

Technology for sustainable protein innovation

Proteins for Food and Health Seminar Series

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CSIRO AGRICULTURE AND FOOD
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Setting the scene...

Global population forecast to grow by over a third by 2050 ⁽¹⁾

As global population increases, greater demand for protein

– seek alternate sources of protein



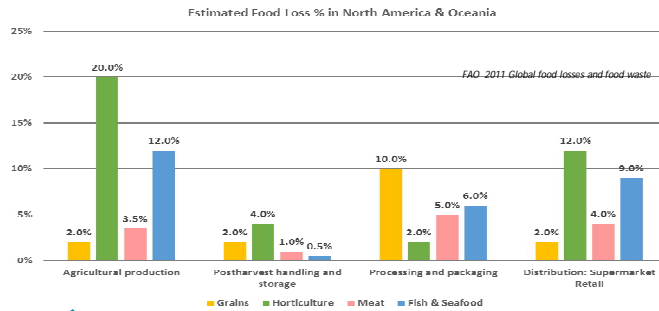
OR

– ways to improve utilisation of current sources, esp. those from food loss streams.

(1) Science (2010), 327:812-818



Food Loss Impact Across the Value Chain



Food Loss in Australia:

Total: \$3.1 million tonnes food disposed; Value: \$3.2 billion

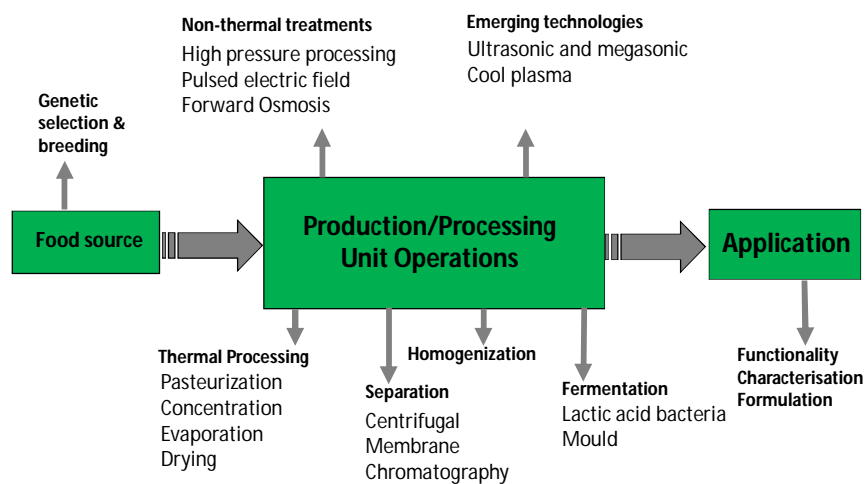
Horticulture Loss & Waste: \$1.8 billion

RIRDC Workshop, Canberra 2015



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CSIRO Capability



Cadwallader & Singh (2009)
Advanced Dairy Chemistry, Volume 3
Third Edition



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Genetic selection and breeding

- Synthetic biology approaches to remove allergy causing proteins from foods. – altering or deleting gene functions by targeted genetic modifications.



Barley Hordein reduced >10,000x
56,000ppm to 3-5ppm

WHO Gluten-free target ≤ 20 ppm

CSIRO: Larkin & Howitt, 2017

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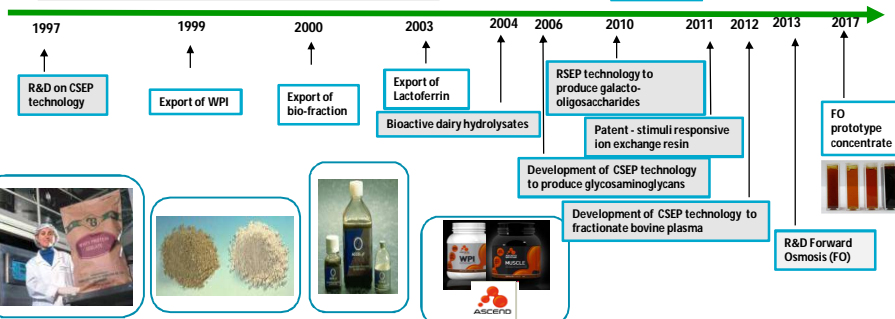
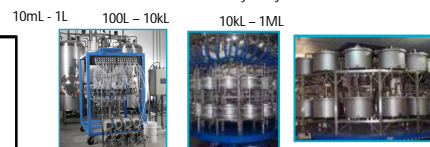


Commercialisation of CSEP Technology



Capital investment >\$15M
3 Protein plants in regional Victoria
Export income >\$50M

Process economic and risk sensitivity analysis



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Membrane separation

Membrane processing adds value through the fractionation and concentration of bioactive and functional compounds.



Green leaves may contain a significant amount of protein: broccoli, moringa, cassava, spinach leaves contain ~27 to ~41% protein.



Key Attributes

- Relatively simple and accepted method commercially
- Separate proteins from other macro- and micro-nutrients and concentrate
- Long history of safe use
- Make use of on-farm waste to obtain underutilised protein ingredient.

Forward Osmosis

Forward Osmosis is a membrane based process that operates under low hydraulic pressure and uses selective membranes to concentrate liquids



Key Attributes

- Cost effective
- Non-thermal concentration, proteins not denatured
- Retention of aroma compounds
- Enhanced functionality?
- Utilised early in the supply chain = reduced logistical costs

Extrusion

Extrusion is a versatile processing technology that combines multiple unit operations such as mixing, heating, cooking, shaping and forming into one integrated process.



Key Attributes

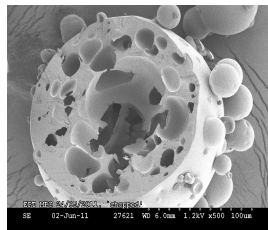
- Transformation of under-utilised food biomass
- Process integration
- High fibre, high protein (~30%) vegetable powder (or ingredient)
- Improved protein digestibility?
- Reduced anti-nutritionals?
- Enhanced functionality?

CSIRO: Ying, 2017

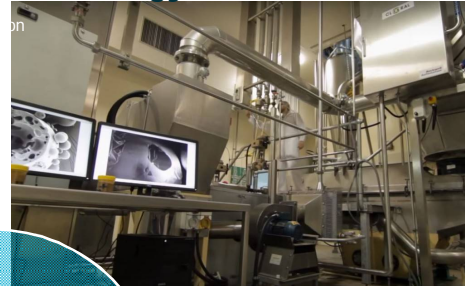
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Extrusion Porosification Technology (EPT)



An electron micrograph of a particle of EPT powder



Key Attributes

- Significantly less energy required than conventional spray drying.
- Low temperature drying - maintain protein structure and functionality
- Foods with improved properties
- Foods retain flavour and aroma.
- Powders are easy to reconstitute, due to internal honeycomb structure



Summary

The
conversion
of protein
sources to
ingredients

- Process development
- Scale and cost
- Functionality
- Sustainability
- Application
- Customised combinations

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Thank you

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