BIOSOLID REDUCTION AND THE DESKIN QUICK DRY FILTER BED

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ABSTRACT

From the establishment of the Warrnambool Waste Water Plant in 1996 the of reuse and reduction of the biosolids produced has been an ongoing problem. At the start of the plants operation a successful composting process was conducted at the Warrnambool municipal tip site but the closure of the tip for rehabilitation forced the authority to seek another suitable site to carry out this process.
A bid for a new site to the north of the township of Koroit was thwarted by strong public opposition and did not go ahead.

An agreement was reached with Melbourne Water to store the biosolids in a lagoon at the Werribee site from 1998. The high cost of transport along with the knowledge that this was only a temporary arrangement has seen the authority move into the field of biosolid reuse and reduction trials.

KEYWORDS

Deskin, Quick dry filter bed, Polymer mixing, Flocc,

1.0 INTRODUCTION

South West Water Authority (SWWA) has trialled a number of alternatives methods of handling biosolids produced at the Warrnambool wastewater treatment plant.

Originally the option of long-term storage was at first considered to be the number one choice but if this option was to be pursued the cost of transport would be a major hurdle to overcome. Drying the sludge to a higher % at the WWTP would be advantageous in reducing these costs so a number of options were reviewed.

A different type of belt press, filter press, and centrifuges were all considered with a trial of a filter press from Germany performed in 1999 but it still did not produce a satisfactory result in cake dryness and consistency. A problem associated with the Warrnambool sludge is the high fat and grease content in the influent from dairy factories and abattoir waste, which create slow drainage rates on belts and filters.

Details of a different type of drying bed in America came to the attention of the authority and a study was undertaken to assess this system for our use. Results of 30%-60% dry cake in 3 days were enough to convince those involved in a trial of the system.

2.0 DESKINS QUICK DRY FILTER BED

The Deskin principle of drying beds were sought and purchased by SWWA and construction began in December 2000 with completion in early February 2001.

To look at the bed looks no different to the Australian version but the difference is in the drainage system and under bed construction.

The "quick dry" filter bed consists of four major components.

- A series of pipes are laid on the base of a bed to provide drainage and also presaturation water to enter the bed prior to pouring on the sludge. These pipes are then covered with 20-25mm rock. A honeycomb grid is placed onto the base rock and filled with 10-15mm rock and a final layer of sand is spread over this to complete the bed.

- A Flocculation system(RapidFloc Mixer).

- An in-line polymer preparation system that injects polymer into the flocculation device.

- A self contained harvesting unit.

Figure 1: ***Deskins Quick Dry Filter Bed***.

Figure 2: ***Rapid Flocculation Mixer***.

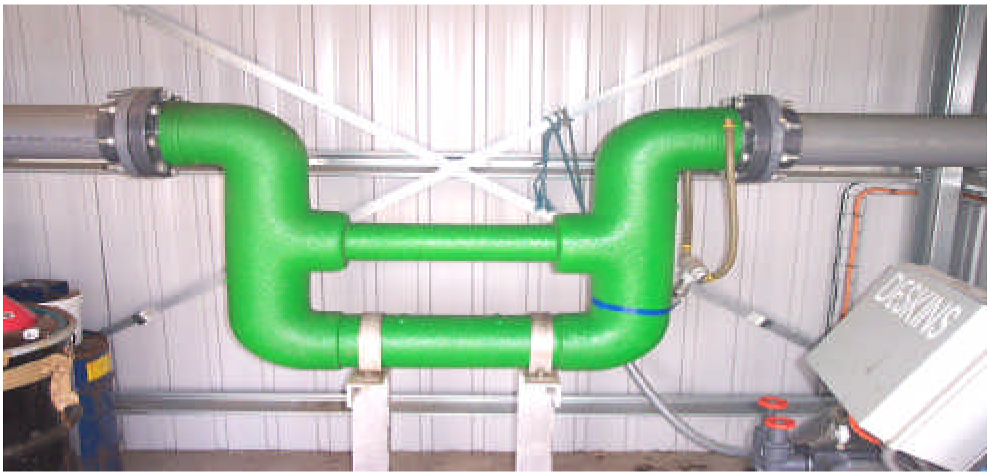

Figure 3: ***Polymer Preparation Unit*.**

Figure 4: ***Dried Solids Harvesting Unit***

The operating principle of the Deskin bed is:

- Thicken sludge to 1.5%-2%.
- Presaturate bed from underneath with clean effluent to a set level.
- Pour WAS flocked with polymer in to the water to a set level.
- Turn off WAS and immediately open drain valve.

Saturation of the bed forces out any air that has been trapped in the filter media and allows the sludge to flow evenly across the bed surface to achieve maximum distribution.

When the underdrain is opened a vacuum or siphoning effect is created and causes the rapid dewatering of the sludge. Along with this cracking or "opening up" of the sludge occurs and allows air to circulate around the cake and further increase drying. Around 90% of the water will exit in 12 hrs and the sludge will continue to drain while it is on the bed.

Initial results produced a cake of 45%-60% dry but during this stage of testing temperatures were 38-40C and load rates were low with sludge of .8%-1.0%. The trial continued with mixed results and it became evident that we would have to change some of the factors governing the testing.

3.0 PROBLEMS WITH THE BED.

In our trials we had encountered a few problems, the first being the sand. The original sand provided excellent drainage but poor retrieval due to the harvester sinking into it and picking up sand as well as cake. When tests were carried out drainability and stability had to be taken into account to determine our needs. While some provided a perfect layer to traverse a longer period of drainage would occur and added time to the process. Some sands were similar to the original and mixes were tried until a compromise was found with a supply from a local quarry.

Polymer was another issue along with dose rate as it is mixed and added without any ageing and totally controlled by the mixing unit.

When all these problems came to a head a different approach was needed to obtain the best result due to the time required on the bed to achieve a dry cake. This meant if a pour was unsuccessful 7 days elapsed before the cake was harvested and the bed prepared for another pour.

4.0 TROUBLESHOOTING.

It was decided to make mini beds out of 80L plastic containers to scale with the bed. In these containers different sands could be trialed along with varying doses and different types of polymer until consistent results were being achieved and we felt confident with the process. These trials could all be carried out at the same time and turn around times depended on the tests being carried out, but were no longer than 3 days.

After these tests were carried out larger containers of 1m x 1m were made up and placed onto the bed on the different types of sand with sludge poured in to simulate an actual pour. All of the tests were carried out using every piece of equipment supplied to mix and dose with the sludge bypassing the bed and returning to the plant with buckets used to transfer samples to the containers.

<u>**Figure 5:**</u> ***Mini trial drying beds.***

After tests had been carried out the following points were identified.

- Coleraine sand provided good drainage and stability.
- Zetag 7878FS40 polymer was equivalent to that supplied by Deskins.
- Mixing of WAS to 1%-1.5% worked but more air was needed in the mixing tank to provide a consistent sludge %.
- Velocity across the bed needed to be higher to provide better more even spread.

After identifying these problems a pipe was connected to the WAS line that feeds the belt press and a flow of 22 l/s was pumped onto the bed which is the maximum limit of the flocking unit.

With the flow velocity, polymer and sand type all identified as problems and rectified, trials could now be done on the bed.

5.0 TRIALING

When trials finally started on the Deskins bed everything worked as we had come to expect from the smaller tests and provided some relief for the operators. The next major problem that started to appear early in the testing we had no control over at all. For 10 pours in a row anywhere between 25mm and 40mm of rain was recorded on the cake as we tried in vain to dry it. Even with the rain on the cake a higher % result than the belt press was achieved although the 7 days taken to reach this result was not all that desirable.

Changes were also made to the original method of pouring WAS into water and draining at the finish of the pour.

No pre-saturation at all was tried, and then a small amount of up to 100mm was found to provide the best result for even and rapid spreading. After this initial spread is achieved draining at a rate similar to the inflow will create a river effect and spread sludge to the entire bed for an even coverage. At around the 4 hr stage the draining slows and sludge is stopped to allow the bed to finish draining.

Table 1: ***Cake Data***

	Sun 1 day	Mon 2 days	Tue 3 days	Wed 4 days	Thu 5 days	Fri 6 days	Sat 7 days
Solids Content (%)	**16.23**	**17.50**	**17.10**	**18**	**26**	**20**	**21**
Thickness (mm)	65 mm	70 mm	65 mm	75 mm	70 mm	70 mm	65 mm
Solids Content (%)	**17.1**	**17.10**	**17.8**	**18.2**	**19.7**	**21.2**	**21.3**
Thickness (mm)	75 mm	70 mm	65 mm	60 mm	60 mm	60 mm	60 mm
Solids Content (%)	**20.36**	**20.46**	**18.2**	**17.0**	**24.9**	**21.6**	**21.8**
Thickness (mm)	55 mm	70 mm	65 mm	60 mm	60 mm	60 mm	60 mm
Solids Content (%)	**13.24**	**14.42**	**15.0**	**16.4**	**17.5**	**19.6**	**20.5**
Thickness (mm)	80 mm	85 mm	85 mm	80 mm	75 mm	75 mm	70 mm
Solids Content (%)	**14.94**	**16.33**	**17.0**	**17.04**	**17.51**	**25.11**	**22.84**
Thickness (mm)	70 mm	70 mm	70 mm	60 mm	60 mm	50 mm	50 mm
Solids Content (%)	**14.58**	**14.86**	**15.6**	**16.8**	**20.7**	**18.7**	**19.9**
Thickness (mm)	85 mm	80 mm	70 mm	70 mm	80 mm	55 mm	50 mm
Solids Content (%)	**16**	**16.8**	**16.8**	**17.2**	**21.1**	**21.0**	**21.2**

Tests are carried out daily to determine dryness along with current weather conditions and rainfall. Along with these tests, wind speed, direction and humidity are also recorded daily from a weather station on site. All of these details are then collated and are used to determine harvesting. The possibility of moisture absorption from the sea spray is also being investigated as a hindrance to the drying process.

Table 2: ***Deskins QDF Pour Results***

Operator running sheet used on all pours from September 2001.

Settings	
Polymer Type:	7878SF40
Poly used ml	12000
Feed Concentration (%):	0.57%
Feed Rate (L/sec):	20.5
Pour Time (hour)	4
Bed Loading Rate (kg/m2)	5.5
Poly Dose Rate (ml/kg):	7.0
Sample No.	
Flowmeter	370200 69250
Total KL Pumped	300950

6.0 CONCLUSION

After extensive trials with different components and trips to observe the operation of this system overseas, the Warrnambool trials have created a benchmark for Deskin in Australia. For the period of the trial we have experienced the coolest summer along with the longest period of rainfall for our area. Even with these elements against us we were able to obtain quite pleasing results even though the time factor for some of these was unsatisfactory.

The location of our plant in proximity to the sea could be seen as a disadvantage to the drying process as it is usually cooler than inland and the sea spray is evident on all vehicles and plant windows suggesting moisture uptake in the drying cake. A location to the north of the Dividing Range would therefore be a location that could sustain a drying bed of this type given that the weather is more settled in the warm to hot range suitable for drying.

A new and different type of drying system that could be very successful in the right climate and Australia has this to offer.

Public awareness to the problem of biosolid production should be on the agenda of all water authorities Australia wide as it is a problem that will more than likely be with us for a long time to come.
The general community would like to see the best result obtained but at no cost to themselves so the cheapest method of disposal tends to be the road that most authorities will follow to satisfy the demands of there customer base.

We all contribute to the impact on the environment in some way so it would seem logical to pay a small price now to lessen the impact in later years.

7.0 ACKNOWLEDGEMENTS

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