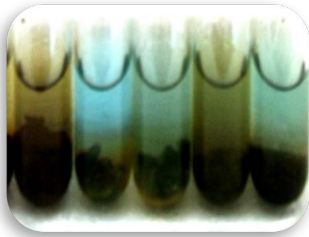


Seaweed Research Activities at CyberColloids



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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: <http://www.cybercolloids.net/sites/default/files/TASTE.pdf>.

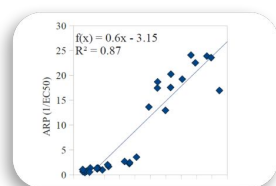
EU funded SWAFAX Project (2010/13): investigating the anti-inflammatory and antioxidant potential of seaweed extracts. For more detail see: Corona *et al.* (2016) and <http://www.cybercolloids.net/sites/default/files/Swafax%20project.pdf>.

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 *et al.* (2014).

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/sites/default/files/Hyyfi%20project.pdf> and Ramnani *et al.* (2012).

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/downloads/seaweed-flavour>.

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).



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.

We are currently participating in a **Marine Biotech ERA NET funded project – SeaRefinery (2016-2018)**: developing eco-friendly chemical and enzymatic processing technologies to extract and purify high value-added components such as antioxidants, antimicrobial components and hydrocolloids from cultivated seaweed species (including *Saccharina latissimi* and *Alaria esculenta*) in an integrated biorefinery. For more detail see: <http://www.cybercolloids.net/sites/default/files/SeaRefinery%20Project%20Factsheet.pdf>.

Some examples of private research and commissions:



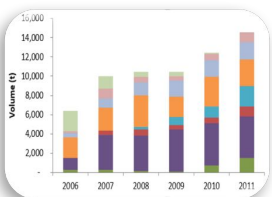
Evaluating minimally processed seaweed ingredients in food applications: with the global drive to produce “healthier”, “more natural” and “minimally processed” food ingredients, seaweed processors are seeking innovative ways to process and use new seaweed ingredients. Recent work focussed the evaluation of novel processes and the application of multifunctional sea vegetable ingredients in dairy and meat products.



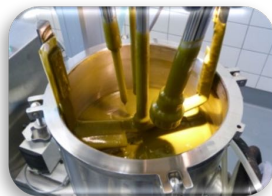
Carrageenan Industry Report (2012): a “snap shot” of the carrageenan market for the period 2006 to 2011 including: a summary of key industry headlines, current trends in sales, end use and NPD; capacities and key players; analysis of raw material supply and overview of the Chinese industry. Available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



Building a seaweed value chain in Malaysia: 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.).



Carrageenan processing in Indonesia: new factories for the production of carrageenan. CyberColloids have been actively involved in the design and commissioning of new processing facilities for semi-refined and gel press carrageenan.

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.



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>.

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