



Analysis of South Australia whey processing options

Dairy Australia Project: DSA/GISA313:
The Whey Forward

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Executive Summary

This study was commissioned by DairySA with funding from Green Industries SA *Better Resource Use Grant Program 2016-17*. The purpose was to gather baseline whey production data and investigate alternative options for application of the full range whey types generated from large and small South Australian cheese manufacturers. The results are summarised as follows:

Guide to whey production from cheese

- The quantity and characteristics of whey can vary widely according to the type of cheese being made and the manufacturing technique. To get some sense of this a simple working guide is:
 - 10 litres of whey is produced in association with 1 kg of cheese
 - 55% of the raw milk solids is separated into the raw whey stream
 - Raw whey will have a composition something like:

Fat	0.3%
Protein	0.9%
Lactose	4.0%
Minerals & Other	1.0%

SA whey production

- 9 South Australian cheese manufacturers have been identified in this study.
- 7 of the manufacturers identified are small in scale (less than 5 million litres of milk processed per annum). One factory processes 5 – 10 million litres per annum. The largest manufacturer in South Australia is processing in excess of 30 million litres per annum.
- Total whey production from the small manufacturers is estimated to be less than 10 million litres per annum
- Total whey production in South Australia is estimated to be less than 60 million litres per annum
- Only one cheese manufacturer is producing a food grade product from whey (sweet whey powder). For other processors, the whey is either going to sewer, piggeries, or is used for farm irrigation.

Whey disposal to sewer

- Raw whey contains often unacceptable levels of fat for sewer disposal. This needs be removed through the production of the secondary cheese product, ricotta, or by clarification using a grease trap, dissolved air flotation (DAF), or mechanical means.
- With respect to chargeable parameters for sewer disposal, it is estimated that clarified whey has the following approximate composition:

BOD	30,000	mg/l
SS	400	mg/l
TKN	1,500	mg/l
TP	600	mg/l
TDS	10,000	mg/l

- Based on SA Water's trade waste charges, the estimated cost associated with whey disposal in the Adelaide sewer system is approximately 5 cents per litre of whey or about 50 cents per kilogram of cheese.

Disposal in biogas and compost operations

- SA Water and Peats Soil & Garden Supplies have offered to receive full strength whey into their sites around Adelaide. SA Water operate an anaerobic sludge digester that produces biogas and Peats run composting facilities.
- For both options a zero cost is being quoted for receiving the whey. The cost would be in transport from the cheese manufacturer to the SA Water or Peats facilities.
- It is estimated that the transport cost of full loads to the biogas or compost facilities would be 2.0 – 2.5 cents per litre. This assumes full loads of 27,000 litres on at Tri-Axle trailer. This represents approximately 50% of the estimated cost of disposal to sewer (based on 2016/17 trade waste fees).
- For these options there would be an initial capital cost for collection and storage in a holding tank prior to transport. That cost is offset by capital savings on the equipment required to clarify and cool whey. There is also potential for cost savings in chemicals used for pH control, plus the cost of DAF operation and sludge disposal prior to sewer discharge.

Sale to a piggery as liquid feed

- Analysis of the value of whey to a piggery operation shows the opportunity for significant cost / benefit in comparison to disposal to sewer or use in biogas or compost production. The exact benefit for individual cheese manufacturers would need to be assessed on a case by case basis.
- The major capital cost associated with this option is the installation of whey storage silos at both the cheese factory and the piggery site.
- Because of the capital cost, plus the need to transport full truckloads of whey, this option is more favourable for medium to sized cheese manufacturers (more than about 500 tonnes per annum). Small cheese manufacturers may however be able to participate in

this opportunity by joining with larger manufacturers in a combined whey collection service.

Production of liquid whey protein concentrate (WPC35)

- For a cheese plant producing 500 tonnes per annum the estimated capital cost for production of liquid whey protein concentrate is \$900,000.
- The estimated cost of production for WPC35 is \$4.40 / kg on a dry basis. This compares with an average sale price of \$2.80 / kg for WPC35 powder. On this basis the value of the liquid product will need to be significantly higher than powder to justify investment.
- Investment in liquid whey protein production will be a challenging decision for small and medium size cheese manufacturers given: the hurdle cost of capital investment; the cost comparison between liquid product and commercially available whey powder; and the complexity involved in development and marketing of a liquid product.

Production of whey powder or whey protein concentrate powder

- An analysis of the cost / benefit of whey powder production in Australia was undertaken by Dairy Innovation and Xcheque in 2013. This work showed that investment in sweet whey powder production was not viable in cheese operations producing less than 5,000 tonnes per annum.
- For whey protein powder the breakeven point was found to be at about 10,000 tonnes of cheese per annum and that this excludes the treatment of the residual lactose / mineral stream.
- Since 2013 drier capital costs have increased significantly as a result of the depreciation of the Australian dollar and increased intensity in international dairy investment.
- Whey powder production is not considered an option for individual small / medium sized cheese processors manufacturing 1,000 tonnes of cheese or less. Aggregation of whey and joint investment in a drier is also considered impractical because of: the wide range of whey types that are produced; difficulty in ensuring quality standards are met; and the complexity of operational logistics when trying to manage small loads of whey from a number of processors.

Conclusions

- The study has found the most promising opportunity for the use of whey from South Australia's small to medium cheese manufacturers is as a liquid feed in a piggery operation.
- Full truckloads of whey are required for optimum cost / benefit when transferring to a piggery, or to a biogas or compost application. To enjoy the benefit of these options, very small cheese manufacturers would need a combined pickup service whereby whey is collected from multiple sites to fill a truck in a single trip.