AquaTechSystems
DECENTRALIZED WASTEWATER SYSTEMS

BioTank

Technical Specifications

Aqua Tech's BioTank bioreactors range in capacity from 160 GPD to 80,000 GPD. They can be installed modularly to build systems with a capacity over 1 million GPD.

Our stainless steel package systems operate with minimal maintenance for decades. They provide a timely and cost-effective alternative to site-built treatment facilities.

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Construction:

The BioTank is a factory made two or multi-chamber aeration tank made of stainless steel AISI-304. It is equipped with fixed and floating media to house microorganisms. The aeration system ensures optimal oxygen conditions.

The air supply is provided by a compressor (submersible or dry). Air feeding pipelines are supplied to distribute air within the whole BioTank.

All chambers of the BioTank are equipped with air distribution pipelines, necessary fittings and fixing elements.

The BioTank is equipped with an electrical panel and control module.

Applications:

- ◊ Residential development in subdivisions
- ◊ Multi-family housing developments
- ◊ Retail outlets including gas stations, restaurants, strip centers, etc.
- ◊ Institutional such as schools, nursing homes or hospitals.
- ◊ Hospitality—hotels and resorts
- ◊ Small to midsized municipal

The BioTank isn't suitable for treating storm water, or water reclaimed from drinking water plants or boiler houses. At this time Aqua Tech doesn't sell systems to treat industrial wastewater.

The BioTank treated effluent quality allows its safe discharge into environment, reuse for irrigation or other technical needs.

The sanitary and environmental safety of the treatment technology and processes provide benign and/or beneficial reuse to the environment!

The Bioreactor can be designed to meet any effluent standards including advanced treatment required for sensitive areas.

General Provisions:

Installation of an Aqua Tech System with BioTank biological reactor will require:

* Site prep including a poured concrete pad for the BioTank, drainage areas and access roads,
* Dedicated electrical power supply (usually 3-phase)
* Effluent discharge system in line with local regulatory requirements.

Also it is necessary to provide:

* Specialized onsite treatment systems for all local sources of wastewaters which do not correspond to the BioTank application terms,
* Wastewater should be primarily treated prior to be pumped to the BioTank. The primary treatment should include mechanical treatment (coarse solids and grit removal), FOG (fats, oils and greases) removal, wastewater settling and flowrate equalization.

Process Specifications

FOG (fats, oils and greases) Removal:

FOG level should be constantly monitored, preferably by means of sensors.

Amount of FOG enter the BioTank should not exceed 50 mg/l.

If FOG concentration is permanently higher than 50 mg/l in any of local discharges, then it is necessary to apply constantly specially selected biopreparation for FOG decomposition, for example, BioEaseTM4210.

If FOG concentration exceeds 100 mg/l, then it is necessary to build a local grease trap and use the biopreparation for FOG degradation.

Coarse Solids Removal:

The feed pumps should be protected from coarse solids present in wastewater. Depending on a primary treatment technology Aqua Tech Systems offers a solution for the coarse solids removal.

Grit Removal:

Wastewater usually contains certain amount of grit and other mineral substances, which should be removed before wastewater feeding to the BioTank.



Primary Settling:

Suspended solids (SS) concentration limit for biological treatment based on the biofilm process is 105 mg/l. As raw wastewater usually has higher SS content (> 105 mg/l), a primary settling should be introduced.

Primary Sludge Accumulation and Digestion:

Primary sludge volume and odor are significantly reduced through the addition of a biopreparation such as Bacti-Bio 9500.

The sludge level should be constantly monitored by means of an automatic sludge level sensor or manual Sludge Judge device. Sludge removal and disposal should be handled by a certified contractor as needed (usually every 3-5 years).

Process Specifications

Flowrate equalization and feeding to Bioreactor:

Wastewater flowrate equalization is needed to overcome the operational problems caused by flowrate variations, to improve the performance of the downstream processes, and to reduce the size of downstream treatment facilities.

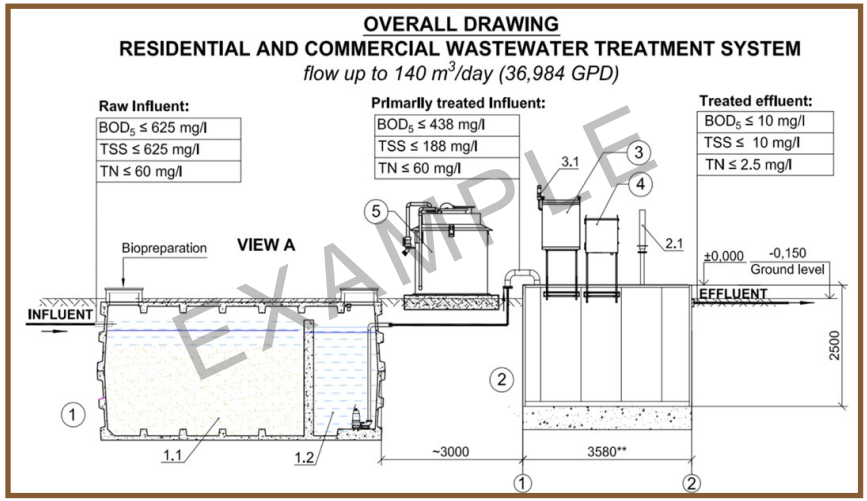
Wastewater equalization enhances biological treatment since shock loads are eliminated or can be minimized, inhibiting substances can be diluted, and pH can be stabilized.

The assumed wastewater feeding duration to the Bioreactor is at least 18 hours/day (12 hours/day for single family units).

The assumed feeding volume is:

v = Qday / 18, m3/hour, where Qday is wastewater amount per day.

Aqua Tech Systems provide necessary settling-digestion and wastewater flowrate equalization tanks of the required volumes which are plastic or ferro-concrete.



Phosphorus Removal:

If required, phosphorus is removed during primary settling through the addition of coagulant.

Biofilm cannot remove more than 1-1.5 mg/l of phosphorus. The formed biocenosis of the biofilm, being in a state of dynamic equilibrium, does not produce biomass and, accordingly, does not consume phosphorus.

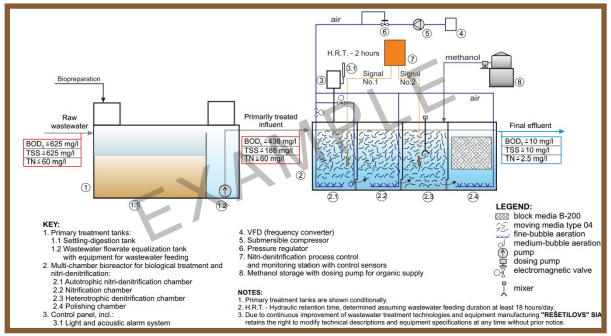
Wastewater processing with coagulant ensures efficient organics reduction and reduces the phosphorus below 1.0 mg/l.

The technology provides coagulant applying at the primary treatment step.

Biological Treatment

General Process Characteristics:

The biological process is based on the biofilm technology. Biofilm is a dense community of attached-growth microorganisms living on special-designed plastic carriers (media). Having direct contact with wastewater, biofilm absorbs and oxidizes pollutants thus providing treatment. Multiple biozones ensure that an appropriate biological system develops according to the nature of wastewater composition. It supports dynamic balance on its own both in mass and qualitative composition according to variations of wastewater parameters (within the range of optimal adaptation rates and permissible values of calculated loads).



Technology

Incoming organics is sequentially oxidised by isolated biocenoses of fixed microorganisms living on the special plastic media retained within the borders of each aeration tank's chamber. The media is submerged in water. Oxygen supply and mixing are provided by aeration.

Due to change of oxidation rate at each process stage - from high on the first stage to low on the last stage – the loads on biocenoses and water saprobity vary from high to low accordingly.

In response to changing environmental conditions and amount of dissolved oxygen, the treatment process occurs as follows:

* Stage One – sorption and oxidation of dissolved organic matter, adsorption of suspended solids and colloids and hydrolysis (fermentation) of suspended solids and colloids;
* Stage Two - sorption and oxidation of dissolved organics,
* Stage Three - biofiltration (biosorption).

Oxygen Conditions:

Oxygen supply is provided by aeration. The oxygen mode is a function of organic load, thickness and density of biofilm and wastewater temperature.

The required amount of dissolved oxygen for each process stage should be optimized and adjusted according to the Aqua Tech Systems recommendations.

Biological Treatment

Nitrification :

The Aqua Tech Systems biofilm process configuration creates conditions for simultaneous nitriification and denitrification.

The corresponding environment allows formation of layered biocenosis. The layers are determined by the amount oxygen diffusion into the biofilm.

The biofilm surface is the *aerobic layer* which creates conditions for heterotrophic microorganisms development, which partially oxidize and reduce ammonium along with oxidation of organic matter.

The internal mass of the biofilm is the *anaerobic layer* that creates conditions for development, growth and accumulation of specific autotrophic microorganisms ANAMMOX, which oxidize and reduce the main part of incoming ammonium.

Biofiltration (biosorption):

Biofiltration or biosorption occurs in the BioTank on a static media.

In low load conditions bacteria release a significant amount of exopolymers capable to capture and retain solids during contact. In turn, solid substances captured by the biofilm (bacteria, organic matter) serve as a food for predators and detritophages that results in reduction of suspended solids amount.

It should be noted here that bacteria and predators create symbiotic relationship after a number of successions, under which predators regulate their quantitative and qualitative composition in a strict accordance with incoming food amount.

Also the significant input in clarification comes from attached stalked ciliates (Peritrichia). The peritrichs provide themselves with food by filtering large amounts of water. One individual is able to consume up to 30 000 bacteria per hour. This way Peritrichia provide in additional high degree of biological disinfection, destroying pathogenic microorganisms.

Low organic load and high amount of dissolved oxygen in the biofilter provide partial ammonium removal.

Ammonium bio-oxidation is carried out in two stages, by two types of chemoautotrophic bacteria:

$$2NH4+ + 3O2 \xrightarrow{Nitrosomonas} 2NO2- + 2H2O+4H+$$

$$2NO2- + O2 \xrightarrow{Nitrobacter} 2NO3$$

Start-Up

Formation of the biofilm occurs spontaneously, without operation staff interference, based on set and maintained level of dissolved oxygen in each chamber. After a period of successions, the dynamic equilibrium is reached, which is characterized by stable treatment process performance in accordance with the project requirements.

Under conditions of actual loadings correspondence to the calculated design values and operation and maintenance performance according to the operation manuals, adapted to particular wastewater biocenoses fully mature:

* For “B” bio-oxidation process – within four weeks;
* For “N” bio-oxidation and nitrification process – within one year.

The treatment efficiency should be 95.99% from the calculated one.

If necessary, the achievement of treatment quality for the process “N” can be accelerated by the use of methanol. The process of nitrogen reduction takes place adding methanol as a food source for heterotrophic microorganisms. Due to lack of oxygen, heterotrophic microorganisms use oxygen from nitrates, thus reducing oxidized nitrogen. In this case it is possible to achieve 90% treatment efficiency by all required parameters within 60 days from start-up.

https://communitysewer.com/wastewater-treatment-residential-development/

AquaTechSystems

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