Organic Waste Management Trial for the Shoalhaven Council using the BiobiN®

Onsite Forced Aeration Organic Waste Bin

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BiobiN® Forced Aeration Waste Collection Bin

This trial is to further enhance the options for the collection and pre-digestion of organic waste generated in the Commercial Sector. This is part of a larger trial being conducted in the Shoalhaven LGA to move forward to realising a separated collection for putrescible and organic waste that is currently going to landfill.

BiobiN® arriving onsite courtesy of Cleanaway Nowra

New compost starter

Due to the length of the journey the compost starter had dried out. New compost material was selected, wet down and inserted into the BiobiN®.

Compost microbe inoculum being placed in the compost starter hopper on the side of the BiobiN®.

BiobiN® Trial 1

With the success of the use of bokashi as an on-site pre-digestion medium in the other trials, it was decided to see whether it would be beneficial in the BiobiN® system.

To test this a side by side test was conducted using unprocessed fish waste and either bokashi or sawdust as the composting medium.

Bags of sawdust in front of the BiobiN®. This is a waste product from a local saw mill.

The BiobiN® is supplied with woodchips on the base. This is on top a piece of steel mesh which covers the aeration pipes.

The bin was simply divided into two by using a piece of cardboard to separate the areas.

Adding bokashi fermentation on top of the woodchip. Pictured right – woodchip covered with a thin layer of the bokashi.

About 80 litres of unprocessed fish waste was spread out over the area using a rake.

Filling the other side with fish waste.

Bokashi & Sawdust was measured out using a 60 litre garbage bin. Both the sawdust and bokashi was added at a ratio of 1.5 times the volume of the fish waste
(80 litres fish waste: 120 litres sawdust or bokashi)

The sawdust and bokashi was raked out over the fish waste to make sure even and complete coverage was achieved.

21st April Observation

Noticeable lack of flies and maggots in the BiobiN® – there were more flies when we put the initial layer of fish in. Gassing off – strong smell of ammonia. Despite this strong smell none was escaping to the outside. It was well contained with the BiobiN®. There was a lot of condensation on the inside and the sawdust and bokashi were both dark indicating moisture. There was minimal (if at all) liquid in the drainage tap at the bottom.

Both sides seem to be going well. The height of the material in the bokashi side appeared to be lower. There were signs of some fish break down.

Added another small (thin layer) of fish and sawdust or bokashi.

6th May Observation

1. Strong smell of ammonia when lifting the lid.
2. This smell was well contained in the BiobiN® – you wouldn't know unless you opened the lid.
3. Both sides had minimal maggots present
4. Hard to recognise fish – all the flesh had been digested with bones remaining
5. The bokashi side had dried out
6. The sawdust side had retained a good level of moisture throughout the heap and was performing better than the bokashi.
7. The compost in the inoculant chamber had dried out. Water with molasses was added to return moisture.
8. It was decided not to continue with the bokashi but to run both sides with just sawdust.
9. Another layer of fish was applied to both sides of the bin and covered with sawdust 1.75 times the volume of fish.

Rove Beetles – Small beetles 10 – 15mm long were discovered living happily in the sawdust fish mix in the BiobiN®. These were identified as being Rove Beetles.

A rove on the emerging from a hole in the surface of the top layer of sawdust.

Identification
Rove beetles are long thin beetles. Most species have very small elytra (wing covers) that cover only a small part of the abdomen. The abdominal segments are flexible. Many species live in the soil and are rarely seen. They are usually black or brown, although the species illustrated is more colourful with blue-black elytra and reddish brown bands on the thorax and abdomen.

Size
10mm

Habitat
usually in soil and leaf litter

Food
some species are predators, others eat carrion, plant matter or fungi

The dark holes have been made by the rove beetles. They probably came in the sawdust. Amazingly they are thriving in this environment, filled with ammonia and long periods of the fan forced air.

This series of three photos show how the sawdust and the fish waste changes over one week. Pictured left is the new sawdust layered on top of the fish waste.

Below left - show the darkened sawdust through moisture and bio-transformation interacting with the fish waste.

Below right - shows a cut away section of the last layer of fish and sawdust. There is a darkened moist area on top where you can see the holes made by the Rove beetle. The sawdust immediately around the fish is drier than the top layer. A large proportion of the flesh on the fish frames has decomposed. The remaining flesh has come from area where the flesh is denser like the fish head.

Below are photos of the decomposition of a large fish over a couple of week. This fish had fillets removed with the head, skeleton and fins still in tact. Flesh attached to the exposed skeleton disappeared quickly. Areas where the flesh was thick, like the head, took longer to breakdown. Small bones were digested faster than the head or tail.

23/5/11

23/5/11

28/5/11

8/6/11

In Conclusion

1. The BiobiN® performed above expectation with the digestion of the unprocessed fish waste.
2. Despite ammonia gas being present upon opening the lid of the BiobiN®, the lid seal contained these smells well.
3. Raw Sawdust out performed bokashi fermented sawdust with the raw sawdust absorbing more moisture allowing digestion to occur.
4. It is assumed that the fan forced aeration provided unsuitable conditions for the bokashi bacteria to operate.
5. Sawdust at a rate of 1.5 times the volume of the fish waste worked well.
6. It is recommended that the digested material be further digested through blending with other ingredients in a windrow compost system.

Cafe Waste and Vegetable Waste Trial

A second trial was conducted using organic waste collected from 2 cafes and a green grocer. Both the cafes had secondary businesses. The first supplied food for a mobile lunch van and the second provided catering services. The green grocer had 3 other people collecting their organic waste.

All businesses were keen to be a part of the trial. The cafes were supplied with 20 litre painters' buckets with lids. These were chosen as they could easily fit along side the existing waste bins, are easily moved around and the lids fit tightly. These were labelled for food waste. The green grocer was supplied with a 60litre round waste bin and lid.

Time was taken to talk with staff at the cafes to find the most convenient location for the food waste bins within the food preparation areas. This guaranteed the use of the bins and reduced contamination. The bins were collected twice weekly with one cafe storing the full bins in their coolroom during summer. This was a good practice to keep the waste fresh and give those staff "peace of mind" who were concerned about rotting organic waste in a food preparation area.

Between 160 to 240 litres of waste was collected weekly from the 3 businesses. This consisted of vegetable peelings; vegetable waste; lettuce leaves; bread; coffee grounds; unsold sandwiches, rolls & pies; some meat and paper hand towel.

Contamination – Non compostable material in the bins collected from the cafes was less than 1%, with the green grocer having on occasion up to 5%. This consisted of waste vegetables wrapped in plastic wrap.

To assist the digestion of the food waste, cardboard was added in layer to balance carbon and nitrogen elements in the BiobiN® and to absorb moisture as it was liberated from vegetables under the forced aeration digestion process. This worked well.

The food waste material spread across the bin.

You can see a layer of cardboard under the food waste.

The food waste was then covered with cardboard and paper. This was added as carbon layer to balance the nitrogen food waste. Cardboard packaging boxes and office paper was used. This was generated from the various sites.

The final step of the project was to empty the contents of the BiobiN® and observe decomposition and smell. The material was then mixed with shredded green waste.

BiobiN® ready to empty its contents. It was mixed with the shredded green waste in the foreground.

Contents from the BiobiN® showing varying degrees of decomposition.

Results.

1. Like the fish waste trial no smell could be smelt escaping from the bin even when the fan was on.
2. Unlike the fish waste, there was very little odour when lifting the lid to add more material.
3. The level of moisture was significantly more than the fish waste.
4. The cardboard worked well to absorb the moisture and assist the breakdown of organic waste.
5. Vegetable matter disappeared quickly, bread took longer.
6. At the rate of about 200 litres of organic waste layered across the 4m3 bin with cardboard covering it worked well.
7. The drain from the bin had to be monitored. Anywhere between 2 -3 litre per week needed to be removed.
8. In the six months of adding material to the bin weekly we never filled the bin. Even though we added cardboard the organic waste continually reduced in size.
9. Care has to be taken to remove the water from the drain regularly as the void at the bottom of the bin can become too full and soil the water in the drain. If this occurs it produces a leachate liquid.
10. The resulting partially digested material worked well mixing it with the shredded green waste.

Conclusion

- The BiobiN® is a good example of appropriate onsite waste technology to manage organic waste in a safe and easy way.
- The sealing of waste from the surrounding environment is excellent allowing it to be placed in confined areas.
- It performed above expectation with the management of unprocessed fish waste and continuously reduced in volume with cafe and vegetable waste.
- On-site management is required to maximise the effectiveness of the system. This could be provided by the customer or the service provider.
- It does require access to 240volt power.
- Management of the liquid captured in the drain in the bottom of the BiobiN® needs to be monitored and managed. This is dependant on the moisture content of the feedstock material.