



ANAEROBIC TREATMENT OF CREAM CHEESE WHEY

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Cream Cheese Whey

- ▶ 1 kg cheese >> 5-10 kg of whey
- ▶ 115 million tons of whey world-wide
- ▶ Globally - 50% disposed of into the environment
- ▶ August 2018 - Fonterra commenced new Cream Cheese production in Darfield



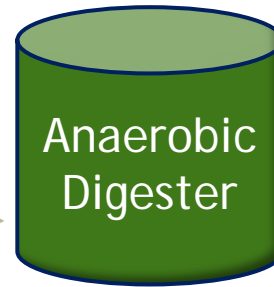
Cream Cheese Whey

- ▶ Cream cheese whey (CCW)
 - ▶ Lactose (44 - 52 g/L)
 - ▶ Proteins (6 - 8 g/L)
 - ▶ Mineral salts (4 - 10 g/L)
- ▶ High COD > 60,000 -120,000 mg/L
- ▶ High nutrient content:
 - ▶ TN 800 - 900 mg/L
 - ▶ TP 600 mg/L
 - ▶ Ca 1,100 mg/L

Anaerobic Digestion of CCW



CCW = Organics + Nutrients



Nutrients to land
or treatment

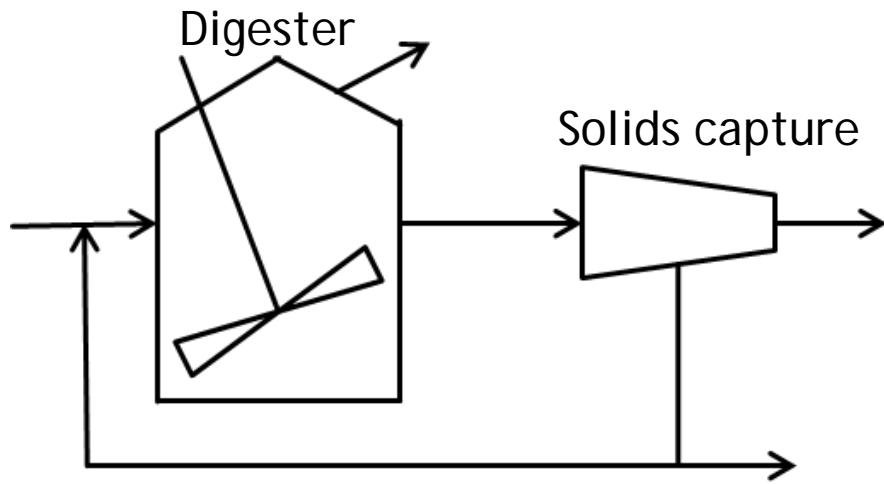
Biogas = Energy

1 tonne whey → 60 kg COD → 20 m³ methane → 716 MJ of energy

Technology Selection

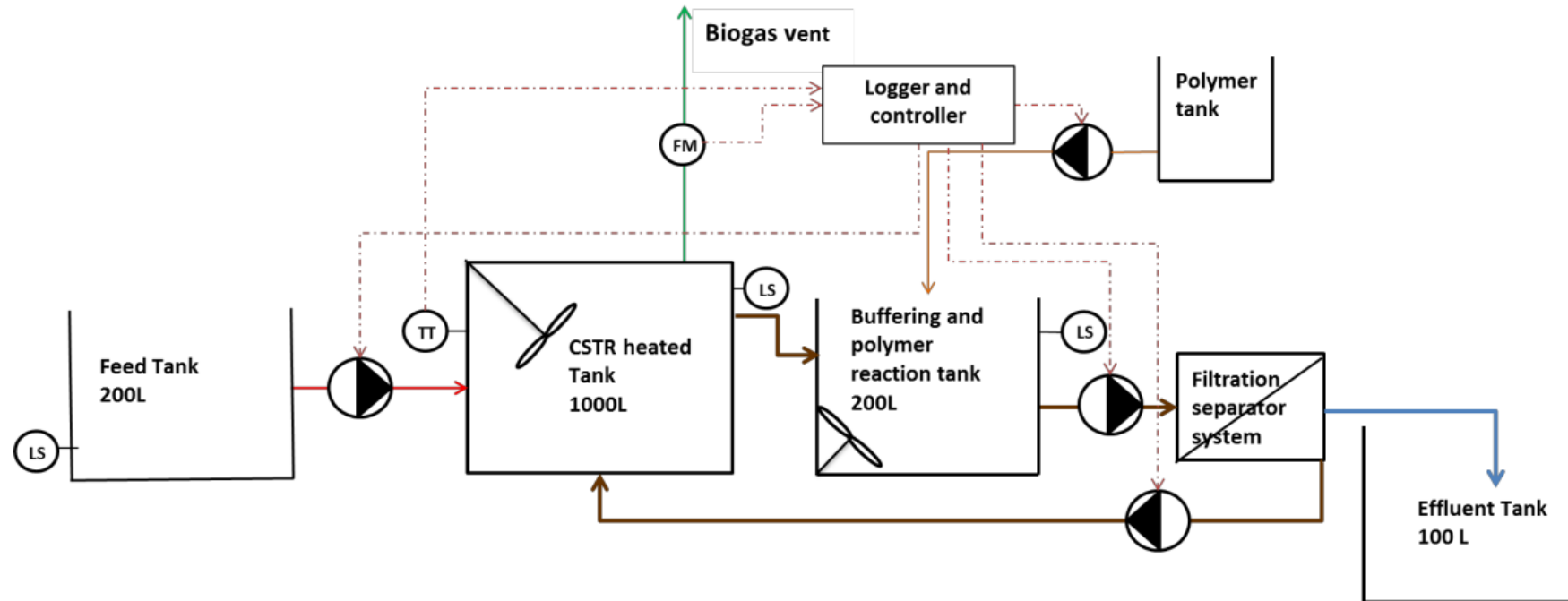
Process Risk	Technology Feature
Fluctuating load (COD, FOG)	High process robustness
Calcium phosphate precipitation	Solids removal efficiency
High solids (fats) content	Low pre-treatment requirements

Anaerobic Contact Process



- ▶ Benefits of Anaerobic Contact process:
 - ▶ High treatment efficiency
 - ▶ Operating robustness
 - ▶ Medium-high loading rate
 - ▶ Controlled solids (precipitation) removal
 - ▶ Low pre-treatment requirements

Pilot Trial



Trial Objectives

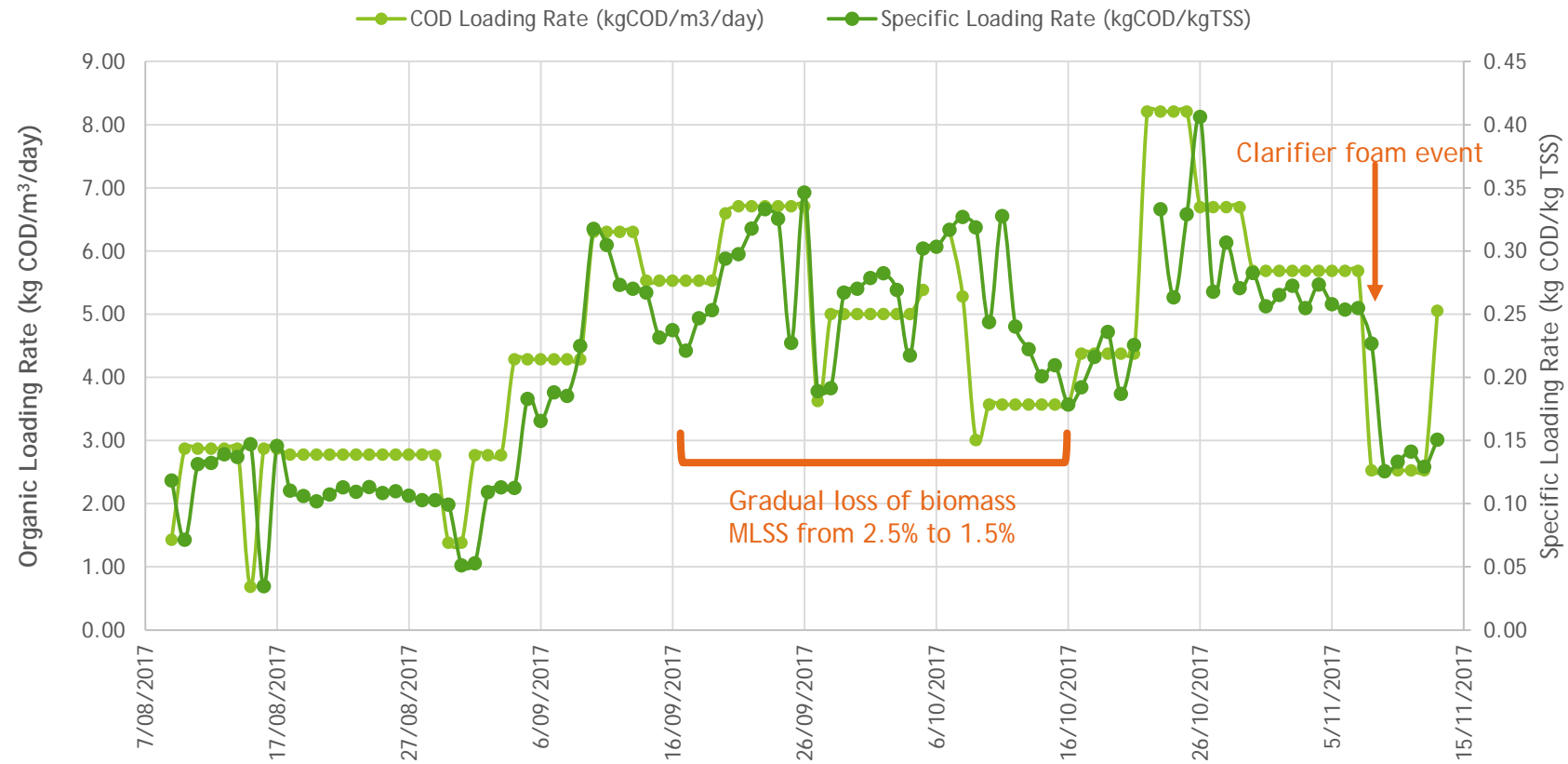
- 1) Design basis for full scale digestion
- 2) Maximum organic loading rates
- 3) Treatment efficiency
- 4) Biological methane potential of CCW



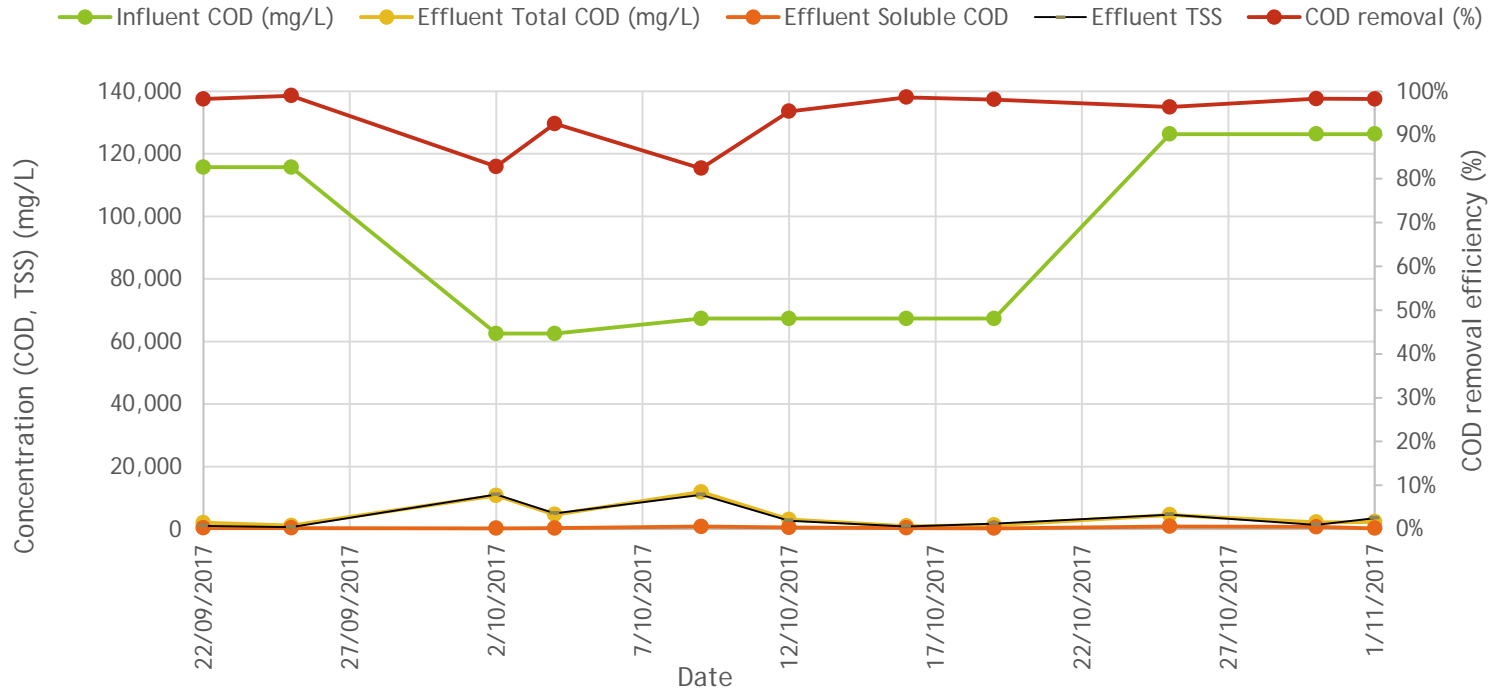
CCW Characteristics - Trial results

Parameter	Unit	Range	Average
Total COD	mg/l	62,500 - 126,300	87,700
Filtered COD	mg/l	47,100 - 62,800	56,520
TSS	mg/l	2,310 - 35,500	14,850
pH		3.49 - 3.64	3.55
Fat	%	0.45 - 1.98	0.89
Protein	%	0.38 - 0.98	0.65

Organic Loading Rate

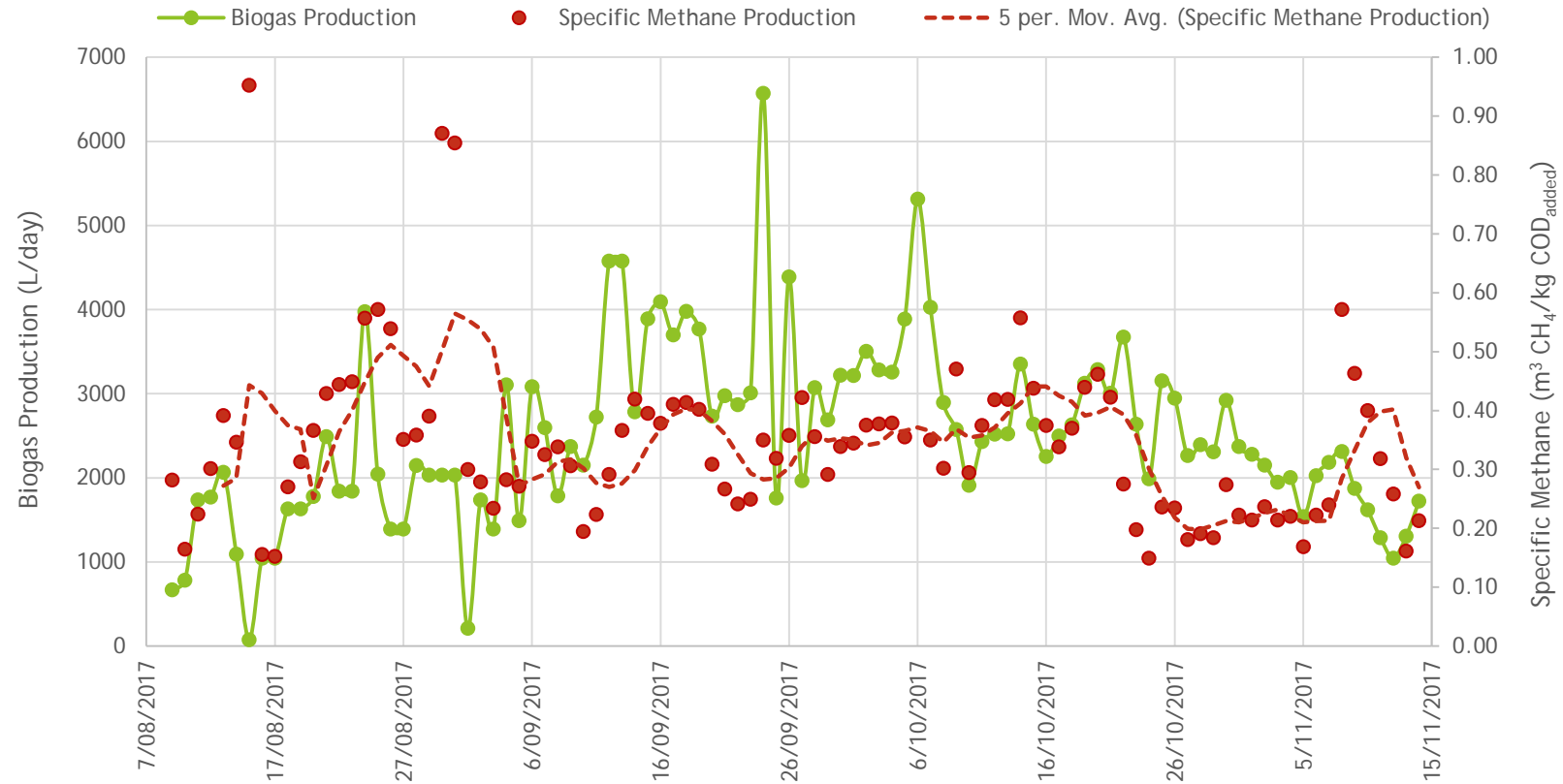


Treatment Efficiency

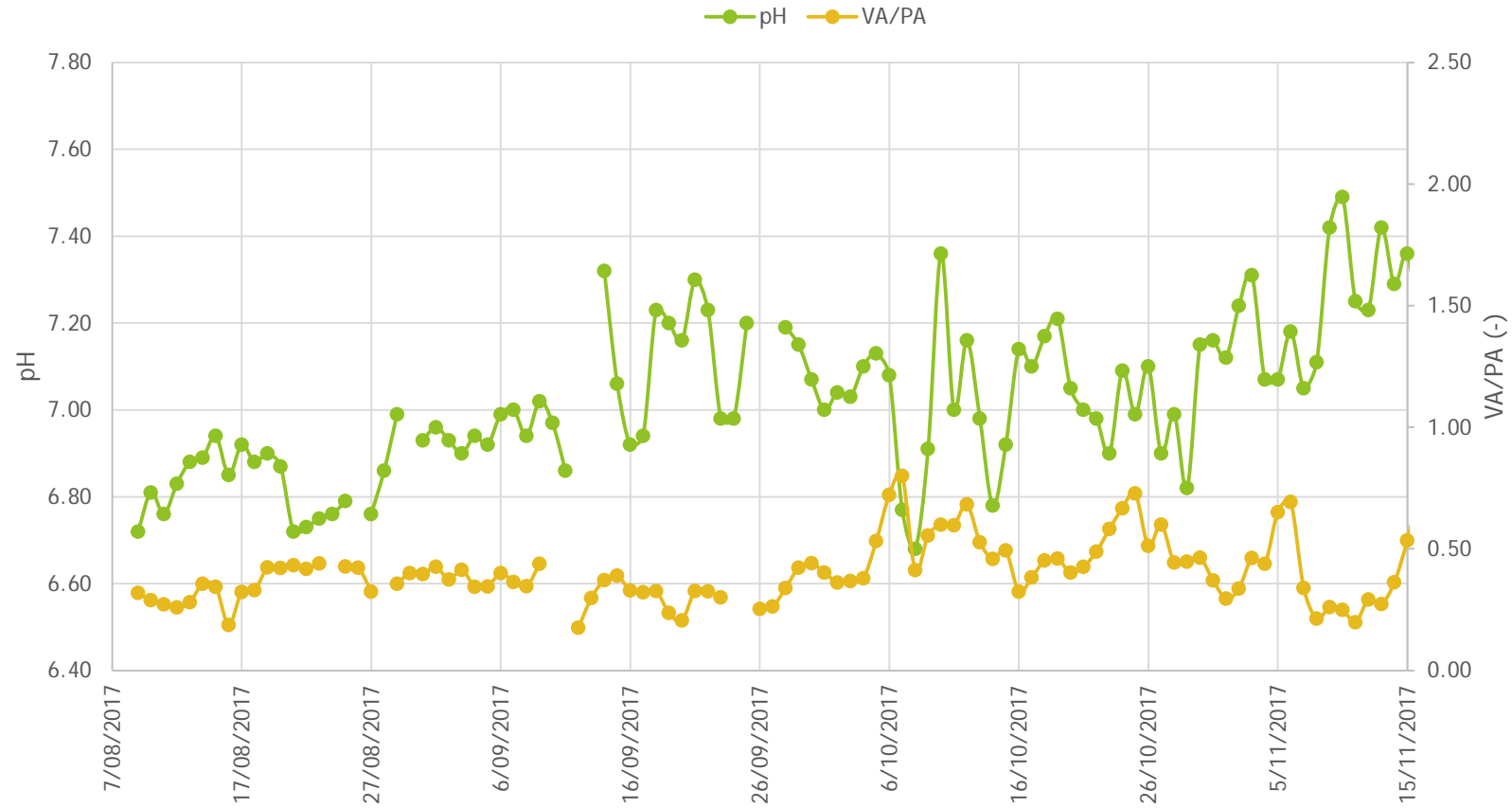


Nutrients		Process
Phosphorus	90% - 96%	Precipitation, removed with solids
Nitrogen	50%	Mineralisation to ammonia

Methane potential



Operating Stability



Pilot Trial Performance

- ▶ Successful operation for ~100 days
- ▶ Some modifications were required due to mechanical issues
- ▶ Operation not fully automated
- ▶ Sufficient amount of operating results was obtained for design of full-scale system

Operating issues:

- ▶ Delay in whey characterisation
- ▶ Pipe blockage
- ▶ Loss of biomass
- ▶ Clarifier foaming



Conclusions

- ▶ Proof of technology
- ▶ Organic Loading Rate 5 kg COD/m³/day
- ▶ Ability to cope with as high fat content as 2%
- ▶ High COD removal efficiency >> high biogas yield
- ▶ No alkalinity supplementation required
- ▶ Significant phosphorus removal occurring due to precipitation

Acknowledgement

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