

Anaerobic Digestion

Anaerobic digestion is the process of biologically degrading organic matter in a low oxygen environment (<2.0ppm). It is common today in the treatment of waste water, agricultural and food wastes. It is also a naturally occurring phenomenon in landfills. Anaerobic digestion leads to the formation of methane gas which can provide a source of renewable energy in the form of biogas that is able to be used for heating or generation of electricity.

The major steps involved in anaerobic digestion are:

1. Hydrolysis: The breaking of large organic molecules into simpler compounds
2. Acidification: The formation of organic and acetic acids
3. Methanogenesis: The formation of methane gas

The compounds formed when organic waste degrades in a low oxygen environment are often different to those that would form in an aerobic environment due to the lack of available oxygen molecules.

Organic waste is made up of the following elements:

- C Carbon
- H Hydrogen
- O Oxygen
- N Nitrogen
- S Sulphur
- P Phosphorus
- CA Calcium

Trace Elements (Potassium, Selenium, Zinc etc)

The exact composition will vary depending on the source of the organic waste, with animal waste having higher nitrogen and calcium content.

Benefits of Use

- Fast acting
- Rapid reduction in VOC's and odor
- Accelerate composting time
- Reduce requirement for turning and aeration
- Avoids problems of odor release upon turning
- Improve leachate run-off quality
- Greenhouse gas emissions reduction in methane and nitrous oxides and from operations
- Labour and fuel savings
- Potential to improve throughput volume and reduce energy and labour costs
- 100% Organic, Biodegradable and Non-Chemical
- Cost effective dosage regime
- Safe and easy to use

Packaging

- 3.5oz / 100g
- 2.2lb / 1kg
- 11lb / 5kg
- 22lb / 10kg



The table below shows the major final products formed by each element in both aerobic and anaerobic conditions, in addition to release of the element itself.

Element	Aerobic	Anaerobic
Carbon (C)	CO ₂	CO ₂
Hydrogen (H)	H ₂ O	CH ₄ / H ₂ / H ₂ O
Oxygen (O)	H ₂ O / CO ₂	CO ₂
Nitrogen (N)	N ₂	NH ₃ / N ₂
Sulphur (S)	H ₂ SO ₄ / SO ₄	H ₂ S

Microbial Processes

The conversion of any feedstock into biogas is performed by bacteria. Anaerobic bacteria, known as anaerobes, like all living organisms require a source of oxygen to survive. In anaerobic conditions the source of this oxygen is primarily the organic matter in the digester and the action of these anaerobes forms intermediate products which are ultimately converted into methane by specialized bacteria known as methanogens.

Enzymatic Process

BiOWiSH™ provides the following benefits in anaerobic digestion:

1. Increased gas volume
2. Increased capacity
3. Increased methane content
4. Reduced ammonia content
5. Reduced hydrogen sulphide content
6. Improved waste water quality
7. Less odorous compost
8. Compost with enhanced properties
9. Increased gas volume

The total volume of gas produced is enhanced through increased solids reduction efficiency in the digester as a result of the high speed action of the BiOWiSH™ enzymes.

Increased Capacity

Through the acceleration of the rate of decomposition of organic waste, BiOWiSH™ is able to improve the throughput rates of an anaerobic digester. The actual rate of increase will depend on a number of environmental conditions, digester design and the feedstock itself.



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Increased Methane Content

The gas produced in anaerobic digestion can vary substantially across differing feedstocks, digesters and ambient conditions. A typical range of gases may be:

Methane (CH ₄)	50-80%
Carbon Dioxide (CO ₂)	20-60%
Nitrogen (N ₂)	0-10%
Hydrogen (H ₂)	0-1%
Hydrogen Sulphide (H ₂ S)	0-3%

BiOWiSH™ has the potential to improve the methane concentration as the enzymatic transformations are performed more efficiently, this means fewer bacteria are required which means that less energy is required to form new bacteria cells. This means there is more residual energy from the feedstock that is able to be converted into methane gas.

Reduced Ammonia Content

BiOWiSH™ is able to breakdown the ammonia molecule in anaerobic conditions. This assists with the creation of less odorous digestate and also has the potential to improve methane production as ammonia is a suppressant of the methanogenesis process.

Reduced Hydrogen Sulphide Content

BiOWiSH™ is able to breakdown the hydrogen sulphide molecule in anaerobic conditions. This assists in prolonging the service life of plant and equipment and can improve the economics of biogas generation.

Improved Waste Water Quality

BiOWiSH™ improves digester waste water quality with lower BOD₅ and COD levels.

Odor Supression

By breaking down volatized organic compounds formed in the anaerobic digestion process, BiOWiSH™ significantly improves the odor of both waste water and digestate.

Enhanced Compost

Digestate matter from anaerobic digesters can be used as organic compost. When treated with BiOWiSH™ it is not only less odorous, it also has higher nutrient availability from the continued action of the BiOWiSH™ enzymes and also confers a degree of crop protection against soil borne fungal diseases that can otherwise occur. Together this has the potential to improve crop yields and to permit the use of the digestate in areas that may not otherwise be possible.



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Testing

Testing was undertaken in a large swine production facility. The farm rears 250,000 pigs at any one time. Research was conducted to see the effect of adding BiOWiSH™ - Odor in anaerobic digesters.

Four test digester units were treated with BiOWiSH™ - Odor. Another four identical digesters were used as controls. Each digester had 1.1tons (1,000kg) of pig manure.

0.134oz/Gal (10g/10L) of BiOWiSH™ - Odor was added into water per treatment (1,000mg/L).

Each digester was treated using the following starter dose on days 1 to 3:

Day	Qty Solution mL	Qty Solution oz	PPM
1	1,000mL	33.81oz	1ppm
2	500mL	16.91oz	0.5ppm
3	200mL	6.76oz	0.2ppm

On an ongoing weekly basis, each digester was then treated at a dose of 500mL (0.5ppm).

Gas composition was assessed using GCMS analysis. Average results across the digesters showed:

Gas	Control	BiOWiSH™ Treated
CH ₄	25-30%	60-65%
CO ₂	65-75%	30-35%
NH ₃	2-3%	0.1%
H ₂ S	0.5-1.0%	0.01%

More Information

For more information on this or any of the revolutionary products based on the BiOWiSH™ technology, please visit www.biowishtechnologies.com

We also welcome your feedback or questions on our products. Please email us at contact@biowishtechnologies.com



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