BGP Environmental Group

TECHNICAL

Biocleaner Unit

The Biocleaner system generates mesophilic geobacters which are activated in the presence of oxygen and food source. The Tube contains 45 lbs of ceramic pellets which contain the immobilized microbes. The microbes only replicate the colony and constantly generate on a logarithmic scale.

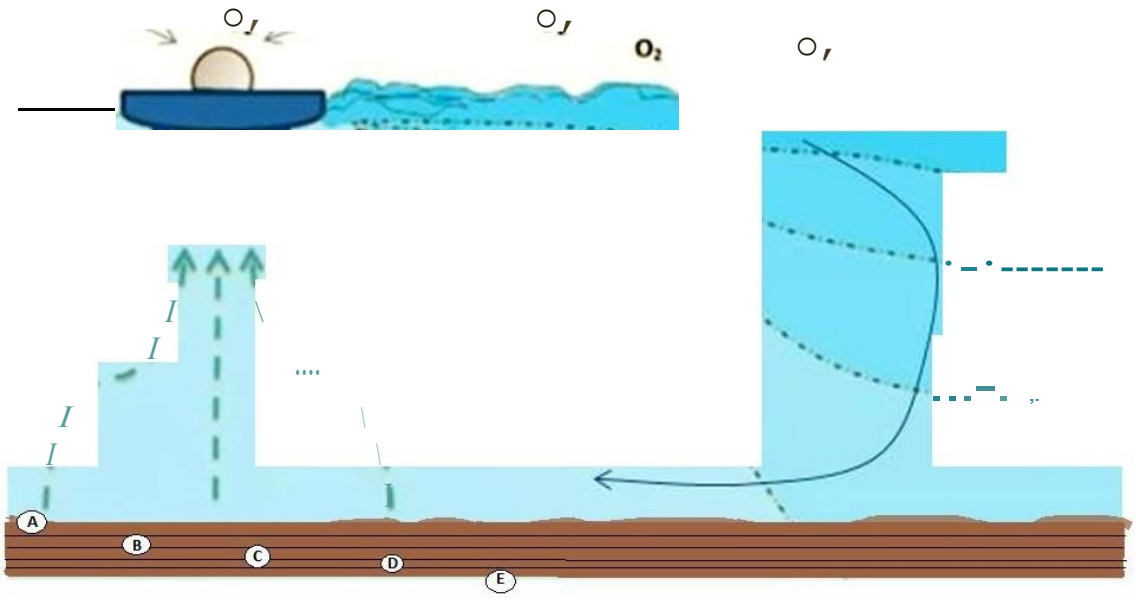
The diffusers generate microbubbles which provide mixing and aeration. The mixer helps push the water to the surface and a gentle laminar flow begins to flow out and settle. The microbes increase the settling velocity of the solids improving the efficiency of treatment. The microbes settle to the bottom and form a dense biofilm that contains a consortium of colonies. Each layer does a specific task.

Layer 1: Denitrifiers – Denitrification process *(Denitrification is a microbially facilitated process where nitrate is reduced and ultimately produces molecular nitrogen through a series of intermediate gaseous nitrogen oxide products)*

Layer 2: POA – Mineralizing Phosphorous into the biobed

Layer 3: Heavy Metals – Mineralizing certain heavy metals into the biobed

The biobed density depends a lot on water depth. The optimal depth for biobed formation is 3m (10ft) – 4.5m (15ft). Shallower ponds or tanks will hinder the formation and the efficiency in reducing the nutrients



Sewage Treatment Calculation

Since Biocleaner is a pre-engineered bioreactor there is a volume of influence we use for sewage treatment with recommended tankage.

1 Biocleaner unit can treat Q = 300 m3/day = 80,000 gal/day or 0.080 MGD that is placed in an Aerobic Tank or Activated Sludge Tank if existing

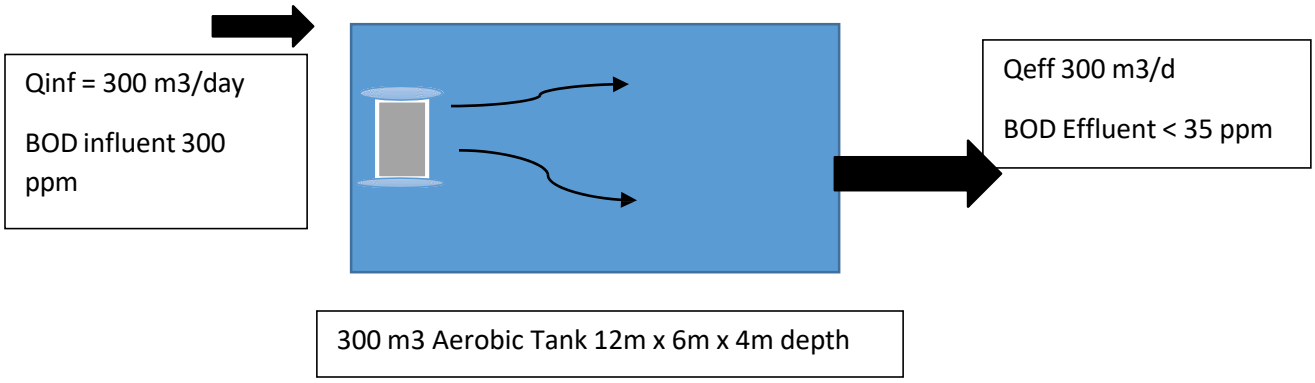
Approximately 80,000-gallon capacity. The unit will degrade BOD 250-300 ppm typical for sewage down to less than 35 ppm BOD with 1 day HRT.

The PID, tank geometry, tank depth, and placement of the unit will affect the performance of the unit

For tank geometry, the Biocleaner performs well in rectangular tanks 2:1 with depths from 3m-4.5m. The depth allows faster settling velocity as well as nutrient recovery.

For anaerobic/anoxic tanks both rectangular and circular tanks work well

To enhance treatment you can add more units, more HRT, use filtration multi-media sand, or advance filtration (UF, MF, AC, RO).



In a conventional STP you have Primary, Secondary, and Tertiary Treatment.

Primary and Tertiary is the same processes and design. Only the Secondary treatment phase is modified biologically with Biocleaner. There are two phases.

Anaerobic/ Anoxic – You do a 5% Return Feed introducing facultative microbes.

Anaerobic/ Anoxic – You do a 5% Return Feed introducing facultative microbes which convert to anaerobic at the bottom depths and can be anoxic if the surface is exposed to the air.

Aerobic – Biocleaner units installed in these tanks

Example Q = 1000 m3/day = 264,000 gal/day = 0.264 MGD BOD 250 mg/l to less BOD 35 mg/l

Minimum HRT for Anoxic/Anaerobic 16

hours for sewage treatment only

Minimum HRT for Aerobic 12 hours for

sewage only

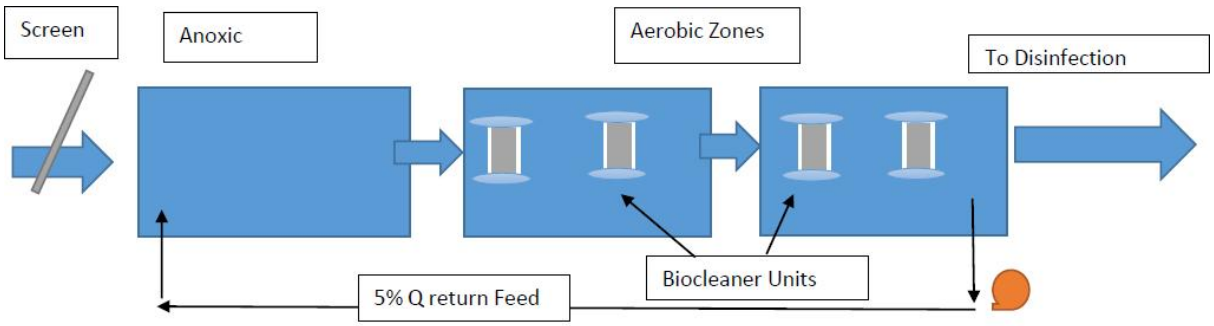
Note: If you have high-strength wastewater you'll need additional HRT

Volume for anoxic tank = * Q = 16 hours / 24 hours day * 1000 m3/day = **666 m3 = 176,000 gal tank**

For number of units 1000 m3/day / 300 m3 volume of influence per unit per day = **3.333 units**

Round off to 4 units.

Since we are assuming 1 day HRT 1000m3 aerobic volume tank capacity you can use 2 tanks of 500m3 each and lower 2 units per tank



Note: You can add contingency such as a sand filter, increase the HRT, adding more units, Baffles, etc

Optimal depth for mixing and biobed formation is 3-4m (9- 14 ft) in aerobic conditions.

Biocleaner Augmentation Units / OS units

The Biocleaner Augmentation Unit / OS unit is the bioreactor without the complete aeration system.

The Bioreactors are designed for certain criteria such as sludge reduction and odor control. In cases where the client may have an odor problem, you can offer an augmentation unit to be lowered in an aeration pond or activated sludge tank. The capacity of the augmentation unit will depend on the flow rate Q and HRT available.

Example:

A 3m Augmentation Unit and surface area influence of 2000m2 in a static pond. For static ponds, we may have cyanobacteria (blue-green algae), odor control or sludge liquefaction.

With continuous flow best to use 1 unit per every 300m3 (86,000 gallons volume)

The Augmentation unit comes in a number of different sizes ranging from the smallest Biobuddy which is only for laboratory testing to the sewer buddy which can be lowered in an aeration tank and used to grow the inocula under aerobic conditions.

Biobuddy Augmentation lmit description Sewer jockey 1/3 ½ 2/3 Augmentation S,w,r Buddy

- Air requirements depend on the depth of water.
- Airpumpusesl15vor220v, 60/50Hz
- Air pump electrical cord length is standard at 5ft. length.
  Cables and ties for a second, airing the unit are not included in the package.

Biobuddy – Used for Jar Tests only. The size of the bioreactor is too small and restricted to be used in an actual application. The bioreactor comes in either Bio 6 or Chem 5 consortium.

Sewer Jockey – Can be used for Jar Testing and applications. The Size of the bioreactor is limited to 20 m3/day. If you have between 20 m3/day – 50 m3/day you can add multiple sewer jockeys or use a 1 m Augmentation/OS unit. The bioreactor comes in either biosix or chem 5 consortium.

Augmentation Unit/OS Unit – These are only the bioreactors without the aeration system. The sizes range from 1m – 3m. The bioreactors come with either biosix or chem 5 consortium.

We offer OS units for sludge and odor control only. The OS units are quicker to implement due to the reduced labor and quicker to commission than adding full units.

The difference between the augmentation unit and OS unit is that the OS Unit has a metal shield that protects the unit from microbubbles penetrating the tube and causing friction and vibration which a period of time can degrade the media pellets.

You can mitigate the Augmentation unit by adding a metal or plastic shield underneath the unit or keeping away from highest density of aeration bubbles in a tank,

Sewer Buddy- This bioreactor has been decommissioned.

One Biocleaner unit volume of influence 300m3 12m x6m x4m. Calculate the oxygen requirements lb 02 / 0.8lb – 1lb BOD Load**.** 1000 ppm x 900 m3/day / 1000 = 900 kg BOD /day = 2000 lbs /day BOD

Using 1:1 BOD: 02 Oxygen demand is 1000 kg Demand 3 units at 3.6 kg / hr = 260 kg 02 = 572 lbs 02 / day Design

2000 lbs Demand > 572 lbs Design without anoxic treatment you will require more units more oxygen for contact time with microbes With Anaerobic/ Anoxic Treatment you can get up to 90% Reduction under ideal conditions. 1000 ppm * 0.2 using 80% reduction anaerobic = 200 ppm BOD leaving anoxic/anaerobic tank 200 ppm x 900 m3/day / 1000 = 180 kg BOD /day = 396 lbs BOD/day

572 Design > 396 Demand is ok.

Note: Equalization Tank with return feed will also have a reduction in the BOD

COD 3500 mg/l Target less 50 mg/l For COD design basis

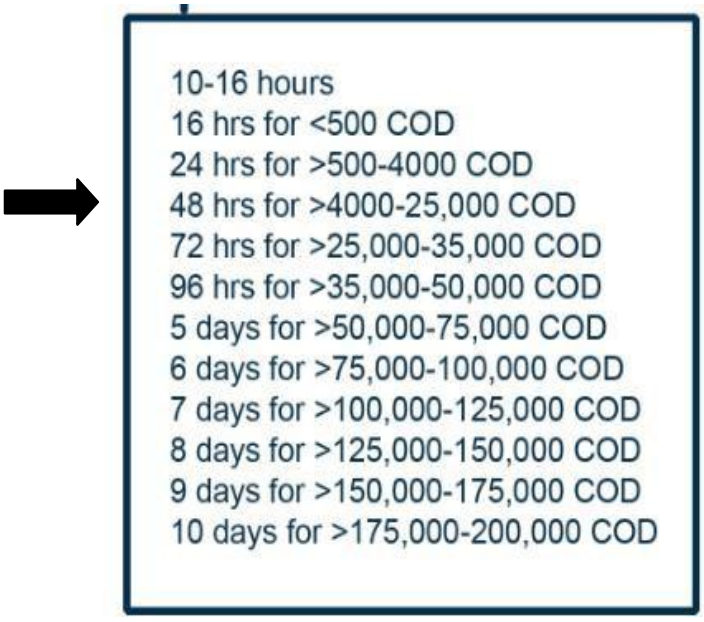
To Find HRT = use COD inf – COD target / 200 ppm COD takedown per hour = 18 hours + 6 hours of base which is the minimum HRT required for one unit
Note: COD takedown rate will decrease as the COD reaches below 2000 ppm also ideal conditions will determine the performance of unit. In industrial wastewater the pH, water temperature, tank geometry, and other factors will impact performance.

Find design volume of influence needed to treat COD 3500 to less 50 24 hours / 24 hours / day =1 day's HRT. 1 day x 900 m3/day = 900m3 Design Volume for 1 zone of aerobic 900 m3 volume / 300m3 volume of influence **= 3 the number is unitless**

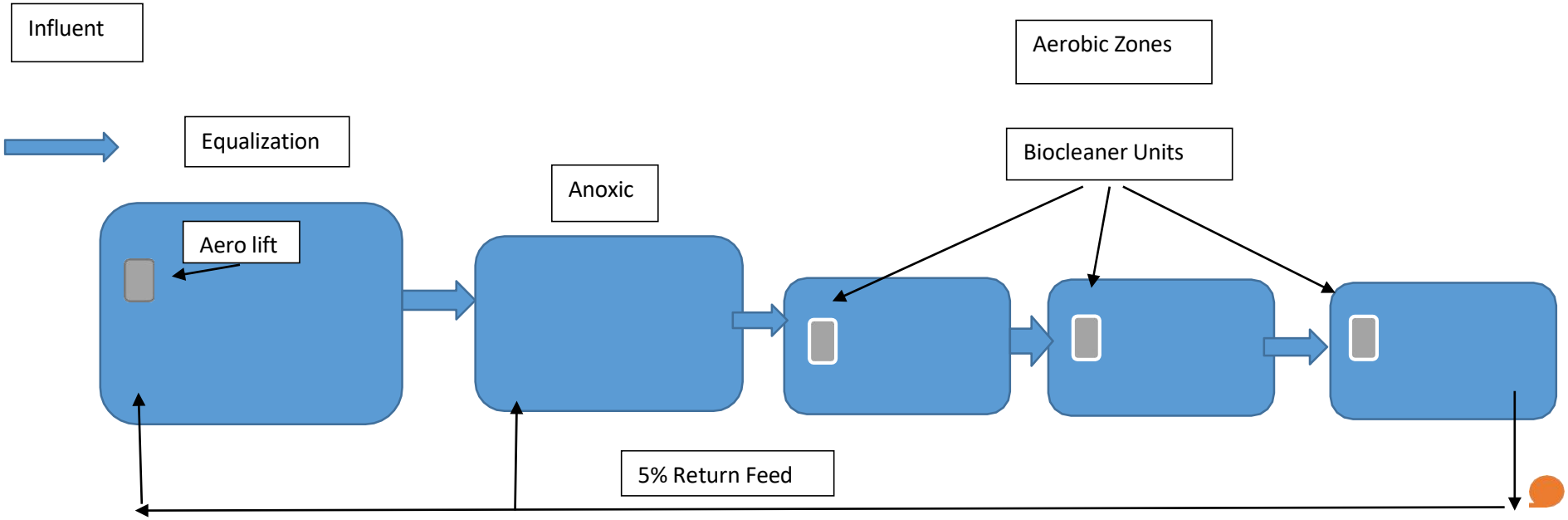
3 unit per aerobic tank

6 Biocleaner Biosix Units Total

Determining Design Anaerobic HRT for industrial wastewater. For this example, you can use 2 days HRT for anaerobic tank to have better margins of safety



Example Industrial Wastewater



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OS UNIT

WITH GREEN HOSE AND AIR COMPRESSOR

OS Unit

Modular All -In- One Seeder Tube

Biocleaner provides proven Industrial Wastewater Treatment plants by implementation of a Seeder Tube that eliminates sludge and odor making it the most convenient system on the market.

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Modular, Convenient, and Efficient

Aging infrastructure and increasing demand for high capacity biological water treatment have created a need for more efficient, compact and affordable solutions. Integrated treatment systems must be easy to operate and install while minimizing capital expenditure. These new systems must also be capable of addressing frequent changes in feed water. A Seeder Tube packaged solution is thus key to enabling companies to manage their wastewater with the most efficient technology at the lowest cost. Biocleaner provides all of these benefits for Industrial Wastewater Treatment facilities. Biocleaner added value to the customer through flexible design, rapid implementation and automation built to minimize manual intervention. Seeder Tube contains a consortium of immobilized microbes that can liquify sludge and eliminate odour.

Industrial Wastewater Applications

- Food and Beverage
- Pulp and Paper
- Meat Processing
- Pharmaceutical
- Industrial Parks
- Malls
- Hotels/Resorts
- Agricultural

Product Features

- Product includes all media and 55 Watt linear blower
- OS Seeder Tube is lowered in any aeration module
- OS Seeder Tube is designed to be configured into all aeration zones.
- OS Seeder Tube can be integrated into an existing treatment for higher quality effluent
- OS Seeder Tube requires external aeration modules

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Operational Benefits

- Modularity for improvement in water quality
- Continuous accelerating microbial loading
- Capacity range of100,000 gal/day and higher
- Simplified installation, commissioning and operation
- Superior effluent quality suitable for further recycle options, irrigation or discharge

OS Unit Configurations

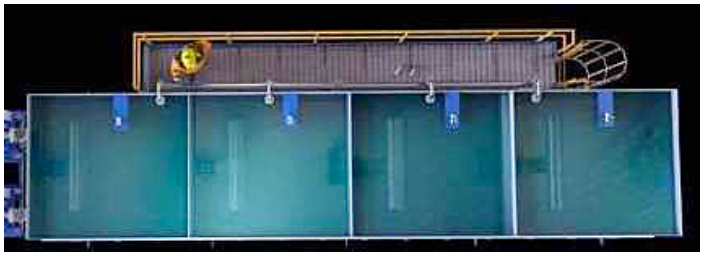
Process Unit	Unit	3 units	4 unit	5 unit	6 units
Flow Rate	Gal/Day	100,000	200,000	300,000	400,000
3 Tank System	Length	36 ft (11m)	40 ft (12 m)	52 ft (16 m)	59 ft (18m)
	Width	18 ft (5.5m)	21 ft (6.5 m)	26 ft (8m)	28ft (8.5m)
	Maximum Height	13 ft (4 m)	13 ft (4m)	13 ft (4m)	13 ft (4m)
COD Level Treatable**	mg/l	<50	<50	<50	<50

Inlet / Outlet Water Quality

Parameter	Unit	Inlet	Outlet
COD	mg/L	5,000 and higher	< 50
BOD	mg/L	3,000 and higher	< 10
Temperature	°F	50 - 104 (10 - 40°C)	50 - 104 (10 - 40°C)
pH		6-8	6-8

4 Aeration Zones for BOD < 5
Add Upflow Sand Filter

3 Aeration Zones BOD < 10
Add Upflow Sand Filter



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Product Advantages

- No Sludge Generation
- No Odour
- Limited infrastructure construction or modification required
- No Importation of Sludge
- Can use Fish Pond as option for disinfection
- Easy to Commission
- User-friendly operation and support
- Fast delivery and Installation

Commissioning Procedures For Industrial Wastewater Treatment

- Fill Tank with approx. 500 mg/l COD
- Lower OS Unit inside Aeration Tank
- Wait 2-3 days until water becomes clearer
- Begin with 10% of Design Flow
- Every 1 hour increase the Flowrate by 5% until you reach 100% Design Flow
- Shut off sludge pumps after 3-4 days if using an existing treatment system