

Cost Saving Coagulation Comparison at Lorne Water Treatment Plant

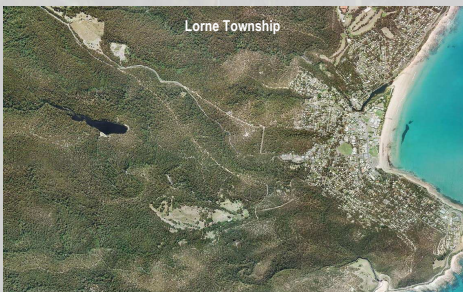
Doyle.S Barwon Region Water Corporation, 2009

SUMMARY

In early 2009, an investigation into the suitability of using Aluminium Chlorohydrate (PAC 23) at the Lorne WTP was undertaken by trialing the coagulant in jar tests and then by online trials at the treatment plant. The results from these trials were compared with historical data of existing coagulants (PAC 10 and Aluminium Sulfate). Since May 2009 PAC 23 has replaced PAC 10 as the preferred coagulant. This poster evaluates the results from these comparisons including the water quality, economic, environmental and OH&S benefits the inclusion of PAC 23 provides at the Lorne WTP.

BACKGROUND

Lorne is located on the Great Ocean Road in South West Victoria. It has a permanent population of 1,000 that swells to over 20,000 during holiday periods. The Dissolved Air Flotation Filtration (DAFF) plant at Lorne sources 400ML per year of raw water from the St George River situated in the Otways.



Since the plant's construction in 1989 two coagulants have been used to treat the raw water - Aluminium Sulfate (Alum) and Poly Aluminium Chloride (PAC 10).

As Barwon Water actively encourages innovation and efficiency, investigations were undertaken on the coagulation process at the Lorne water treatment plant with the aim of reducing operational costs and improving plant performance. This took the form of trialing the use of PAC 23 as an alternative coagulant.

The table below compares the three coagulants in regard to their chemical specification. Of particular interest is the difference in basicity between PAC 10 and 23. Due to its basicity, during times of a low raw water pH while dosing PAC 10, Soda Ash has typically been required to bring the pH up above 5.7.

Coagulant Chemical Specification

Chemical	Al as APO ¹	pH	SG	Basicity
Aluminium Sulphate (Alum)	7.5 – 8.4%	2.3 – 2.8	1.28 – 1.34	
Poly Aluminium Chloride (PAC 10)	10%	2.2 – 2.8	1.18 – 1.22	45 – 55%
Poly Aluminium Chlorohydrate (PAC 23)	23%	3.0 – 4.5	1.33 – 1.35	82 – 85%

METHOD

Jar test results gave an indication PAC 23 would work at a dose range between 5 – 8.5 mg/L with no pH adjustment required. This represented a potential saving of between \$16,000 to \$23,000 per year based on PAC 10 being dosed at 10mg/l and the plant producing 400ML per year.

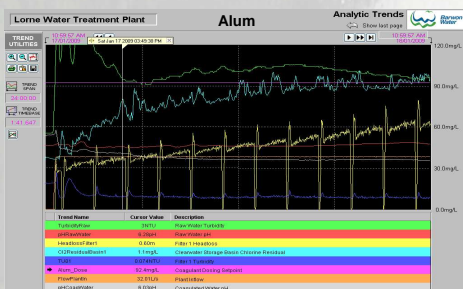
Following the successful jar tests, full scale PAC 23 trials were undertaken from a temporary 80l day tank. Dose rates ranged from 5.5-6.5mg/l achieving a filtered water turbidity of 0.06NTU.



RESULTS

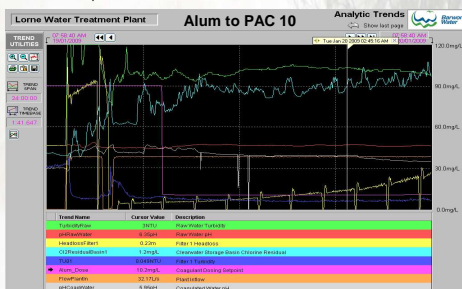
1. Aluminium Sulfate Trend

Depicts an average 24hr run at the Lorne WTP while using Alum (92.4mg/l) as the coagulant and Soda Ash (22mg/l) for pH adjustment. Key points of the trend include Filter Water Turbidity (0.074 NTU) and Raw Water Turbidity (3 NTU). True Colour was 90HU. Cost at this dose rate is \$55.23 per ML.



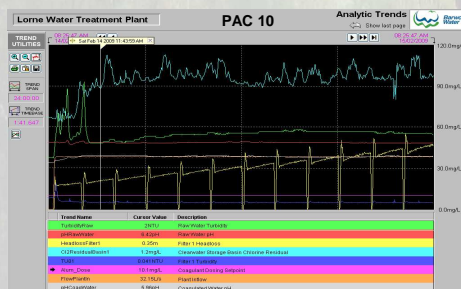
2. Aluminium Sulfate to Poly Aluminium Chloride 10 Trend

Shows the change in coagulant dose rate from 90mg/l of Alum to 10.2mg/l of PAC 10. Soda Ash dose rate for pH adjustment changed from 25mg/l to 10mg/l once PAC 10 was introduced. Change over occurred 3hrs after a backwash as shown. Filter Turbidity improved to 0.04ntu during the 34 hr run time. Cost comparison Alum - \$56.59 per ML. PAC 10 - \$85.87 Per ML.



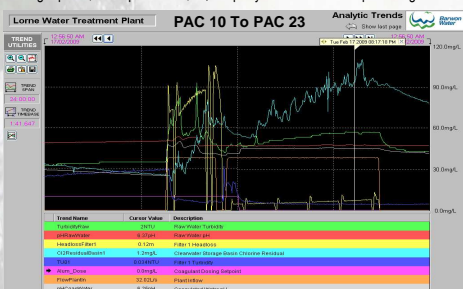
3. Poly Aluminium Chloride Trend

The dose rate for this 24 trend was 10.1mg/l of PAC 10 and required 7mg/l of Soda Ash to achieve a coagulated pH of 5.9. True Colour was 110HU. Cost \$82.76 Per ML.



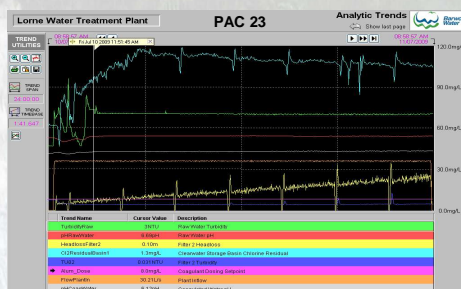
4. Poly Aluminium Chloride to Poly Aluminium Chlorohydrate Trend

The change over of coagulants occurred 40minutes after a Backwash. PAC 10 10.1mg/l and 9mg/l of Soda Ash to PAC 23 7mg/l and no Soda Ash. The cost saving equals \$50.41 per ML or \$20,000 per year at Lorne WTP producing 400ML.



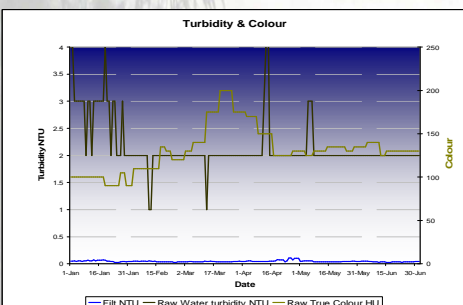
5. Poly Aluminium Chlorohydrate Trend

A typical PAC 23 (8mg/l) trend is shown below achieving a Filtered Water Turbidity of 0.03NTU and costing \$38.76 per ML.



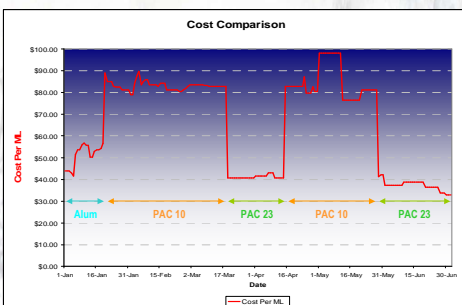
Turbidity and Colour

The graph below shows the Raw Water Turbidity and Colour along with the Filtered Water Turbidity over a six month period from 1 January 2009 to 30 June 2009. A feature of the six months was the stability of the Raw Water enabling a period of time to compare coagulants.



Cost Comparison

The below graph is a six month trend over the same period as the Turbidity and Colour trend. It shows the three coagulants dose rate in mg/l and cost per ML to produce. The soda ash dose rate has been included in the total cost.



Cost Comparison Chart

The Cost Comparison Chart has been calculated by averaging each coagulants dose rate over the past six months. The final costing figures include the contract price based on weight of delivered chemical. This figure does not include electricity or post treatment costs such as Chlorine and post filter pH adjustment which in comparison would further reduce the cost of PAC 23 to PAC 10.

PAC 10	PAC10 Dose rate (AL203)	10.2 mg/L
	Dose neat	102 mg
	PAC10 Cost	\$78.03 per ML
	Soda Ash Dose	6 mg/L
	Soda Ash use	6 kg
PAC 23	PAC23 Dose rate (AL203)	7.7 mg/L
	Dose neat	33 mg
	PAC23 Cost	\$37.30 per ML
	Soda Ash Dose	0 mg/L
	Soda Ash use	0 kg
Alum	Alum Dose rate (AL2SO4)	87.6 mg/L
	Dose neat	165 mg
	Alum Cost	\$36.00 per ML
	Soda Ash Dose	19.2 mg/L
	Soda Ash use	19.2 kg

CONCLUSION

The introduction of PAC 23 has reduced the operating costs at the Lorne Water Treatment Plant. Along with the operating costs there are additional benefits associated with its inclusion such as:

- reduction in the amount of sludge produced
- less post pH dosing
- less Soda Ash required = less exposure to chemical, manual handling
- filters require less frequent backwashing
- less coagulant being dosed = less chemical deliveries
- higher quality of water being produced = lower amount of chlorine dosed to achieve residual

Lorne WTP will save above \$20,000 this year from changing chemical alone