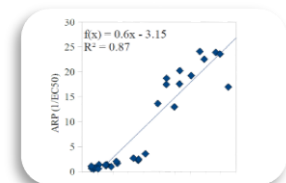
EU funded SWAFAX Project (2010/13): investigating the anti-inflammatory and antioxidant potential of seaweed extracts. For more detail see <http://www.cybercolloids.net/services/research-innovation>.

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: <http://www.cybercolloids.net/downloads/anti-cancer-compounds-seaweed> and 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.

EU funded HYFFI Project (2008/11): developing novel processing techniques to produce low molecular weight agars and alginates with prebiotic potential. For more detail see: <http://www.cybercolloids.net/services/research-innovation>.

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 (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](https://doi.org/10.1301/nr.2007.dee.535-543) and www.intertradeireland.com/innovate/casestudies/name,711,en.html.



Global raw material supply, value chains and markets

The combined technical and commercial expertise within the CyberColloids team enables the company to offer a unique range of services that spans the entire seaweed value chain and the company has been active in this respect at a global level (SE Asia, Africa, India, Central America, Western and Nordic Europe).

CyberColloids has a particular interest in exploring the use of new raw materials and downstream products that are derived from seaweed material, in developing novel processing methodologies including integrated biorefinery style processing, new ingredients and innovative applications for use in the food and health sectors.

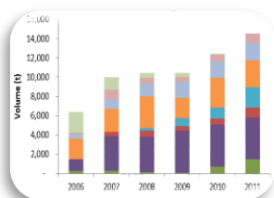
Examples of private research and commissions are given below:

Carrageenan Industry Report (2012): a “snap shot” of the carrageenan market for the period 2006 to 2011 including: a summary of key industry headlines, current trends in sales, end use and NPD; capacities and key players; analysis of raw material supply and overview of the Chinese industry. Available at <http://www.cybercolloids.net/downloads/carrageenan-market-report-2012>.

Building a Seaweed Value Chain, Malaysia SE Asia: upgrading of a non-food seaweed extract value chain in a remote part of Borneo, Malaysia to a sustainable food grade facility. Involving all levels of the value chain from seaweed (*Eucheuma cottonii* species) cultivation, to processing to marketing and sale of final products.



Irish Seaweed Producers: commission from the Irish Development organisation Bord Iascaig Mhara (BIM) in Galway to help Irish seaweed producers in Galway, Mayo, Sligo and Donegal produce sustainable good quality seaweed products for a variety of applications and markets. Including edible varieties for local and international markets; seaweed extracts for cosmetics and personal care; seaweed bath products; seaweed horticultural products; seaweed as a flavour enhancer for food (salt replacement, spice etc.).



Baltic Seaweed Processing: assessment of processing and application potential for a furcellaran extraction business. Involving the provision of technical expertise for optimisation of factory processing operations and in house rheological and application research to assess potential applications for the extracted furcellaran.



Adding Value to Edible Seaweed Resources: a strategic review aimed at developing value creation options for a European seaweed producer. Comprehensive review of academic literature, market intelligence and patent literature to identify current and potential uses and opportunities for new product development in food, agriculture & horticulture and other interesting markets.



Improved Purchasing Specifications for Hydrocolloids Users: validation of hydrocolloid functionality in specific products and applications, resulting in improved purchasing specifications and financial benefit to users of alginate, agar and carrageenan.



Edible Seaweeds for Chinese Markets: developing routes to market in China for UK edible seaweed varieties. CyberColloids has utilised its South East Asian network to facilitate the test marketing of these products in China.

Nutritional and Cosmetic bioactives from Irish seaweeds: investigating the potential nutritional and bioactive components of Irish seaweeds for an Irish company in the cosmetics and thalassotherapy sector, through critical review of the scientific and commercial literature and a comprehensive patent search.

Developing functional seaweed ingredients from Irish Seaweeds: aimed at developing a product for the water treatment market based on Irish *Chondrus crispus* and to test the functionality of Irish *Chondrus crispus* against industry standards in food application model systems.

Developing processing methodology for horticultural extracts from Irish seaweed: development and optimisation of mild processing techniques for Irish seaweeds for the production of innovative extracts and foliar feeds for the horticulture market.

Training, Marketing and Business Development

Training modules for agar, carrageenan and alginate - CyberColloids routinely deliver customer specific training for users of all hydrocolloids including those derived from seaweed: alginate, agar and carrageenan. A general introduction to carrageenan (from source to end use) is also available for download at <http://www.cybercolloids.net/downloads/introduction-carrageenan>.

Web based information service – the company website is a valuable resource with technical articles, legal specifications, hydrocolloid manufacturers, recipes and photos available at <http://www.cybercolloids.net/information>. Much of this information is also available for download <http://www.cybercolloids.net/downloads>.

Bibliography

- Baldrick, F.R, Sung, C., **Hotchkiss, S.**, Wallace, J.M.W., and Gill, C.I. (2012). The effect of seaweed derived polyphenols on inflammation and oxidative stress in vivo – The SWAFAX Study. 4th Annual Translational Medicine Conference, Inflammatory Processes and Cardiovascular Disease - Innovative Healthcare for Challenging Times™ City Hotel, Derry/Londonderry, Northern Ireland 10-11 May 2012.
- Defreitas, Z.**, Nicholson, D., **Philp, K.**, & **Trius, A.** (1997). Processed Seaweed: more for less. Paper published in Meat International 7(3): 30-33.
- Doyle, J., Giannouli, P., **Philp, K.** & Morris, E.R. (2001). Effect of K⁺ and Ca²⁺ cations on the gelation of k-carrageenan Gums and stabilisers for the food industry 11.
- Gray, C.J. & **Philp, K.** (1991). Morpholine induced gel formation with propylene glycol alginate solutions Carbohydrate Polymers, 15, pp 283-297.
- Gray, C.J. & **Philp, K.** (1994). Hydrodynamic and other properties of poly(morpholino) alginamide (PMA) Carbohydrate Polymers, 25, pp39-44.
- Harrington, J.C.**, Foegeding, E.A., Mulvihill, D.M. and Morris, E.R. (2009). Segregative interactions and competitive binding of Ca²⁺ in gelling mixtures of whey protein isolate with Na⁺ K- carrageenan. Food Hydrocolloids, 23: 468-489.
- Hotchkiss, S. & Trius, A.** (2007). The most nutritious form of vegetation on the planet? Food Ingredients, Health & Nutrition. January – February 2007. Pages 22-23.
- Hotchkiss, S.** (2010). Investigation of the Flavouring and Taste Components of Irish Seaweeds Industry-Led Award, Final Report. Marine Research Sub-Programme (NDP 2007-'13) Series. Marine Institute, Ireland 2010.
- Hotchkiss, S.** (2012). Edible seaweeds: A rich source of flavour components for sodium replacement.
- AgroFOOD industry hi-tech - November/December 2012. Vol 23 n 6.
- MacArtain, P., Gill, C.I.R., **Brooks, M.**, **Campbell, R.**, Rowland, I.R. (2007). Nutritional Value of Edible Seaweeds. Nutr. Rev., 2007, 65, 535.
- 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.
- Philp, K. & Campbell, R.** (2006) Hydrocolloids from Seaweed Resource In: World Seaweed Resources [DVD]. Edited by Alan T. Critchley, Masao Ohno and Danilo B Largo.
- Ramnani, P., Chitarrari, R., Tuohy, K., Grant, J., **Hotchkiss, S.**, **Philp, K.**, **Campbell, R.**, Gill, C., Rowland, I. (2012). "In vitro fermentation and prebiotic potential of novel low molecular weight polysaccharides derived from agar and alginate seaweeds", Anaerobe, Feb 18(1):1-6.
- Trius, A. & Philp, K.** (1997). Processed Seaweed: more for less. Meat International Vol. 7 No. 3, p 30-33.
- Trius, A.** and Sebranek, J.G. Carrageenans in meat products. (1996). Critical Reviews in Food Science and Nutrition 36(1& 2): 69-85.
- Trius, A.**, Sebranek, J.G., Rust, R. E., and Carr, J.M. (1995). Ionic strength and chloride salt effects on the performance of carrageenans in a model system sausage. Journal of Muscle Foods 6: 227-242.
- Trius, A.**, Sebranek, J.G., Rust, R.E., and Carr, J.M. (1994). Effects of meat pH and sodium tripolyphosphate on the performance of carrageenans in beaker sausage. Journal of Food Science 59(5):941.
- Trius, A.**, Sebranek, J.G., Rust, R.E., and Carr, J.M. (1994). Evaluation of low-fat beaker sausage and bolognese containing different carrageenans and chloride salts. Journal of Food Science 59(5):946.