

HEALTH FOODS

from the sea

A Multi Billion Dollar Industry Made Possible by New Technology

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Breakthrough technology can lead to the most surprising results. Recent technological developments aimed at improving yields, quality and nutrition in the fruit processing industry have been trialled on the preparation of functional foods from the Sea. The results are a pleasant surprise indeed.

These functional foods can be derived from waste streams arising from the conventional processing of fin-fish or crustaceans, or from seaweed. The bioactive components from these raw materials include omega 3 fatty acids, beta carotene, carrageenan, vitamin E and the related tocopherols. Bioactive compounds are defined as those which provide a defined benefit to human health such as the lowering of cholesterol, lowering of blood pressure or the lowering of glycemic response. These compounds are implicated in the mitigation or prevention of human diseases, particularly those known as “diseases of affluence” i.e. heart disease, cancer, diabetes, obesity and arthritis.

This breakthrough technology comes at a time when the global demand for higher quality food is growing rapidly and the available land to supply this demand is diminishing or static at best. This is due to climate change and competition from energy crops and diminishing supplies of surface water for irrigation.

The Technologies

In recent years the emergence of a series of new

technical tools available to the food industry has opened the potential for a range of exciting new food ingredients. The most important direction for these new ingredients is to provide benefits for human health and wellness particularly by incorporating the bioactive component of raw foods into processed foods. In traditional processing, most components of whole foods which are responsible for health benefits are removed as waste streams because they are associated with bitter or astringent tissues or tissues with poor texture. New technology is enabling a broad range of capabilities not previously available to food processors, in particular, the ability to separate bioactives from distasteful compounds.

At the same time, scientific knowledge of the mechanism by which bioactives lead to positive health outcomes is growing rapidly from an already large base, the new technologies enable us to reduce the science to practice.

These technology developments include inventions such as diffusers capable of transferring soluble components of food raw materials out of or into particulate foods either to recover an extract such as a juice or a soup or to reinforce a particulate food with desirable nutritional components or flavours. Diffusers are characterized by very high efficiency (high yield), high product quality and low energy use. Importantly in today's world, processes which employ continuous diffusers as core technology require minimal water for operation and cleaning (about one tenth of conventional processing).

A second example is extremely robust filtration equipment capable of the most difficult filtration tasks. These filters employ sintered stainless steel membranes and are capable of removing microorganisms from liquid foods “in line”. Conventional filtration generally uses filter aids such as diatomaceous earth which is difficult to dispose, or synthetic membranes which require frequent replacement and are limited in application. Conventional filtration is not generally capable of reducing microbial populations to the level which is safe without preservatives in the process.

Other membrane technologies have emerged for the inline removal of water in industrial processes (concentration by reverse osmosis) and for the separation of soluble compounds on the basis of molecular size or shape (molecular sieving).

New industrial chromatography techniques have been developed which enable the separation or enrichment of the so-called bioactive compounds in raw foods.

Chromatography enables the separation of individual compounds or groups of compounds on the basis of how strongly each compound is bound by a particular adsorptive substance (usually synthetic beads). As a result, a large range of compounds can be adsorbed onto the bead and individually taken off in order of the strength of the bond.

Technology systems which combine diffusers, membrane technology and chromatography are a particularly powerful combination for the separation of bioactives and their incorporation into processed foods.

Other recent technical developments include new drying techniques which enable low temperature drying without the need for excipients or “carriers” such as malto dextrin commonly used to prevent stickiness in dried food products. These techniques include radiant energy dryers (including the Refractance Window Dryer), freeze dryers, dryers which employ microwaves, infra-red or ultra violet



radiation, all techniques which enable the control of crystallization during drying and hence the flowability of resultant powders.

Finally, techniques which recover and isolate volatile aroma compounds are now available and include the spinning cone column, a very efficient device for recovering aromatic compounds in the same relative proportions they exist in the raw food, and a variety of molecular distillation systems which are capable of separating the constituent molecules which make up a particular whole aroma. These provide the food processor with an unprecedented ability to preserve true aromas.

Application to Marine Products

Whilst these new techniques have so far been used by and large to process land based plant and animal materials, there is very considerable potential for their use in adding value to a wide range of marine species and we outline some particular examples.

The recovery of stocks and broths from fish processing wastes.

Such ingredients can be recovered from processing waste streams such as the frames of bony fish after filleting and from the bodies of marine crustaceans such as crabs, crayfish, lobster and shrimp after removal of legs or tail meat. Such extracts can be prepared coincidentally with extracts of herbs and vegetables for the production of traditional broths. Preliminary work has already been undertaken to trial these techniques on Cod frames from Newfoundland and Snow Crab bodies also from Newfoundland. Early work has also been undertaken on recoveries from Australian crayfish and prawn bodies. At the same time very large and rapidly growing markets are emerging throughout the world for high quality convenience products in the categories of soups, cooking stock and broths (estimated annual values of \$6bn).

The phenomenal growth of aquaculture, where output is expected to exceed that of wild fisheries in the near future, provides a circumstance in which the incorporation

Opposite page: Dr. Pranav Bhatt and his staff inspect free-flowing blueberry powder, a process in which no chemicals are used.

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of these technologies can proceed in an orderly and economic manner.

Many seaweeds are known to have therapeutic properties, a high nutritional profile or to contain molecules, particularly polymers, with highly desirable physical properties such as viscosity or colour. Examples of seaweed components of high value include agar, beta-carotene, omega 3 fatty acids, carrageenan, vitamin E and the related tocopherols.

Especially in Newfoundland & Labrador, we have *Palmaria Palmata* (Dulse), *Laminaria Longicuris* and *Ascophyllum nodosum*. The last two brown weeds are already being harvested in Newfoundland by AMPI (Isle-aux Morts) and NAPI (Ramea). Dulse is being harvested here as well as (and cultivated) in significant amounts in New Brunswick and Nova Scotia.

During such comparative studies on various drying techniques for the quality retention, characteristics of strawberry and carrot purees dried using the Refractance Window TM (RW) drying method was evaluated against freeze drying, drum drying, and spray drying methods. Ascorbic acid retention of the strawberry purees (94.0%) after RW drying was comparable to 93.6% in freeze-drying. RW drying altered the overall perception of aroma in the drying industry, globally. In some seven trials undertaken around the world, the retention of these Bio actives proved superior to other available drying technologies.



A commercial Counter Current Extractor

Natural Newfoundland Nutraceuticals Inc. (NANI) very strongly desires to pursue this very opportunity to evaluate other marine products of similar types in order to prove the superiority and enrichment of Newfoundland bio actives and to convert them into value added marine products. These technologies help the firm to develop natural products, which are 100 % free from all the chemicals. Such efforts will open up doors for NANI and the Province to sell scientifically proven, value added and health enhancing marine products within Canada and globally.

About Natural Newfoundland Nutraceuticals Inc.

(NANI) NANI is a new company established to process berry fruits principally from Newfoundland. With its primary emphasis on the processing of blueberries, NANI's products will include juices, juice concentrates, sweetened dried berries and nutraceutical powders. These products will be of the highest quality and with a superior nutritional profile when compared to conventional products.

NANI has as its shareholders Dr. Hilary Rodrigues who is the Newfoundland visionary behind the scheme, and Lang Technologies Pty Ltd., an Australia based company providing much of the technology for the processing systems.

The NANI Vision

In addition to berry fruits, NANI intends to process brown seaweed. This is one of the many emerging opportunities to supply foods for human consumption from marine plants. The technologies outlined above could be readily applied to the recovery of these seaweed components, their enrichment and preparation into dried powders. In its initial phase, NANI will have installed most of the technologies needed to recover high quality food supplements from brown seaweed and in its second phase, will have all of the necessary process components.

Brown seaweeds are a rich source of Vitamin E and the related tocopherols. Vitamin E is a key antioxidant and is protective of all fatty tissues in the body, including the brain. The tocopherols (precursors in the biosynthesis of Vitamin E) are also strongly bioactive and have been shown to have anti cancer properties. Recently, Japanese researchers have discovered compounds in brown seaweed which convert fatty tissue to energy and may contribute to control of obesity. Other compounds help lower LDL cholesterol and stimulate the liver to produce omega 3 fatty acids.

NANI is planning to bring new dimensions to the processing of marine materials in Newfoundland to human food. It will build on traditional processes with leading edge technologies and advanced nutritional science.

For further information on NANI, they may be contacted at: www.nani.ca, Tel. +1 (709) 759-3003 or by email at ceo@nani.ca.