



Encapsulated whey for stockfeed

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Problem

- Whey is dilute and highly perishable
- Large volumes of whey produced

10kg to 1kg



3kg to 1kg



- Whey proteins, lactose, minerals: large manufacturers
- Disposal, high transport cost for piggeries: SME

Piggeries



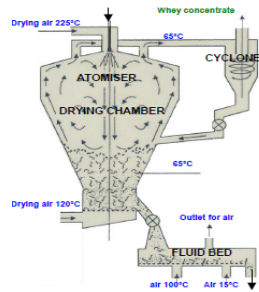
Land



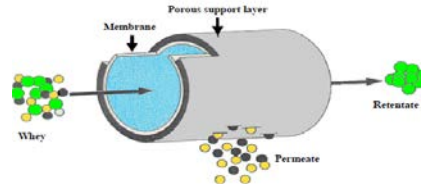
Worldwide
60 Million Ton of whey unutilised,
600,000 ton of whey protein,
In Australia
300,000 tons of whey unutilised,
3000 ton of whey protein

Current solutions:

Concentration and drying



Filtration



Chromatography

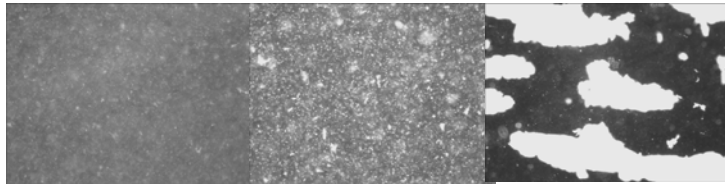


Whey proteins are mixed with other ingredients



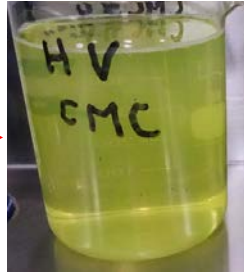
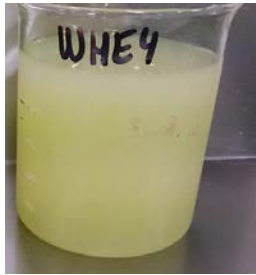
Whey protein biopolymer interaction

- Complexation of anionic polysaccharides such as carboxymethyl cellulose that results in whey protein precipitation at a pH below their isoelectric point has been reported as an alternative method to recover proteins since 1970.
- Bentonite, Sodium Lignosulfonate, Chitosan, Alginate, Pectin, Gum Arabic, Carrageenan, Gellan Gum etc
- Optimisation of pH and concentration of biopolymer



Our solution: Biopolymers and polyanionic compounds

Protein 0.88 %
Solid 7.3 %



Protein 8.4 %
Solid 18 %



Protein 46 %
Solid 94 %

- 50-90 % of protein recovery
- ~10 % lower BOD and whey volume
- 50% whey protein in dry complex
- Excellent amino acid profile
- Excellent digestibility
- Selectivity

Whey protein complexes as stockfeed?

Amino acid profile

| | Stockfeed | Crude Protein (%) | Methionine+ Cysteine +Lysine (g/100g) |
|------|------------------|-------------------|--|
| Com. | Maize | 9 | 1.06 |
| | Sorghum | 11 | 0.8 |
| | Soybean meal | 48 | 4.86 |
| | Maize gluten | 65 | 2.54 |
| | Meat/ bone meal | 39 | 4.35 |
| | Fish meal | 65 | 7.95 |
| Exp. | LVCMC-WPC | 50 | 7.69 |
| | HVCMC-WPC | 47 | 7.05 |
| | NaLig-WPC | 52 | 7.72 |
| | NaHMP-WPC | 56 | 8.68 |

WPC35: 5.97 g/100g

WPC80 13.64 g/100g

Why protein complexes as stockfeed?

Digestibility

| | Stockfeed | Protein content (%) | Metabolisable Energy (MJ/kg DM) |
|------|-----------------|------------------------|------------------------------------|
| Com. | Milk powder FC | 35 | 12.8 |
| | Wheat | 12 | 13 |
| | Barley | 11 | 13 |
| | Clover hay | 13 | 9 |
| | Calfgro pallets | 20 | 12.5 |
| | Dairy pellets | 14.5 | 11 |
| | Maximise plus | 21.5 | 13 |
| Exp. | LVCMC-WPC | 50 | 15.6 |
| | HVCMC- WPC | 47 | 15.2 |
| | NaLig- WPC | 52 | 12 |
| | NaHMP- WPC | 56 | 15.8 |

Cost of materials

| | HVCMC* | | LVCMC* | | NaLig* | | NaHMP* | |
|------------|-------------|------------|--------------|------------|-------------|------------|-------------|------------|
| | \$5.3/kg | | \$5.3/kg | | \$4.20/kg | | \$3.95/kg | |
| | Protein (%) | \$/ton | Protein (%) | \$/ton | Protein (%) | \$/ton | Protein (%) | \$/ton |
| Wet sludge | 8.41 | 137 | 11.34 | 224 | 3.2 | 188 | 8.1 | 374 |
| Dry ppt | 46.50 | 762 | 54.13 | 1070 | 56.8 | 1425 | 45.3 | 2088 |

*Consolidated Chemicals

Whey Powder feed grade: AUS\$1450/ton + GST ex works Brisbane (BEC Feed)
13-15% protein

Competitor products

Market size:

300,000 Ton per annum
unutilised whey in Australia

Globally 60 Million Ton,
Including 27 Million ton in
Europe

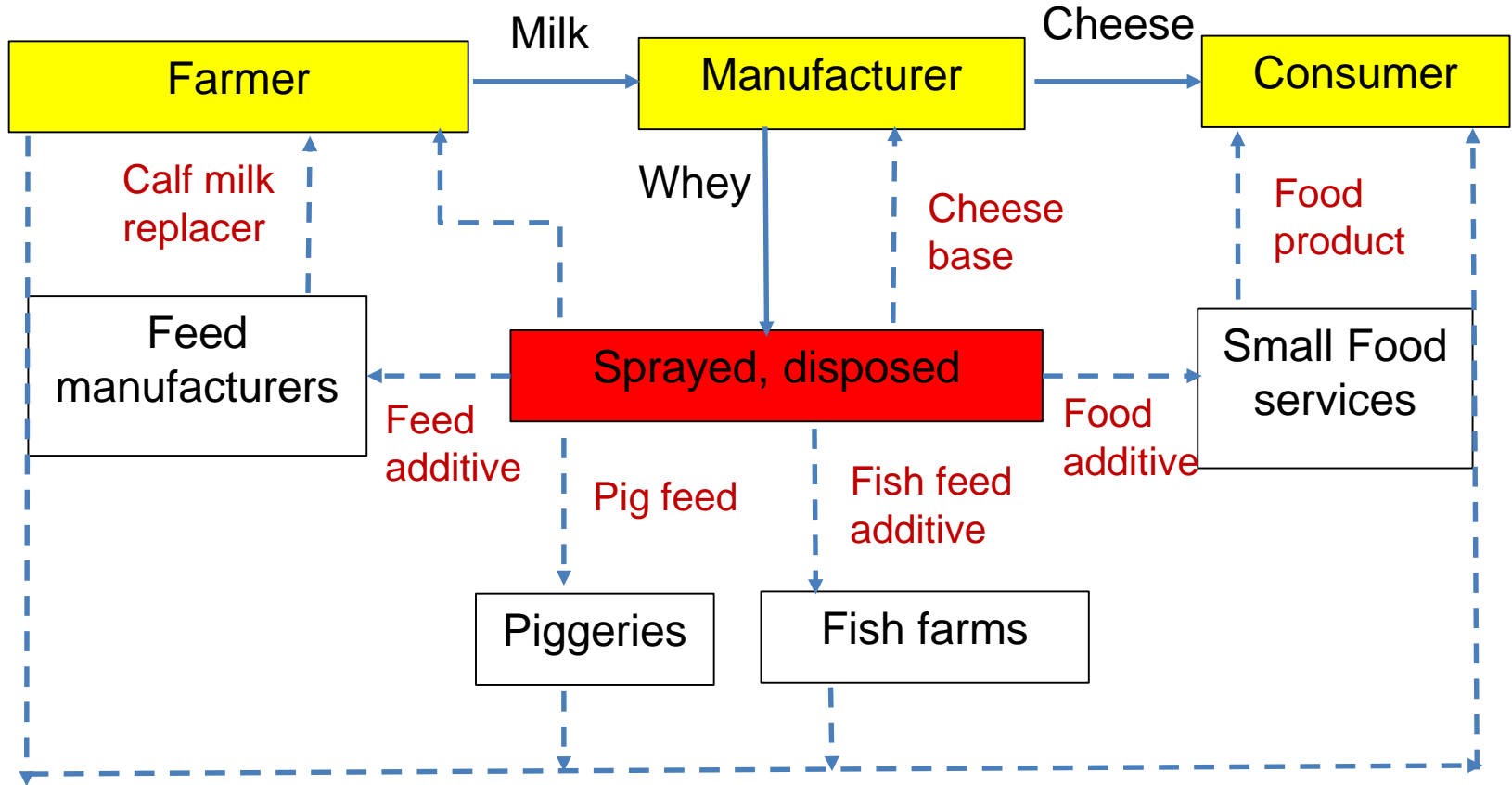
| Stockfeed | Crude Protein (%) | Met+ Cys +Lys (g/100g) | Price (\$/tonne) |
|--------------------|-------------------|------------------------|-------------------|
| Fish meal | 65 | 7.95 | ~2000 |
| Meat and bone meal | 39 | 4.35 | ~500 |
| Whey Powder | 13 | 2.21 | ~1400 |
| WPC 35 | 35 | 5.97 | ~2000 |

Where we are now

- Proof of concept in bench scale
- Received Curtin Commercial Innovation Awards, Health Sciences Award 2015
- Further experiments identified further cost reduction

What we like to do

- Target applications and test
- Pilot scale production
- Commercialisation
- Identify companies with synergies



Using biopolymers in a simple and cost effective method to utilise food waste

Acknowledgements

- Dairy Innovation Australia Limited (DIAL)
 - Brownes Dairy
 - Milne Feed