

BiOWiSH™ - Aqua

Enhancement Technology for Existing Waste Water Treatment Plants



Introduction

Effective waste water treatment is critical to management of the environment and ultimately human health. Today the waste water treatment industry is challenged to continuously tighter discharge standards whilst minimizing cost and environmental impact. Most recently additional considerations of greenhouse gas emissions are impacting on plant management.

Sewage

Sewage treatment has its primary goals in achieving nutrient minimization through reduction of nitrogen and phosphorus and effective pathogen removal. Plants typically use a combination of biological treatment and physical processes such as flocculation and sedimentation. Plants are typically large, treating high volumes, with significant public and private investment in installed infrastructure. It is estimated that in major industrialized countries 1.5% of total electricity is used in waste water treatment.

Industrial Waste Water Treatment

Due to the wide range of industrial processes that create waste water, there is a huge diversity of contaminant profiles and accordingly a large field of treatment technologies employed. While biological treatment is often a core part of a treatment process, the limitations of natural bacterial cultures often demands the adoption of other, more costly treatment methods and chemicals.

What is BiOWiSH™ - Aqua?

BiOWiSH™ - Aqua is a revolutionary high potency enzyme formulation produced specifically to enhance biological removal of nutrients from waste water. It is based on the discovery of a super catalysing enzyme known as Super Catalase which substantially increases the reaction rate of a wide range of catabolic enzymes.

Mode of Action

BiOWiSH™ - Aqua is delivered in a dry powder format that is pre-cultured prior to dosing into a WWTP. Upon activation it is delivered in a live microbial culture that create the range of BiOWiSH™ enzymes (including super catalase) which rapidly remove contaminants. BiOWiSH™ - Aqua is suitable for dosing into all existing biological plants with minimal batching and dosing equipment.

BiOWiSH™ - Aqua changes the biology of a WWTP from being reliant on a large volume of biomass to both digest nutrient as energy and to take nutrient up to create new bacterial cellular material, to one where water is treated through high speed enzymatic transformation into inert end products.

Benefits

- Energy saving in aeration (potentially > 50%)
- Sludge reduction (potentially up to 95%)
- Odor control
- Chemical saving
- Process stability
- Potential to increase plant capacity
- Potential improvement in classification of bio-solids
- Reduction in total operating costs
- Suitable for all biological WWTP's
- Cost savings typically exceed cost of BiOWiSH™
- Improved plant carbon footprint
- Potential carbon credits
- Suitable for plants with biogas generation

Test Results using BiOWiSH™ - Aqua

Treatment Outcomes

	Raw mg/l	Treated mg/l	Improvement %
Phosphorus	12.8	2.35	81.6
Total Nitrogen	61.3	28.9	52.9
COD	709	166	76.6
Suspended Solids	435	46.8	89.2

Test performed in static pre-fermenter – No aeration < 4 hours resonance. Municipal sewage treatment plant, NSW Australia.

Odor Control

	Raw	Treated	Improvement %
Odor Value Dilutions to threshold	412	119	71.1
Hydrogen Sulphide (H₂S) ppm	15.8	4.49	71.6
Ammonia Gas (NH₃) ppm	35.4	6.15	82.6

Odor tests performed at sewage station, Beijing China. 40 minutes after treatment.

BiOWiSH™ - Aqua enhances all Biological Waste Water Treatment Plants

Dosing Systems

Dosing of BiOWiSH™ - Aqua should take place as high upstream in the influent flow as possible. This allows for maximum contact time for the high speed enzymes to break down pollutant and nutrient molecules. It also allows maximum strength culture to be present in the aeration chamber.

Simple two tank pre-activating dosing systems are the most effective in introducing the technology into the influent. This represents a very minimal capital requirement and delivers the most economical result to plant operators. For very low flow plants the technology is applied by simply hanging the BiOWiSH™ - Aqua in a filter bag in the influent.

In sewage operations the optimal dosing point may be within the collection network. Dosing at key rising mains or pumping stations throughout the collection system will result in substantially treated influent arriving at the treatment plant.

Anaerobic Tanks / Biological Nutrient Removal (BNR)

When BiOWiSH™ - Aqua is used in a plant there is less reliance on processes such as BNR or anaerobic or anoxic chambers. These stages are introduced to assist with nutrient uptake by the bacterial biomass. As the BiOWiSH™ treatment technology is not dependent on uptake by microbial biomass the role for these stages is reduced. Their presence in the stream are not however detrimental to BiOWiSH™ as it operates effectively as a facultative anaerobe and will continue its action through anaerobic and anoxic stages.

Phosphorus Management

Sewage treatment is principally about the removal of nitrogen and phosphorus nutrients from the influent as effectively as possible before discharge usually into a natural water course - either a river, lake or ocean. Efficient nutrient removal is essential to prevent eutrophication of waterways.

Unlike nitrogen compounds which can be broken down and off-gassed as nitrogen gas (N₂ - see Nitrogen Management), phosphorus cannot be converted into a gaseous state for removal at useful temperatures in a waste water environment. As a result, phosphorus is most effectively treated in plants adopting the enzymatic BiOWiSH™ technology, through coagulation and sedimentation. The phosphorus is then removed from the plant as phosphate. In large scale plants this is commonly achieved through alum dosing.

Whilst there has been a trend to Biological Nutrient Removal (BNR) in recent years targeting uptake of phosphorus by phosphorus favoring bacterial strains, the benefits of this are far outweighed by the overall plant efficiencies that enzymatic treatment with BiOWiSH™ offers.

Nitrogen Management

Nitrogen is typically removed from waste water through a combination of uptake into bacterial cellular material, microbial digestion and sedimentation. Removed from the plant as a component of sludge the majority of the nitrogen then completes its transformation through the nitrogen cycle external of the plant.

BiOWiSH™ has the ability to enzymatically accelerate the completion of the nitrogen cycle to remove a large portion of nitrogen in the form of nitrogen gas (N₂) within the confines of the plant. This process requires ammonification - nitrification - denitrification to ultimately break the nitrogenous compounds in influent into CO₂ (Carbon Dioxide), H₂O (Water) and N₂ (Nitrogen Gas).

This action is evidenced by higher than normal in-process measures of ammonia, nitrites and nitrates demonstrating progressive break down of the nitrogenous waste at rates much faster than are otherwise possible. Despite these higher in-process measures, final effluent is typically lower in total nitrogen, ammonia and nitrate than traditional plant operations provides, due to the enhanced biological efficiency in the aeration chamber.

Sequencing Batch Reactors (SBR) / Biological Reactors

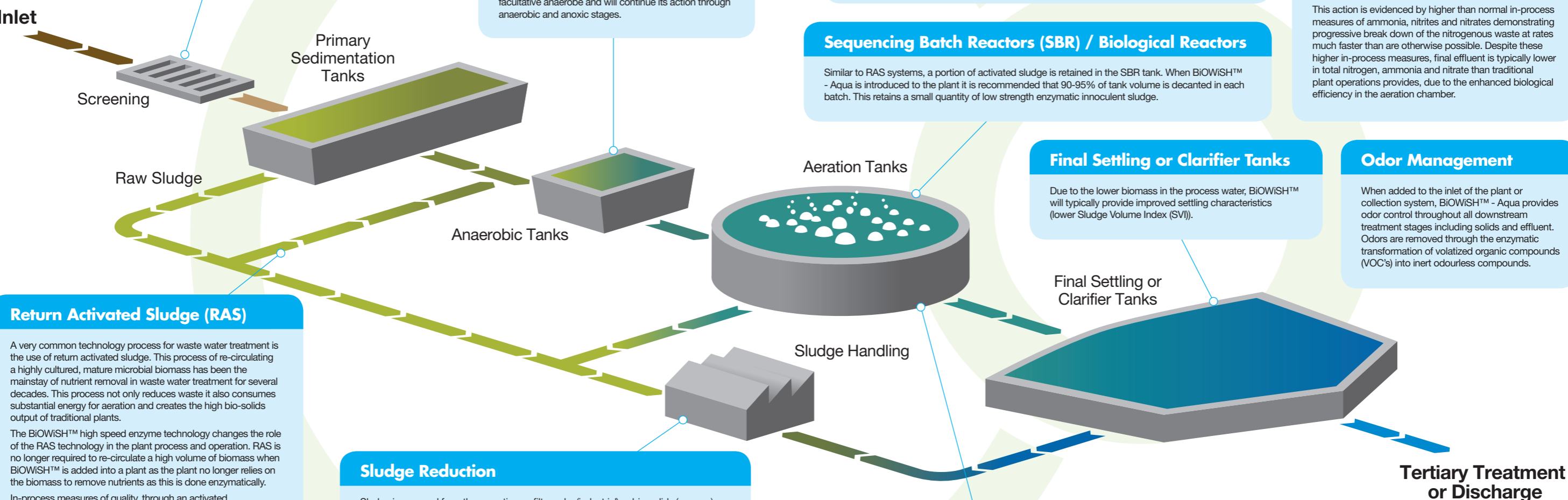
Similar to RAS systems, a portion of activated sludge is retained in the SBR tank. When BiOWiSH™ - Aqua is introduced to the plant it is recommended that 90-95% of tank volume is decanted in each batch. This retains a small quantity of low strength enzymatic inoculent sludge.

Final Settling or Clarifier Tanks

Due to the lower biomass in the process water, BiOWiSH™ will typically provide improved settling characteristics (lower Sludge Volume Index (SVI)).

Odor Management

When added to the inlet of the plant or collection system, BiOWiSH™ - Aqua provides odor control throughout all downstream treatment stages including solids and effluent. Odors are removed through the enzymatic transformation of volatized organic compounds (VOC's) into inert odourless compounds.



Return Activated Sludge (RAS)

A very common technology process for waste water treatment is the use of return activated sludge. This process of re-circulating a highly cultured, mature microbial biomass has been the mainstay of nutrient removal in waste water treatment for several decades. This process not only reduces waste it also consumes substantial energy for aeration and creates the high bio-solids output of traditional plants.

The BiOWiSH™ high speed enzyme technology changes the role of the RAS technology in the plant process and operation. RAS is no longer required to re-circulate a high volume of biomass when BiOWiSH™ is added into a plant as the plant no longer relies on the biomass to remove nutrients as this is done enzymatically.

In-process measures of quality, through an activated sludge plant, typically shows a worsening of quality prior to improvement, due to the reintroduction of the concentrated activated sludge. This inherent inefficiency can be avoided if the raw influent can be treated without the addition of activated sludge however previous technologies have failed to achieve adequate nutrient removal.

When using BiOWiSH™ - Aqua, best results are achieved by allowing the high speed enzymes to operate as effectively as possible by not re-introducing nutrient, biomass or contaminants back into the waste stream. In process terms, this means wasting all accumulated sludge and biomass from the system shortly after the introduction of BiOWiSH™. Thereafter the plant operates enzymatically. At this time the RAS system is employed to return approximately 5% of inflow volume to assist with enzymatic inoculation.

Sludge Reduction

Sludge is removed from the operation as filter cake (industrial) or bio-solids (sewage).

In certain industrial treatment plants, the biological activity is often low due to the type of contaminant being treated, and as a result of low resonance times. Filter cake is a result of high coagulation and flocculation additives utilized to remove suspended solids and contaminants. The BiOWiSH™ enzymes rapidly remove the contaminants at the molecular level including many suspended solids, hence the need for flocculation and coagulation is substantially reduced, resulting in reduced filter cake volume.

In sewage treatment and some industrial processes, the majority of bio-solids produced are dead bacterial cells that were formed to remove the nutrients (carbon, nitrogen, phosphorus etc) from the sewage through microbial digestion for energy and in the creation of new bacterial cellular material. As a high speed enzyme technology, BiOWiSH™ does not rely on a biomass to remove the nutrients, solids and contaminants.

The second source of bio-solids is residual contaminant material. Through its high speed action, BiOWiSH™ achieves a higher removal rate of this waste. In combination this enables BiOWiSH™ - Aqua to achieve bio-solids reductions of up to 95%.

Energy Savings

Waste water treatment typically requires high levels of aeration to sustain sufficient oxygen levels to support high levels of biomass and oxidation of waste material. This high oxygen demand leads directly to high electricity consumption for aeration.

By removing the reliance on biomass to remove nutrients and contamination, oxygen demand is substantially and rapidly reduced. The key contributors to the reduced oxygen demand are reduced microbial respiration due to lower levels of biomass, rapid removal of organic waste hence lower oxidation demand, lower microbial cell formation. The result of this is a natural increase in dissolved oxygen (DO) levels.

Where employed, auto DO monitoring equipment will manage aeration allowing for BiOWiSH™ technology to deliver energy savings often in excess of 50%. Where such technology is not employed, manual monitoring and adjustment of aerator run time and speed are required to realize energy savings.

This not only provides direct cost savings to the plant but may offer options to generate carbon credits or obtain other forms of incentive for the adoption of energy saving technologies.

Using BiOWiSH™ - Aqua

BiOWiSH™ - Aqua can be adopted in all biological waste water treatment plants without the need for large capital expense. It is compatible with and will enhance all common treatment technologies.

The information below is a summary of usage recommendations. For detailed application advice please refer to the BiOWiSH™ Waste Water Technical Manual for detailed dosing tables or visit www.biowishtechologies.com.

Dosing Rate

Application rates and methods are dependant and calculated based on the following parameters:

1. Influent Type (Sewage vs Industrial)
2. Average Ambient Temperature
3. Daily Flow Rates
4. Influent Strength
5. Plant Capacity and Resonance Time

Indicative Dosing Table

Indicative dosage recommendation only. Dosing calculated based on daily influent flow rate. Please refer to the BiOWiSH™ Waste Water Technical Manual for detailed dosing tables or visit www.biowishtechologies.com.

	Dosing Day	Dosing	US Imperial oz/1000Gal	Metric g/1000L
Sewage	Day 1	4ppm	0.6	4
	Day 2	2ppm	0.3	2
	Day 3	1ppm	0.15	1
	Ongoing	0.3ppm	0.05	0.3
Industrial	Day 1	10ppm	1.4	10
	Day 2	5ppm	0.7	5
	Day 3	2ppm	0.3	2
	Ongoing	1ppm	0.15	1

Dosage is based on a phased implementation to establish a culture of BiOWiSH™ - Aqua in the plant.

Dosing Location

BiOWiSH™ - Aqua continues to offer improved performance with longer resonance times. As a result, it is recommended that dosing occur at the inlet to a plant such as a Grit or Screening Chamber. This provides benefits in all aspects of the treatment process.

It is also beneficial in some instances to apply the product in the collection system prior to the plant. One or more major pumping stations are ideal locations and can assist with odor and corrosion control through the collection system as well as offering greater resonance time and improved influent quality further improving overall performance.

Pre-Activation

Pre mixing and activation of BiOWiSH™ - Aqua for 24 hours prior to dosing is recommended to achieve optimum results and economics of use.

Pre activation allows for an increased population of the enzyme creating microbes to be cultured – effectively increasing the dosage rate without the cost. Studies have shown that concentration of the active constituents increase by approximately 100 times through this method. This facilitates very low ongoing dosing rates i.e. 0.3ppm in sewage to be highly effective.

Pre-activation also ensures that the microbial culture has an opportunity to mature prior to introduction into the influent stream enhancing overall performance.

Dosing System

A dosing system is based on:

1. 2 Tanks (sized to allow BiOWiSH™ - Aqua solution < 20,000ppm)
2. Continuous aeration / circulation system to each tank
3. Dosing pump or suitable gravity feed to dosing point

For plants of less than 5,000 Gal / 20,000L flow per day it is possible to use a simple filter bag dosing system. Suspend bag in the inflow to the plant. Weekly dosing is possible with this method.

Next Steps

Review the BiOWiSH™ Waste Water Technical Manual for more detailed dosage rates and refer to our fact sheets and case studies at www.biowishtechologies.com

Technical Support

BiOWiSH Technologies can support your implementation of BiOWiSH™ - Aqua by responding to specific technical enquiries you may have. Please contact techsupport@biowishtechologies.com for assistance.

Storage

Store in original packaging and keep in a cool dry location out of direct sunlight and humidity to maintain shelf life. Once opened BiOWiSH™ - Aqua must be kept in a dry and airtight container to prevent activation.

More Information

For more information on this or any of the revolutionary products based on the BiOWiSH™ technology please visit www.biowishtechologies.com. We also welcome your feedback or questions on BiOWiSH™ products. Please email us at contact@biowishtechologies.com

3.5oz / 100g and 2.2lb / 1kg product packaging shown here - also available in 11lb / 5kg and 22lb / 10kg sizes



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