PRODUCING STABILISED MAGNESIUM HYDROXIDE LIQUID CHEAPLY USING TREATED WASTEWATER AT YOUR STP

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ABSTRACT

Safe, effective, economical and environmentally responsible odour control and asset protection in sewerage collection networks has long been the bane of Councils and Water Authorities in Australia and other parts of the world. Masking agents, corrosive chemicals, non-performing "snake oils" and expensive solutions have all entered the market making various claims in one form or another.

Published studies and articles by various companies, organisations and individuals comparing stabilised Magnesium Hydroxide Liquid (MHL) with other chemical alternatives for dosing sewer networks, has proven MHL to be the safest, most cost effective and environmentally responsible to use for odour control of H_2S gas and long term protection from collection system corrosion.

1.0 INTRODUCTION

Manufacture and supply of stabilised Magnesium Hydroxide Liquid in Australia has up until now, been basically monopolised by one major company. The method of delivering in IBC's and bulk road tankers, in many cases over long distances comes at a cost to customers not only for MHL, but the operation and maintenance of vehicles. This method also sees the end user being delivered approximately 45>50% potable water which adds an additional load to the treatment system.

Now there will be an additional cost through the introduction of the Federal Governments carbon tax. Many Councils and water authorities are aware of the benefits of using MHL but have struggled with various factors, primarily the high cost associated with purchasing MHL by weight, being approximately 1.4 by volume.

Along with the cost, the lack of knowledge and also experienced advice about the characteristics of stabilised MHL in establishing correct storage and dosing equipment, has seen MHL put into the 'too hard basket' by many Councils and Water Authorities that would benefit greatly from its use.

Wise Waste Solutions (WWS) has designed and manufactures a world first MHL batching plant which empowers Councils and Water Authorities to produce their own stabilised MHL very cheaply using the treated waste water at their existing STP's, breaking the virtual monopoly of bulk delivery, purchasing by weight and importantly, the opportunity to reduce their carbon footprint. See Figure 1.

Figure 1: ***500L Micro MHL Batching Plant with 2000L Storage***

2.0 DISCUSSION

2.1 A request to evaluate existing MHL dosing at SPS's by a Water Corporation

Having extensive experience of the wastewater industry in both treatment plants and Sewage Pumping Stations, (WWS) personnel were approached in late 2008 to evaluate a number of sewage pump stations for Unitywater north in SE Queensland. They asked for advice on the functionality of the dosing system and the Magnesium Hydroxide Liquid being used, as Unitywater were experiencing high maintenance costs in keeping the MHL flowing to the wet wells.

Investigation concluded that Unitywater had legitimate concerns and there was a necessity to improve the flow characteristics and stability of the MHL in use for both the storage and dosing systems already installed, to reduce maintenance and callouts.

WWS undertook the evaluation process at no cost to Unitywater as a project to improve and perfect the flow ability of MHL and also lower or eliminate the need for regular maintenance of the storage tanks, dosing equipment and lines. Investigations also concluded that there were only five major suppliers with their own formula in the whole world.

Researching the characteristics of reactive MgO led us down many intriguing paths over the next two years and finally, with the assistance of a manufacturing colleague, the safest ingredients and best process for WWS to produce stabilised Magnesium Hydroxide Liquid was discovered. This has enabled WWS to become a serious competitor in the MHL market within Australia and the world, whereby MHL can now be produced economically by the litre using treated wastewater at the STP's and not purchased by expensive weight.

2.2 Why is MHL the 'green' choice compared to other products on the market?

- NOT classified as Hazardous
- NOT classified as Dangerous Goods
- NOT classified as a Scheduled Poison
- Not Corrosive

2.3 In 2009 Unitywater commissioned GHD to carry out a case study of a CRM.

The CRM serviced a community of 38,000 EP and comprised of six pump stations and 24km of MSCL and DICL pipes and Unitywater wanted to determine the best option for dosing the sulphide laden lines. In the study, the GHD team compared sulphide control technologies comprising of Oxygen, Magnesium Hydroxide (MHL), Ferric Chloride and Calcium Nitrate. See Table.

Table 1: ***Preventative Sulphide Control Technologies***

Technologies	Advantages	Disadvantages
Oxygen dosing	Relatively simple application Proven technology	Promotes the removal of readily degradable BOD Complex delivery system for effective oxygen transfer Cannot be easily relocated Medium/high capital costs Medium operating costs Reaction time is pH dependent and may be slow Need to consider dosing location carefully O_2 can accumulate at high points and cause corrosion. Also, risk of explosion is increased Works best under high pressure rising mains Doesn't work well unless flow is semi-continuous Liquid oxygen is hazardous
Magnesium Hydroxide (MHL)	Non-Hazardous Increased the alkalinity and reduces the SAR of wastewater Non-corrosion Low/medium capital cost	Cost is directly proportional to flow treated Single supplier Limited shelf life (3 months) Effectiveness declines as salinity increases Tends to settle to the bottom of PS wet-wells and form a gelatinous mass there Frequent flushing of dosing lines and mixing of storage tank contents is needed to prevent blockages Effect on struvite production at treatment plant is not known
Ferric Chloride ($FeCI_3$)	Low/medium capital cost Longer shelf life than MHL Handling high sulphide loads Rapid reaction	Hazardous Corrosion Medium operational costs Does not oxidise non-sulphide odorous compounds Consumes alkalinity so alkali addition is often required Dosing increases with sulphide concentration Will also react with phosphate Creates a sediment and may have impacts on sludge dewatering and handling at the STP Contains metals other than Fe
Calcium Nitrate	Safe handling Suitable for most systems, particularly when dosed prior to sulphide formation	Promotes the removal of readily degradable BOD Increases total-N load, which can be an issue for downstream wastewater treatment plant Stimulates consumption of organic compounds that assist Denitrification at the WWTP Potentially high operating costs Complex dosing control in some cases may promote

		precipitation of $CaCo_3$

The case study identified disadvantages of all four products. I draw attention to the comments regarding MHL that possibly prompted Unitywater to seek out further advice on MHL in use.

- Single Supplier
- Tends to settle to the bottom of PS wet-wells and form a gelatinous mass.
- Frequent flushing of dosing lines and mixing of storage tank contents is needed to prevent blockages

Following the initial assessment of the products, the study then focused on an evaluation criteria for the four products predominantly operating in collection systems to find the best product. See Table 2.

Table 2: ***Evaluation Criteria***

Criteria	Comment on Criteria	Weighting	Worse possible score	Best possible score
Effectiveness	Ability to meet the target 80 per cent reduction in dissolved H_2S	30	1	10
Environmental	Whether there are any direct, consequential environmental impacts	5	1	10
Operability	Whether the system is easy to operate, and reliable	10	1	10
Ease of installation and maintenance		10	1	10
OH&S	Safety and material handling issues	10	1	10
STP and Re-use	Impact on downstream STP and biosolids and effluent re-use plants	5	1	10
Cost	Net present cost	30	1	10

In Table 3, it shows that MHL ranked the highest overall score by far against the other three products. It should also be noted the evaluation criteria did not take into account any corrosive aspects by products such as Ferric Chloride. The MHL score of 4 for operability reflects the comment in Table 1, "Tends to settle to the bottom of PS wet-wells and form a gelatinous mass". Note the cost of MHL from the single supplier was the assessed best at 6.9.

If gelatinous build up is occurring, then effective control of headspace H_2S gas in the SPS is not being achieved and the dosing regime is ineffective in suspending sulphides flowing into the downstream lines.

There is a right and very wrong way that MHL dosing needs to be installed and dosed to raise the pH, control H_2S and stop the gelatinous concentration in the bottom of the wet wells.

Table 3: ***Evaluation Results (Score 1-10)***

Evaluation Criteria	Oxygen	Calcium nitrate	Magnesium hydroxide	Ferric chloride
Effectiveness	4	6	8	6
Environmental	5	5	5	5
Operability	6	6	4	6
Ease of installation and maintenance	4	5	8	7
OH&S	5	8	8	5
STP and Re-use	4	2	7	5
Cost	5.0	0.0	6.9	4.6
SCORE	465	405	706	549

3.0 Actual Business Case for producing MHL using treated wastewater at a STP

Unitywater personnel recognised many years ago through extensive odour logging, CCTV of the network pipes, manual inspection of the SPS's, consultants advice and extensive trials using MHL, that the benefits of dosing MHL into the network collection system would be invaluable in controlling H_2S gas and saving infrastructure refurbishment and replacement costs well into the future.

In 2011, Unitywater carried out a comprehensive business case study using internal management and external consultants to evaluate the advantages/disadvantages and Return On Investment (ROI) of installing and operating a MHL batching plant at one of their STP's, compared with the only other method of purchasing MHL by weight and bulk deliveries.

The results in favour of purchasing and operating a batching plant for short and long term savings to produce MHL using treated wastewater at the STP were extremely impressive.

With MHL use at the time and the projected use over the following years, the ROI for Unitywater to purchase a batching plant to produce their own MHL using treated wastewater at their STP was assessed to be 1>2yrs.

For Unitywater this equates to continuous resolution of H2S odour control and saving millions over future years in asset protection.

3.1 Advantages identified in the research to economically produce MHL at the STP

For the exercise of comparing litres to weight, let's say MHL weighs out at approximately 1420kg/1000L, equating to approximately 700L = 1000kg.

Using the example of purchasing by weight and being charged say $1.25/kg, this would equate to approximately $1.78/L. This then equated to $1780/1000L.

Comparing the installation of a batching plant at the STP to produce MHL by the litre using treated wastewater, the cost to produce 1000L of MHL was noted to be as little as $0.96c/L depending on the STP location. This equated to $960/1000L which is a saving

of $820 or almost half the cost of purchasing MHL by weight.

Using the treated wastewater at the STP was seen as another important advantage as there is no additional load being added to the network.

Another advantage identified was the introduction of the carbon tax that will see STP's assessed as part of their green principles and the reuse of the wastewater could be considered a carbon offset. Current long haul transportation of MHL will incur the carbon tax and this in turn will increase the cost of MHL deliveries, which made producing MHL at the STP using treated waste water an even more favourable option.

Councils and Water authorities that currently use Ferric or Ferris Chloride and have wanted to change over to the environmentally safe MHL but were prohibited by cost, now have a real choice to do so, based on producing their own stabilised MHL.

4.0 CONCLUSION

One of the first comments of most organisations requested to change their mindset of suppliers, products, production methods or purchasing capital equipment is mainly 'what's it going to cost me' without very importantly, also considering 'what's it going to cost me if I don't change suppliers, products, methods or purchasing trends'.

Introducing the safe, economical and environmentally stable MHL for the protection of the collection system network and controlling the formation of H_2S gas, repays the implementer immediately and importantly in subsequent years, by large savings on future capital costs for early relining or replacement of the infrastructure that would have normally been corroded over time without the use of MHL.

In an economic climate that demands more savings coupled with more efficiency, there is now an opportunity for Council's and Water Authorities to embrace the protection of MHL with the new and proven technology of a MHL batching plant, allowing the safe and very economical production of stabilised Magnesium Hydroxide Liquid using treated wastewater at the Sewerage Treatment Plant.

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6.0 REFERENCES

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