



Issue 10: February, 2014: This e-bulletin is aimed at personnel in fisheries & aquaculture, at fish packers, processors, distributors, retailers, and finally consumers.

Hidden Wealth from the Sea

Consumers are aware of the sea as a provider of seafoods but relatively few know of the hidden wealth in our seas in terms of beneficial biomolecules and extracts from seaweeds, sponges, fungi and bacteria. Many of the biomolecules have potential to combat serious diseases and can be delivered to us as pharmaceutical products, cosmetics and as inclusions in functional foods. A wide range of potentially useful biomolecules have been extracted, characterised and studied in the three year EU Framework 7 BAMMBO (Biologically Active Molecules of Marine Based Origin) project which held its final meeting in Limerick in February 2014.

BAMMBO project (<http://www.bammbo.eu/>)

The project was coordinated by Limerick Institute of Technology and had 9 research and 2 SME partners representing 8 countries. This spread enabled research on samples from the Atlantic, Mediterranean, Bering Sea and Antarctic. There were five objectives: (a) target known/novel marine organisms as sustainable sources of beneficial high added value compounds; (b) overcome bottlenecks in sustainable & economic culturing methods of the organisms; (c) laboratory extraction & screening of compounds from algae, sponges, fungi & bacteria; (d) sustainability assessment of the use of the organisms for industrial scale production of biomolecules; (e) exploit the discovered knowledge & technologies.

Biobank and bioassays

The project biobank is a register of all the marine samples coming from the project and upwards of 100 have been logged. Procedures for bioassays are central to the success of BAMMBO in order to determine the efficacy of the biomolecules in treating disease. The structure of many of the biomolecules is very complex thus making synthesis in the laboratory difficult if not impossible. Therefore, they must be obtained from natural sources.

Macro and microalgae

Macroalgae (27) were screened and brown species had the highest antioxidant activity with *Fucus spiralis* particularly good. Cultivated *Fucus spiralis* compared favourably with wild-grown and sustainable

cultivation may be the way forward. Bacteria associated with macroalgae were also screened and contained bioactives with potential. Extracts of the macroalgae have anti-bacterial, anti-tumour and anti-inflammatory properties.

Microalgae (e.g. green scums) grow rapidly (3-4 fold/day) and produce large amounts of biomass. New tubular culture systems embracing unique paddles and lighting are more suitable than ponds but are expensive because of pumping costs. Focus in BAMMBO was on extraction of high value compounds from green microalgae with emphasis on astaxanthin. This sells for €10/g, has very high antioxidant activity, is protective against UV light, aids in immune response and is produced by the Irish SME partner.

Sponges, fungi and bacteria

Studies on sponges and their associated bacteria showed a great diversity of potentially active biomolecules. The supply of wild sponges is a bottleneck although cultivation in coastal locations is showing potential. Culturing in on-shore tanks is minimal because of difficulties in delivering conditions that suit both the sponges and their associated bacteria. Biomolecules from sponges may have potential for treating certain cancers, Parkinson's and Alzheimer's diseases. Efficacy of the biomolecules is being tested on sea urchins as they are a good model for humans.

Over 500 marine fungi and bacteria were studied and a range of bacterial enzymes were isolated. A phytase gene was successfully implanted into *E. coli* and *Bacillus subtilis* host species enhancing their commercial exploitation potential. Arctic Protist species were isolated and selected which were amenable to sustainable *in vitro* culture for production of DHA (docosahexaenoic acid; aids brain development & cognitive health). A range of cold tolerant (<15 °C) lipases were isolated from fungi with potential use for water treatment, cosmetics and in fine chemical industries.

Life cycle analysis; technology offers

Life cycle analysis on the inputs/processes/outputs of the BAMMBO project showed a good overall outcome in terms of sustainability and the environment; however, greater efficiency is needed in the use of electricity (for supplementary lighting) and solvents (for extraction). A number of technology offers are available as outputs of the BAMMBO project from daniel.walsh@lit.ie

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