



BioShaft

Water Technology

GREEN INNOVATION IN WASTEWATER TREATMENT

INTRODUCTION

Based in Southern California - USA, **BIOSHAFT WATER TECHNOLOGY** owns the **the patented BIOSHAFT Wastewater Treatment Plant & Method**. BIOSHAFT designs and manufactures Domestic & Industrial wastewater (Sewage) treatment plants using this patented method. The Turbo MBBR design of the BIOSHAFT System is elegantly simple. Within the heart of our system is the BIOSHAFT Turbo Reactor. It works by emulating and accelerating a natural process found in rivers utilizing **100% attached growth process that generates high concentration of Biofilm**.

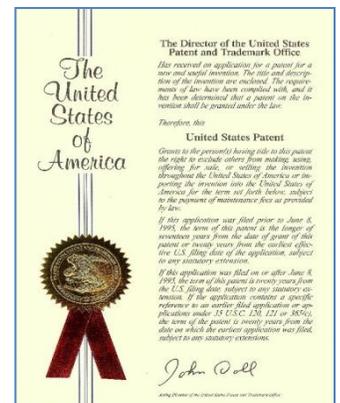
Conventional wastewater treatment produces significant amounts of sludge which must be additionally treated and disposed of at tremendous cost. In fact, it is estimated that over 35% of the operating costs and 25% of the capital costs of a conventional wastewater treatment plant are devoted to the pressing, dewatering, transportation and disposal of sludge.

The BIOSHAFT System technology successfully overcomes many of these types of problems that have confronted prior attempts on wastewater Treatment.

The design of the Turbo MBBR BIOSHAFT SYSTEM is elegantly simple. The main advantage of the T-MBBR system is the **reduction of Sludge and elimination of odor** using minimal electromechanical components. The system has many significant advantages over other systems.

ADVANTAGES

- ✓ Large reduction in **energy** consumption (< 50%).
- ✓ Requires **less land** compared to conventional activated sludge plants of the same capacity.
- ✓ Eliminates **odors**, due to high concentration of the dissolved oxygen created by the system.
- ✓ Lower **capital cost**, due to simplicity of design.
- ✓ Low **noise** emission
- ✓ Lower maintenance and **operational cost**, due to less energy consumption and mechanical components.
- ✓ Easy **Expansion** due to the modular nature of the HANS BIOSHAFT® SYSTEM Turbine which provides phased installation or expansion where appropriate with high levels of **flexibility**.
- ✓ **Underground installation**. Particularly useful where land is at a premium cost, where no visual disturbance is required or where extreme temperature exists.



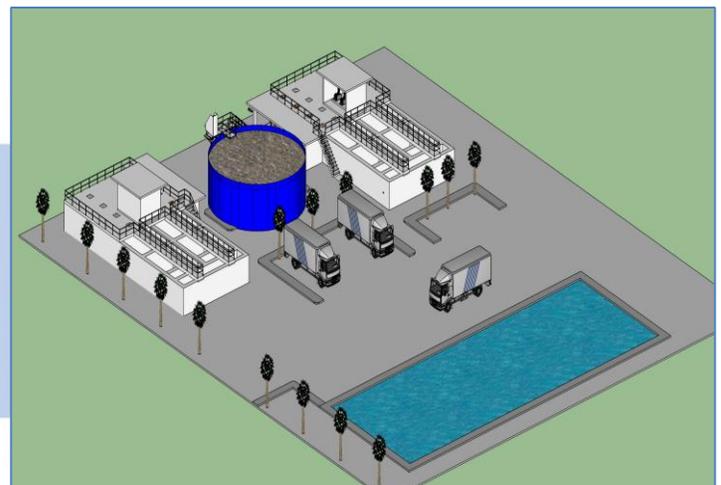
PRODUCTS

T-MBBR BIOSHAFT PACKAGED PLANT



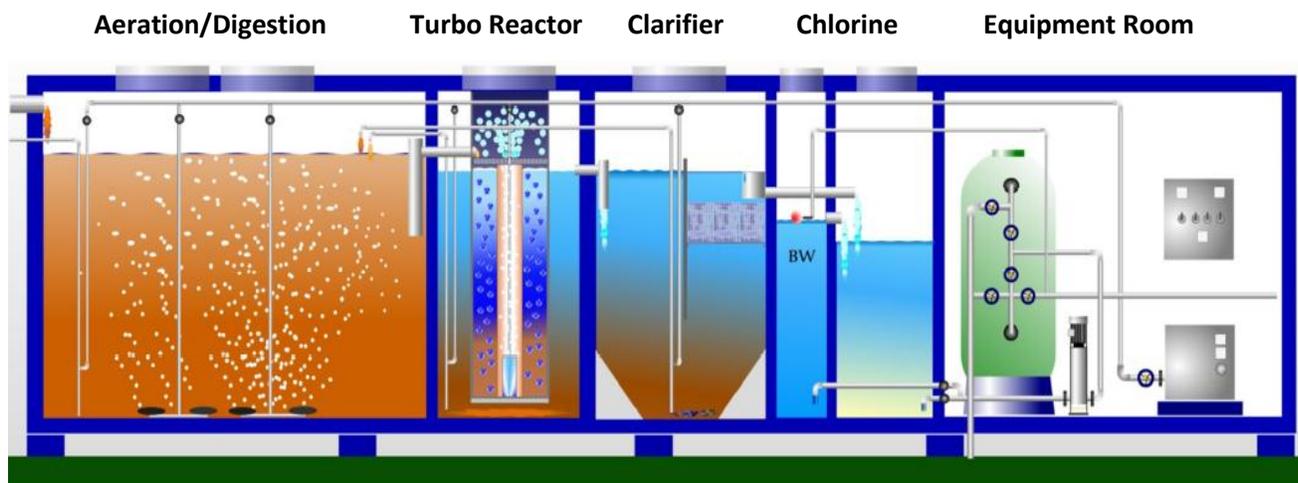
T-MBBR BIOSHAFT TURBO REACTOR

BIOSHAFT CUSTOM INDUSTRIAL PLANT



THE PROCESS

The **Turbo MBBR BIOSHAFT System** Process is an **Advanced (MBBR) process** developed and patented by Dr. Hans Badreddine, a professor of industrial chemicals at Aachen university, Germany.



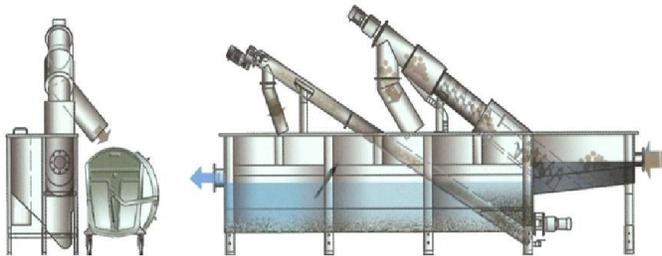
On February 10, 2009, BIOSHAFT received the United States Patent from the United States Patent and Trademark Office for BIOSHAFT wastewater treatment plant and method. The patent number is **7,488,413**. BIOSHAFT also owns the United Kingdom patent number: **GB2390365** for BIOSHAFT wastewater treatment plant and method.

*Based on Dr. Hans Badreddine findings, a new system was developed by designing a vertical (**BIO REACTOR**) capable of achieving and for the first time , a process utilizing **100% attached growth Microorganisms**.*

This invention is called “ **The Turbo MBBR BIOSHAFT System Process**” which **reduces biological sludge production** and reduces inorganic solids to less than 50% by eliminating all suspended bacterial presence in the (BIOSHAFT Bioreactor) .

All other known systems that utilizes partially attached growth processes, still contains suspended bacteria allowing the production of organic sludge as a byproduct.

PRIMARY PRETREATMENT PROCESS



The Wastewater generated from different sources of the project development or communities will flow by gravity into a lift station where Submersible Pumps are installed and automatically transfer the wastewater

to the main sewage treatment plant. The wastewater will pass through an automatic washed bar screen where solids bigger than 10 mm are dewatered and compacted by inclined screw. A Grit Separation phase follows where sand and grit is removed and discharged by horizontal screw to the bottom of the inclined screw conveyor.

The grit is dewatered during transportation and discharged into a container. Finally the waste water passes to an oil and Grease Separation process. It is recommended that the mechanical pre-treatment (SGO) be installed at the very beginning of the waste water treatment system. This will eliminate the unfavorable impact of (physical objects, sand and grit, oils and grease) on any of the system's components including pipes, valves, and lifting pumps. For above ground system installations, the BIOSHAFT system is designed to accept incoming waste water flow at a pressure of (0.5 bar) provided by others. The incoming flow will pass through the (SGO) system which is located at or below ground level.



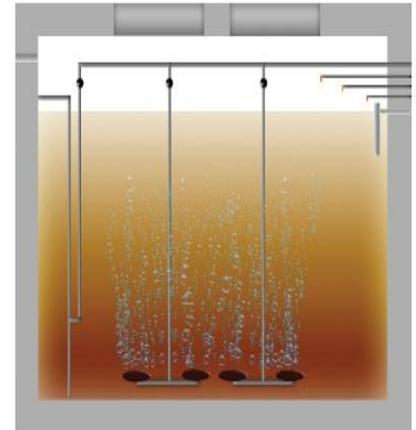
The pretreated effluent is then collected in **the lifting equalization (LE) tank** where shock loads at peak flow times are equalized and lifted to the next phase by submersible pumps operating at a uniform pumping rate (Average flow) The (LE) tank capacity is rated at 3 X average Hourly flow. The effluent is then lifted to the **Aeration Digestion (AD) tank** which is the beginning of the Biological second phase of treatment.



BIOLOGICAL SECONDARY TREATMENT PHASE

The Aeration Digestion (AD TANK)

Effluent from the primary mechanical pretreatment and equalizing buffer tank flows by pumping to the Aeration Digestion (AD) Tank. The equalizing tank receives variable influent loading conditions where shock loads are absorbed over a period of time and delivers a homogeneous average flow rate to the Aeration Tank using submersible pumps. In this zone the organic matter gets aerated and continuously mixed using fine bubble diffused air generated by the aeration equipment. The high concentration of attached

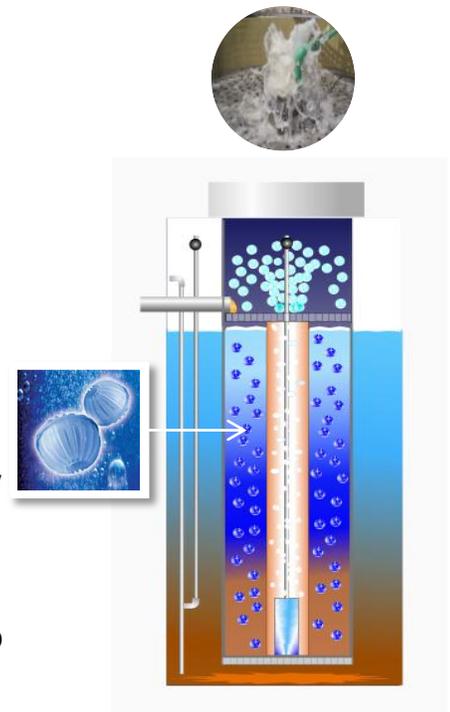


The BIOSHAFT Turbo Reactor

The pretreated wastewater in the (AD) tank is transferred by gravity to the Turbo Reactors where attached growth biofilm process occurs. The attached growth bacteria is grown to full maturity on the large surface area of the floating carriers until attached growth bacteria (Biofilm) dominates and eliminates suspended bacteria.

The Biofilm acts on the biological matter without producing any byproducts (Sludge) which is normally produced by suspended bacteria. The fully matured Biofilm falls off the surface of the carrier to the bottom of the reactor where it gets transferred to the (AD) tank by either an air-lift pump or by a centrifugal

high concentration of active oxygen rich Biofilm in the (AD) tank making organic decomposition very effective, quick and produces no sludge or objectionable odor. This ensures that the installation is safe, trouble free and environmentally friendly.



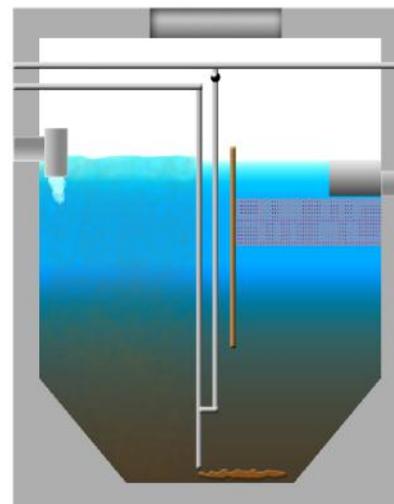
BIOLOGICAL TERTIARY FILTRATION PHASE

Purified water rises up the outer compartment of the Turbo Reactor to the effluent flange and flows by gravity to the Clarifier tank for final settlement and polishing before discharge. Any remaining Biofilm will settle to the bottom of the clarifier tank and will be periodically recycled back to the AD tank.

This recycled oxygen rich, Biofilm containing large numbers of highly active bacteria from both the Reactors and the Clarifier tank will initiate the decomposition and digestion process that will lead to the unique 95% reduction of the sludge. Since sewage has only a **2 to 4%** solid content, the quantities of accrued insoluble solids ("Biofilm") will be minimal; hence the AD tank will require emptying much less frequently than in a conventional plant.

Odors are eliminated due to the absorption of large quantities of oxygen in the system which converts odorous gases into dissolved chemicals. Due to the low content of suspended particles and the fast settling characteristics of the Biofilm, low retention time is required in the clarifier and no floating scum forms at its surface.

The biofilm is a light fluffy material similar to a jelly type material which naturally tends to collect itself into colonies within few minutes. Natural polymerization occurs which naturally coagulates the fine suspended matter and attracts it to the falling colonies of bacteria. Once the colonization is completed it gets heavy and drops to the bottom of the clarifier. Only minutes are required to reduce suspended particles to levels below (10.0 ppm).



SUSTAINABILITY

As members of the international community, we understand the weight and the importance of sustainability with our clients; our designed solutions will meet these goals. We offer integrated sustainable solutions that incorporate an environmental, social and economic focus to promote the preservation of our world's water resources

Comparative Point	T-MBBR	Conventional	Membrane Bio-Turbine
Technology	Attached growth	Activated sludge	Separation
Capital Investment	Low	High	Very High
Cost & Efficiency	Low	High	Very High
Required Land	Low	High	High
Sludge Treatment	Minimal	High	High
Energy Consumption	Low	High	Very High
Maintenance & Cleaning Process (Chemicals)	Minimal	High	Very High
Replacement of Major Items	Low	Very High	High
Operating Cost	Low	High	High
Maintenance	Minimal	High	High
Underground Construction Capabilities	Very High	High	High
Expansion Flexibility	Very High	Low	Low
Landscape Disturbance	Low	High	High
Odor	Minimal	High	Low
Effluent Quality BOD/TSS	10/10 mg/l	30/30 mg/l	5/5 mg/l