Sanfords - leading the way in fish by-product research

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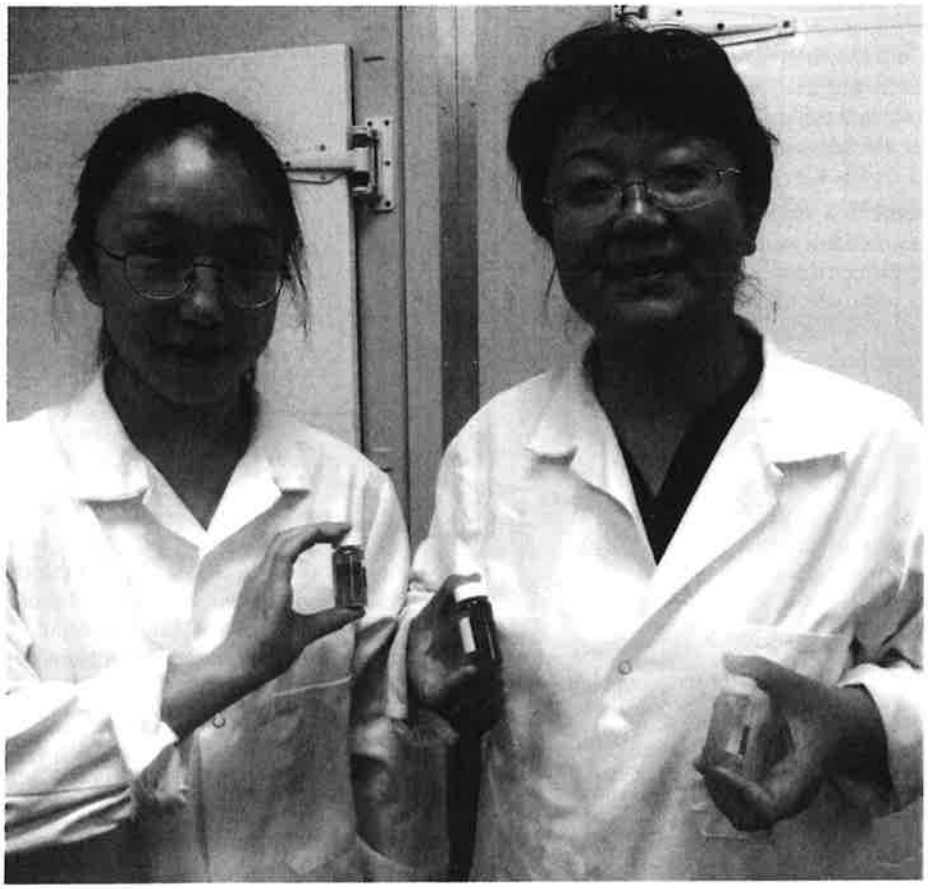

Dr Sabrina Tian, right, with PD technologist Nicole Chen. They are holding phials of oil extracts from fish waste. The bright orange oil is from snapper

"Sanford used to be a traditional fishing company. They harvested the fish then sold it. They used to do value added products by changing the presentation. Now, they are a truly innovative seafood company and focus on fresh," said Dr Sabrina Tian when I met her at Sanfords a little before Christmas.

Albert Sanford never met a food scientist. There was no such thing in 1865 when he first threw a line into the Hauraki Gulf. The business he started has occupied the same harbour-side site in Auckland since 1924. But this not a history lesson, it is about the drive for innovation in today's seafood industry.

Sanfords' innovation team

Sanfords started an innovation team in 2012 under the leadership of innovation manager Andrew Stanley. Sabrina joined the team the same year. The newest member of the six-person team is PD Technologist Nicole Chen. She was a student of A/Prof Marie Wong and graduated B Food Tech with honours from Massey University in 2014. She was also a student representative on the NZIFST Auckland branch for two years.

It was obvious to Sabrina that the filleting process created a lot of low value waste and there was a good opportunity for the company to create high value products from it. They started work to

Sabrina Tian: journey of a food scientist

Sabrina has crafted her career steadfastly. She tells her story.

In 2001 I migrated here with my husband and young son from China. I had a dream that I wanted to study here. But first I just wanted to get established.

People were very friendly in my first job with RJ Hill Laboratories in Hamilton. I spent 2 years working with their high tech HPLC and other equipment and improved my technical skills and English at the same time.

I wanted to use those skills more so moved to Fonterra. First I was at the central lab at Te Rapa then moved to the R&D centre at Hautapu. It was a perfect job and I developed strong interest and good experience in dairy.

While there I was involved in the commercialisation and product launch of Fonterra's high value ingredient, lactoferrin. I developed an interest in lactoferrin and thought "this a good area to follow my dream and do a PhD." I was interested in the synergistic effects on gut health and did research on the linkages between lactoferrin and probiotics. Professor Ian Maddox from Massey University was my supervisor. Much of this work was done at Plant & Food Research laboratories at Mt Albert.

Then in 2012 I joined Sanfords and have never looked back.

Callaghan Innovation

Callaghan Innovation is a New Zealand crown entity that provides a range of services to assist companies. Services include applying specialist scientific and engineering capability to address technical challenges and assist with research and development work via the Business R&D Grants process. Teams are well connected with other R&D providers, and if a company has an interest then it is well worth an enquiry to find out if the Research and Technical Services (R&TS) team or others can help.

The R&TS teams have expertise in data analytics, internet of things (IoT) technologies, sensing and automation, manufacturing and design, advanced materials, process engineering and analytical services. Process engineering and analytical capability is particularly relevant for companies looking to transform and add value to resources from primary production.

Process engineering capability includes expertise in a range of extraction technologies. Specialised pilot plant facilities, with a range of standard industrial equipment used for upstream and downstream processing, enable the team to work with clients to evaluate new product concepts and optimise manufacturing methods. The team also has expertise in fermentation and microbiology, relevant to a range of sectors.

Analytical capability complements process engineering expertise, and is used to identify, characterise and quantify the composition of raw materials and transformed products. This includes checking that materials will meet a client's specifications for identity, purity and stability – a vital part of process and product development work. The Lipid Chemistry team is expert in characterising complex lipids and polyunsaturated fatty acids from various sources and the Natural Products Chemistry team has expertise in a range of natural products, including phytochemicals from plant materials and bee products. The Protein Science team specialises in protein structure and function and assay development and work with a variety of materials and value-added products produced from them.

Process Engineering and Analytical capabilities enable the teams to assist clients to:

- evaluate new add-value opportunities (undertaking trial runs and economic evaluations),
- develop and optimise processes for yield and product quality, and
- transfer technology to NZ manufacturers by providing pilot plant production and scale-up assistance.

In addition, work can be conducted under MPI approved Risk Management Plans (RMPs) as well as Food Control Plans (FCPs) for the processing of fruit, vegetable, herb and plant parts, allowing the teams to support clients requiring the production of food grade products.

On the R&D Business Grants side, there is a range of options to meet a company's business needs. These include Getting Started Grants for companies in the early stages of R&D, Project Grants for companies expanding their R&D activities, Growth Grants for companies experienced in R&D and with substantive R&D programmes and Student Grants that can help to increase a company's R&D capability while enabling students to develop technical skills in a commercial environment. In addition to providing valuable funding to support R&D initiatives, companies often comment that the process of planning their R&D with the support of one of the Callaghan Innovation team adds value to their R&D activities. www.callaghaninnovation.govt.nz/

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develop processes for extracting lipids, collagen and marine calcium from fish frames, heads, liver and skin.

They started desk top research in 2012 then moved into the lab (test kitchen). They researched the oil content of various species and determined where the oil is stored in the body e.g. head, skin, organs etc. This gave some good baseline information for the company. Work is in progress on understanding the fatty acid profiles and EPA/DHA Omega-3 content of these various oils.

After doing lab-scale work Sanfords applied for some R&D funding from Callaghan Innovation. This was successful and led to pilot -plant trials at the FoodBowl in 2014. The new processing methods worked. They made salmon oil from salmon waste, some single species fish oils, and also made fish calcium, protein and collagen powder from hoki.

A first for the company was making fish oil from both snapper and tarakihi. Snapper oil is a beautiful orange-red colour and looks very special. Lots of people know about salmon oil but they have never seen or heard of snapper oil. It has only 2-5% oil so is not normally thought of as a raw material for fish oil.

Hoki is our main species and cold or "natural" processing was developed to extract virgin oil from the liver. "We wanted to keep as much natural vitamins and nutrients as possible and were pleased we got very low oil oxidation indices," said Sabrina. "The traditional way of processing fish oil is the fishmeal rendering processing technique but this involves heat and has negative effects to the oil."

The research and scale-up trials all worked, providing a range of product prototypes."

Adding value to greenshell mussels

Sanford sells 90% of its greenshell mussels in frozen half-shell form. The company has a goal to lift up their export value, as the half-shell price is not very high. This is another of Sabrina's areas of responsibility. Research on the anti inflammatory and pain relief properties of greenshell mussels has been going on for 40 years.

"I have had very strong passion in this area since I began at Sanfords. In 2014 I started working on a new extraction technology to produce high-grade greenshell mussel powder. The process can potentially extract lipids as well.

Support from Callaghan Innovation

Research scientists and engineers at Callaghan Innovation have assisted Sanford with this process development work. This has been a valuable addition to Sanford's in-house capability and has added significant value to their greenshell mussel-derived ingredients.

Sanford sees a big future in greenshell diversification as research results come in and people recognise the health benefits from seafood.

Working with Cawthron Institute

Last year Sanford and Cawthron Institute successfully applied for a research grant to study mussels from the government- funded High Value Nutrition National Science Challenge. The 3-years collaborative research project, with Cawthron Scientist Dr Matt Miller includes four objectives:

1. Understand whether the raw material harvested and the preparation affect high anti-inflammatory properties or not.

2. Learn how chemical composition links with inhibiting inflammatory conditions in an in vitro human or animal cell model.

3. In vitro and in vivo animal studies to see how a mussel product is digested and moves into the blood stream and how it links with biomarkers.

4. A small clinical trial to validate mussels as a functional food. Under study will be the dosage rates, and how good the process is. For example it may be proved that heavy processing lowers the nutritional benefit.

Sabrina is an enthusiastic ambassador for her work and I hope to hear a paper on the subject at the NZIFST conference in Nelson in July.

The team's work has been well received. "Our efforts in by-product utilisation and new technology have had positive feedback from the commercial and scientific world. I believe it is the direction that New Zealand should be going".

In 2014 Sanfords initiated a new process to save the hoki oil extracted from the hoki by-products on deepwater vessels. In 2015, Pure Oil NZ started to use this oil for formulating their Leg Up essential equine oil. The inclusion of hoki oil enhances the balance between omega 3 and omega-6.