corodex industries

# Committed to **Protecting Life** and **Preserving** the Environment

Water Purification, Wastewater Treatment and Odor Control Solutions


## Company Profile

Corodex Industries is a pioneer in engineering, manufacturing, assembly and fabrication of various water purification and wastewater treatment plants and equipment. Corodex Industries was one of the first companies in the Middle East to offer water treatment services, along with extensive research and development, focused on utilizing advanced technologies in the water purification and wastewater treatment industry.

Established in 1974 as a part of the Concorde - Corodex Group, the company has evolved to become a leader in the water industry offering a diverse portfolio of products and services such as, water and wastewater treatment services, marine and industrial chemical cleaning, and operation and maintenance services. The Company prides itself with its certified Quality, Environment and Occupational Health and Safety Management Systems (QHSEMS), in compliance with ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2007.

## Core Activities

- Water Treatment Equipment & Systems
- Grey Water Recycling Systems
- Wastewater Treatment Systems
- Odor Control Systems
- Sludge Treatment Systems
- Operation & Maintenance Services

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Corodex Industries specializes in the design, manufacturing and construction of water treatments systems for municipal applications, industrial uses, food and beverage industries and potable water provision.

## Reverse Osmosis (RO)

Corodex offers quality Reverse Osmosis Desalination plants designed and constructed to meet a wide range of needs for potable grade water. Depending on capacity, these plants can be supplied skid mounted or in containers ready for on-site deployment. Higher capacity plants are engineered to suit the clients' special requirements and specifications.

### BWRO

Modular Reverse Osmosis plants with feed water TDS up to 8,000 ppm

### HBWRO

High Brackish Water Reverse Osmosis units with feed water TDS up to 15,000 ppm

### SWRO

Sea Water Reverse Osmosis Units with raw water TDS up to 60,000 ppm

### QDRO

Containerized Quick Deployment Reverse Osmosis units for mobile camps and emergency relief operations


## Sea Water Intakes

The design of a sea water intake, choice of materials and proper installation are critical

for the successful operation of any sea water desalination plant. Corodex has mastered the design and full construction of all marine work related to open water intakes, and has inked its name on several prestigious projects.

## Multi-media Filters

Media Filtration is the most reliable method for removal of suspended organic and inorganic solids from water. Corodex media filters operate on the same basic principle as nature's own ground water filtering process.

Corodex filters are available in epoxy coated steel or fiber glass material with automatic or manual operation. Manual plastic or cast iron valves and electrically actuated valves can be provided. Automatic top- mounted or side-mounted heads can also be fitted, with stager and a nest of air-operated diaphragm valves.

Upon request, steel pressure vessels can be supplied in either vertical or horizontal configurations, in single or multiple parallel units.

Types of multi-media filters include:

» Multi-media Sand filters for reduction of total suspended solids

» Activated Carbon Filters for the removal of organic matter, certain contaminants, chlorine residual and to enhance aesthetic qualities such as color, odor and taste

» Greensand /Manganese filters for the removal of iron and manganese

## Water Softeners

Hard water can clog pipes, damage boilers and ruin heat exchangers along with many other critical components. Water softeners can prevent these negative effects.

Calcium and magnesium are often referred to as "hardness minerals". Water softeners mainly remove calcium (Ca) and magnesium (Mg) ions.

Various types of hardness removal softeners with different control and automation options are available from Corodex. Materials of construction of softener vessels include rubber or special epoxy coated steel, stainless steel and fiberglass. Single, twin, duplex, and multiplex softener configurations are available, running in intermittent or continuous mode of operation. Timer and meter initiated regeneration processes are available, using standard softeners, heads, stagers, or PLC based control systems. In special cases, where raw water hardness varies, an on-line hardness monitoring system may be provided to initiate regeneration mode.

## Deionizers (DI)

Deionization is the process of removing mineral inorganic ions (cations and anions) from water and exchanging them with hydrogen (H) and hydroxide (OH) to produce high purity water. Deionized water is used in applications such as boilers, electronics manufacturing, power industry, petrochemical and pharmaceutical industries.

Corodex deionizers are factory designed and built with PLC based control systems. Material of construction of the exchange vessels can either be rubber lined or special epoxy coated steel, or fiberglass. Corodex uses exchange resins only from reputed manufacturers to ensure consistent high quality and ultra-pure water.

## Forced Draft Degasifiers

Forced Draft Degasifiers are used to remove unwanted gases (e.g. Hydrogen Sulfide and Carbon Dioxide) from raw water. The degasifier removes gases by passing the water over a packed media that helps the water form a thin film over the surface area of the packing. A counter current airflow is introduced at the bottom of the tower and travels upwards.

Corodex forced draft degasifiers are constructed from Polyethylene (PE) or Glass Reinforced Plastic (GRP), with SS 316 distribution nozzles and polypropylene stripping media. Corodex degasifiers can be factory assembled complete with air blowers. The collection tank, circulation pump, chemical injection system and control panel are available as optional items.

### Functions of Forced Draft Degasifiers:

- Removal of $H_2S$ from RO permeate, thus enhancing effluent quality and reducing odor, corrosion. When introduced before the RO unit, degasifiers can reduce membrane sulfate fouling potential
- Stripping $CO_2$ from RO permeate, thus increasing permeate buffering capacity
- Stripping VOC's from RO permeate
- Increasing the dissolved oxygen level in RO permeate

## Chemical Injection Systems

Chemical injection systems typically consist of multiple chemical services with associated single or multi-compartment storage tanks or pressure vessels. The chemicals are transferred from the tank to the injection point by means of injection

pumps, while flow rates can be adjusted locally or remotely in order to ensure that the correct amount of chemicals is injected.

Corodex Industries manufactures and supplies custom-built injection systems for a wide range of process applications, ranging from raw and potable water treatment to boilers and water network systems and process industries.

## River Pure

Corodex River Pure packaged units are designed and constructed to achieve purified water with quality that meets or exceeds WHO standards from turbid and salty raw river water. The units are characterized by simplicity of operation and low maintenance cost. The treated water quality is monitored via pH and TDS meters, and the plant operation can be totally automated via a PLC based control panel. Tanks and frames are constructed from epoxy coated steel with 304 SS available as optional material.

**Corodex River Pure systems are compact, mobile and easy to operate. They incorporate one or a combination of the following:**

- Coagulation and flocculation system for efficient precipitation
- Clarification system with lamella tube or plate settlers for maximization of settling area and reducing foot print
- Automatic (3 cycle) multimedia sand filtration system (NSF approved high performance FRP tanks) with automatic air scour aided backwash where needed
- Micron cartridge or bag filtration systems for removal of fine suspended solids
- Chlorine injection system with residual chlorine detection for water disinfection
- Skid (MS epoxy coated, NACE certified for maximum corrosion resistance)
- Automatic sludge disposal system
- Eyewash station for safety


## Pumping Stations

Owing to its extensive experience in the water industry, Corodex has managed to develop in-house capabilities for design and construction of sewage, irrigation and fire pumping stations. These vary in capacities and can be as small as lifting stations for packaged sewage treatment plants to large water transmission pumping stations.


## Grey Water Systems

Domestic water usage continues to put higher stress on municipal supplies and Higher costs on consumers. In water stressed areas, recycled grey water can be a good source of water for toilet flushing, irrigation and wash water. Grey water is usually considered to be all the wastewater from residential bathroom sinks, showers, bathtubs and washing machines, excluding any water that has come into contact with feces. Ideally suited for newly built developments, where dual drainage can be designed at an early stage, grey water can be collected and treated separately from black water.

Grey water treatment plants coupled with reverse osmosis modules can also be used for further purifying municipal TSE to a degree suitable for district cooling and other similar applications.

Benefits of Corodex's EfloGREY:

- Save / reduce fresh water demand
- De-centralized treatment
- Reduced cost of recycling since it is separated from costlier treatment of normal sewage or black water
- Automatic skid mounted process including disinfection
- Modular systems
- LEED and PEARL benefits


Corodex Industries, in partnership with UK's EFLO Interactional, work together to design and manufacture packaged sewage treatment plants in the UAE. EFLO has more than 40 years of experience in designing and building sewage treatment plants for both land and marine use. Installations include hotels, villages, hospitals, military camps, oil rig and accommodation platforms as well as cruise ships and war ships. EFLO has references in the region since 1972, and has more than 500 wastewater treatment plants in operation worldwide.

## Corodex Standard Products

EfloCT Extended Aeration with Constant Transfer

EfloSBR Sequential Batch Reactor 'Filandraw'

EfloSAF Submerged Aerated Filter

EfloDAF Dissolved Air Floatation

EfloSEP Oily Water Separator

EfloMBR Membrane Bioreactor

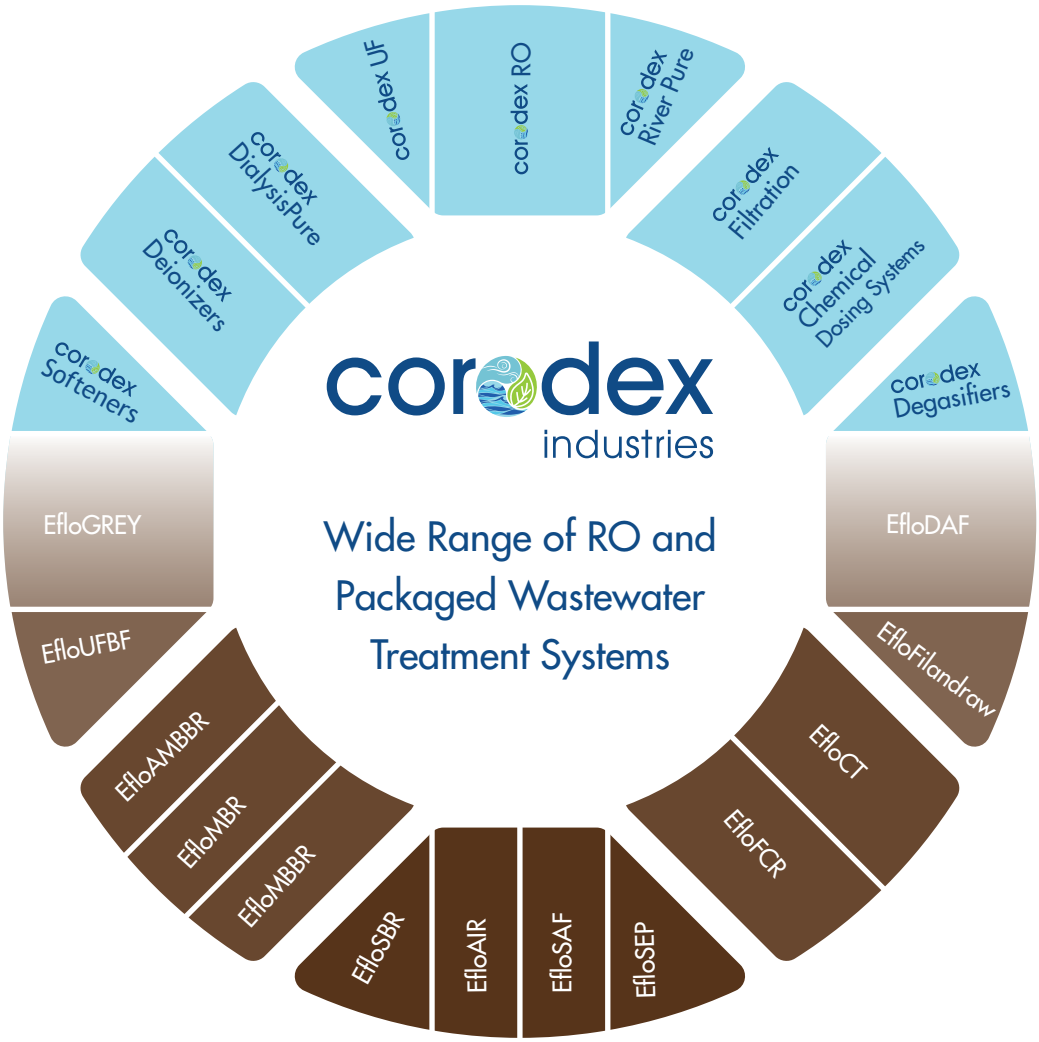
EfloMBBR Moving Bed Reactor

EfloAMBBR Advanced MBBR

EfloFCR Food Chain Reactor

## EfloCT

The EfloCT Constant Transfer process is conventional extended aeration followed by settlement. Its most significant advantage over gravity transfer plant is that there is no direct connection between inflow and outflow. All surges of inflow, regardless of rate, can be stored in the aeration tank which doubles as a massive balancing tank.



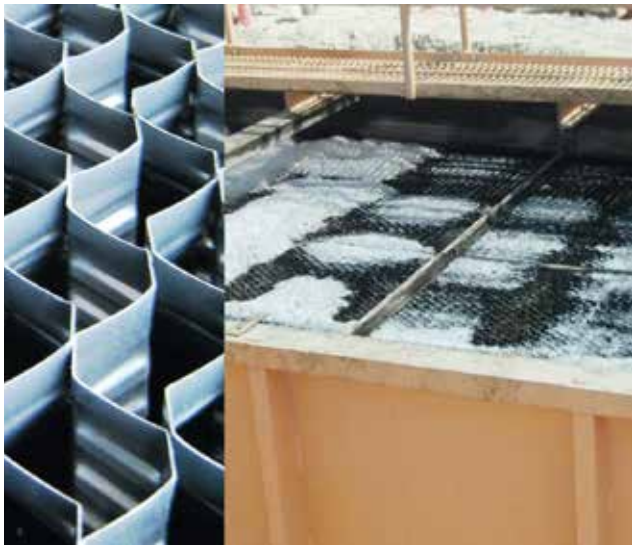

## EfloSBR

The EfloSBR Sequencing Batch Reactor is a product developed from the "Fill and Draw" process. EfloSBR carries out the functions of equalization, aeration, clarification and effluent evacuation in a time sequence rather than continuous flow. When PLC controllers are incorporated, all functions can be conducted automatically. This allows EfloSBR technology to be designed with the ability to treat a wide range of influent volumes, giving the process a high degree of flexibility.

## EfloSAF

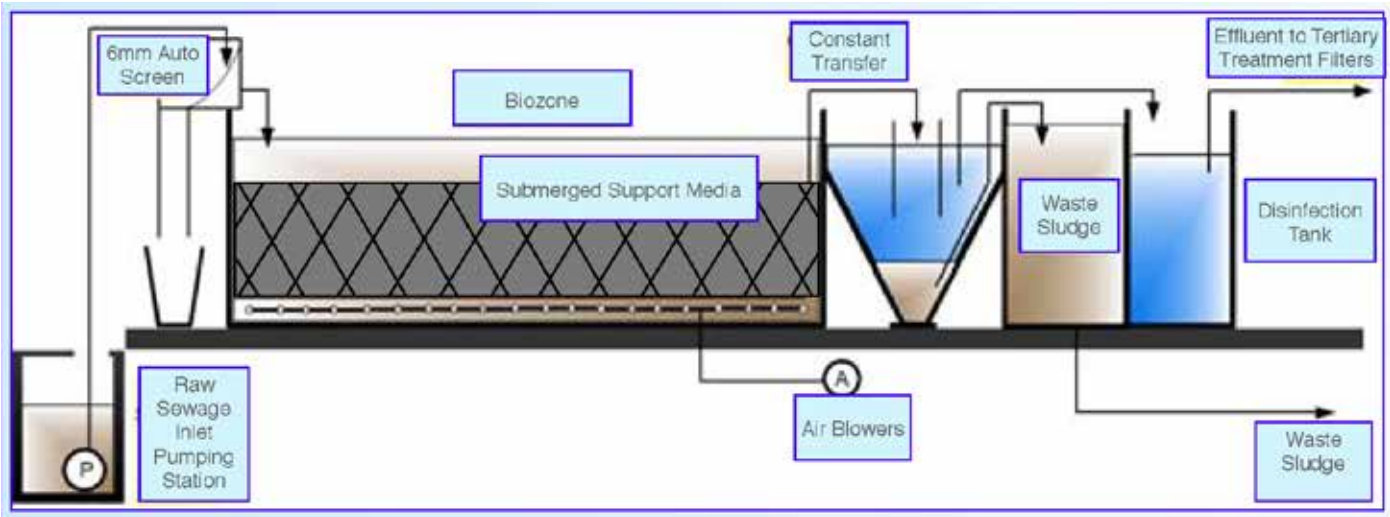
The Corodex EfloSAF is a high rate biological treatment process based on the submerged aerated biofilter principle, using a fixed film that promotes an attached growth process. It is

designed to achieve a final effluent of 10/10/2 in terms of BOD5/TSS/N-NH3. The high rate biological oxidation process is performed using an extremely efficient Submerged Aerated Filter with a very high specific surface area.



### Advantages of EfloSAF Submerged Aerated Filter:

- Small foot print
- Low sludge production
- No moving parts
- High efficiency
- Stable high quality effluent of 10 BOD and 10 TSS



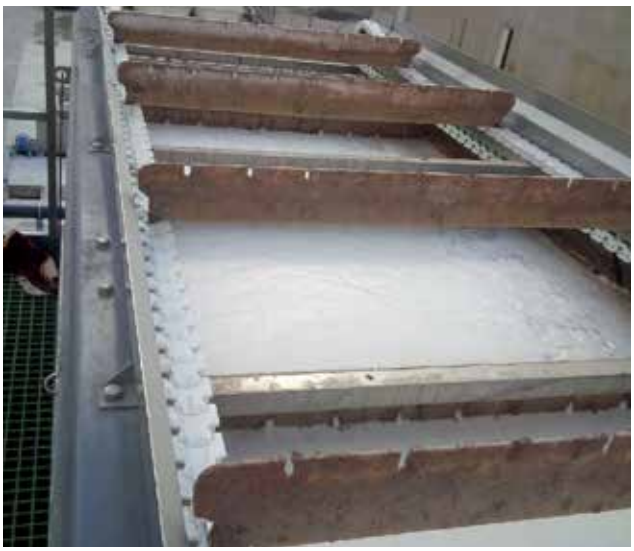
## EfloDAF

Eflo DAF Dissolved Air Flotation is mainly used for FOG, BOD, COD and SS reduction. The Corodex EfloDAF uses the principle of air flotation to separate contaminants from wastewater streams. Contaminants such as emulsified oils and greases are first broken from suspension using coagulant dosing. A flocculant is then dosed to create larger particles that are persuaded to float to the surface of the tank by the introduction of minute air bubbles. The surface scum is scraped to a collection chamber, leaving a clean water discharge.

EfloDAF is a key process component in industrial water reuse systems achieving significant oil and solids removal as well as reductions in COD/ BOD. Typical applications of Corodex EFLODAF include:

- Dairy and food manufacturing
- Oil field produced water
- Metal finishing, cargo and car wash
- Mining
- Brewery and vegetable oil production
- Tanneries

Larger systems can be built using concrete tanks with pre-fabricated internal components.



## EfloMBR

EfloMBR is a high rate membrane based biological wastewater treatment process. The Corodex EfloMBR is designed with special submerged flat sheet or hollow fiber membranes, with pore size of 0.2µm. The membranes are made of materials that enhance performance in the presence of greases. EFLOMBR achieves a TSS removal of up to 99.7%.

Typical applications for EfloMBR include municipal and domestic sewage treatment, mobile or temporary camp sewage treatment and industrial wastewater biological treatment. The system can be installed above or below ground, and it can be mobile if it is skid mounted for temporary/ emergency use. Corodex also provides the required ancillary upstream and downstream equipment for the EfloMBR. These include grit removal, inlet sewage pumping, flow control and inlet screening. Downstream equipment include disinfection systems (UV or chlorine dosing), irrigation/water storage, pumped distribution and further treatment that allows direct water reuse.

## EfloMBBR


Corodex has done extensive research into Moving Bed Bio-Reactors (MBBR) to optimize the process. Essentially, the EfloMBBR system is a biofilm process. Biofilm processes in general require less space than activated sludge systems because the biomass is more concentrated.

The EfloMBBR process relies on the use of small plastic carrier elements that are kept in constant motion throughout the entire volume of the reactor to enhance biofilm growth. The high surface area media is employed in both Integrated Fixed Film Activated Sludge (IFAS) and moving bed biofilm reactor (MBBR) configurations. In IFAS mode, the MBBR enhances the simultaneous growth of suspended biomass and biofilm inside the system.

EfloMBBR offers an excellent upgrade solution for an activated sludge system, SBR or extended aeration process struggling with increasing loads, and for municipal sewage treatment plants to promote nitrification and reduce the load on the secondary clarifiers. As such, the capacity of an existing treatment plant can be increased without increasing the footprint.

Corodex also offers a variance of the MBBR process specifically designed for industrial applications that have high strengths, variable flows, and shock loads. The selected carriers ensure a very high protected surface area with a controlled biofilm thickness. The process can act as pre-treatment for overloaded existing industrial wastewater treatment plants.

EfloMBBR offers the following advantages compared to activated sludge systems:

- Higher effective sludge retention time (SRT)
- Tolerance to load fluctuations without operator intervention
- Less sludge production
- Less footprint
- Resilience to toxic shocks

## EfloAMBBR

Eflo Advanced MBBR is a modification of the MBBER process that utilizes Turbo Reactors® to enhance and speed up the treatment process. It is an advanced, high intensity, sludge aeration system. The plant is totally enclosed and is essentially non-mechanical in operation, ensuring a virtually odor-free, simple operation, environmentally friendly and long-life solution for the treatment of domestic and municipal sewage and, where appropriate, organic industrial wastewater.

The EfloAMBBR process:

» Emulates nature

» Minimises sludge production

» Is a 100% attached growth natural process occurring in flowing water bodies

» Is highly stable, rich in $O_2$, generating high concentrations of BIOFILM

The equivalent MLSS in a typical MBBR is 6,000 to 10,000 mg/l. The EfloAMBBR, as the most advanced hybrid activated sludge system, goes to 30,000 mg/l, so the footprint is nearly one-third of the activated sludge process!

Due to the fact that the thickness of the optimally thin biofilms on the EfloAMBBR BioChip is controlled by the self-cleaning effect due to shearing forces, the removal performance is maintained at a highly constant level.This is a critical factor for the end-customer and authorities where the stability of the biological treatment process is a highly important criterion in order to not exceed the required effluent parameters at anytime.

The EfloAMBBR advantages are:

√ Up to 99% less sludge

√ Significant energy reduction: 0.44 kWh /m3

√ Small footprint

√ Lower CAPEX than competing products

√ Elimination of odors

√ Lower OPEX & fully automated operation, minimum operator attention required

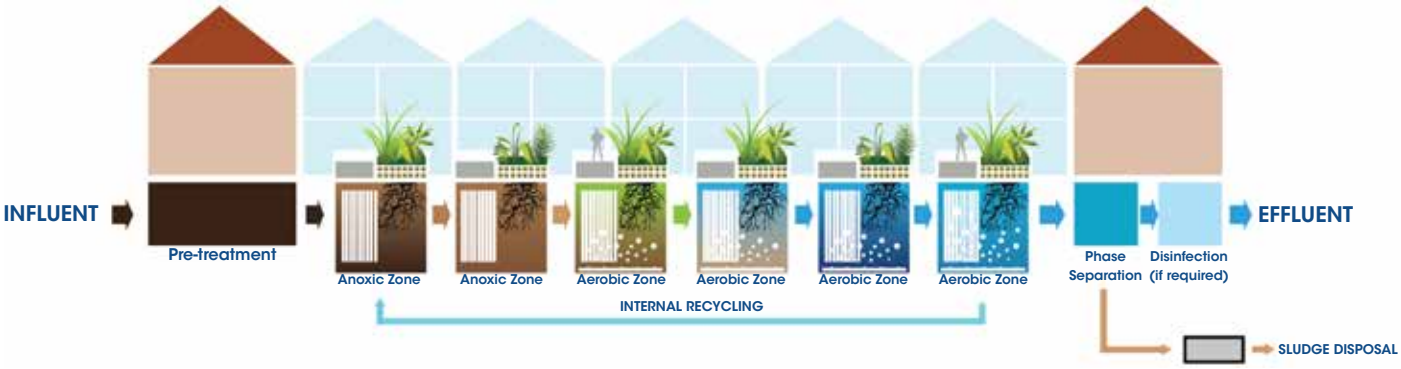
√ Suitable for new WWTP, retrofit and upgrades

√ Sustainable technology

## EfloSEP

The Corodex EfloSEP is a high performance single stage oil interceptor. EfloSEP Oily Water Interceptors are used for the separation of free floating oils in wastewater streams. Applications include food processing factories and industrial sites where rain or wash down water can wash spilt oils into storm drains. Other uses include pre-treatment to downstream water treatment processes, where oil contamination may cause process problems. EfloSEP is a key process component in industrial water reuse systems. Enhanced oil removal to greater than 50 mg/L can be achieved by incorporating and utilizing plastic oil attracting media. EfloSEP units are available as packaged, steel fabricated systems.

## EfloFCR




Corodex has a license from, and cooperates with, Organica Water, to offer Food Chain Reactor (FCR) solutions. The FCR process technology employs an innovative patented combination of flora root structures and bioengineered fibers, which contributes to Organica's solution being among the best-in-class in operation expenses, footprint, and effluent quality suitable for reuse. Organica's unique integration of engineering disciplines, architecture and biology creates a new type of iconic wastewater facility resembling a beautiful botanical garden that blends harmoniously with urban/residential centers. FCR facilities can be built to cover a wide range of hydraulic capacities: from 500 $m^3$/day (125,0000 GPD) to more than 100,000 $m^3$/day (25 MGD).

### EfloFCR is a Series of Food Chain Reactors:

» The biological process takes place in a series of cascade reactors, with standard pretreatment at the beginning, and phase separation (via Organica Disc Filters or Secondary Clarifiers) and final polishing at the end of the process.

» As water flows through from one reactor zone to the next, different ecologies will grow and adapt to the conditions in each stage. This configuration allows the "food chain effect" to develop, as higher level organisms become predators for the simpler ones.

» The result is enhanced removal efficiency and resiliency, whilste utilizing less energy and producing less sludge.


## Odor Removal

EfloAir odor control solutions have become critical as a result of growing concerns for HSE, corrosion problems in the sewage collection systems, rising costs for sewer rehabilitation work, and complaints from citizens living near existing pumping stations and sewage treatment plants.

In the sulfur cycle of the sewage networks, anaerobic bacteria reduces sulfates to sulfides, and oxidizing bacteria converts hydrogen sulfide to sulfuric acid. At high concentrations, hydrogen sulfide presents a serious HSE hazard and corrodes network assets.

There is a wide variety of odor control products available, however the majority can be grouped into three categories:

» Chemical Scrubbing: Acid and caustic wet scrubbing

» Biological Oxidation: Bio-trickling filter and bio-filter

» Adsorption: Activated carbon and other adsorptive medias

Combined technologies can offer a fourth category. Often, the most effective solution for most cases is combining one or more of the three major technologies referred to above.

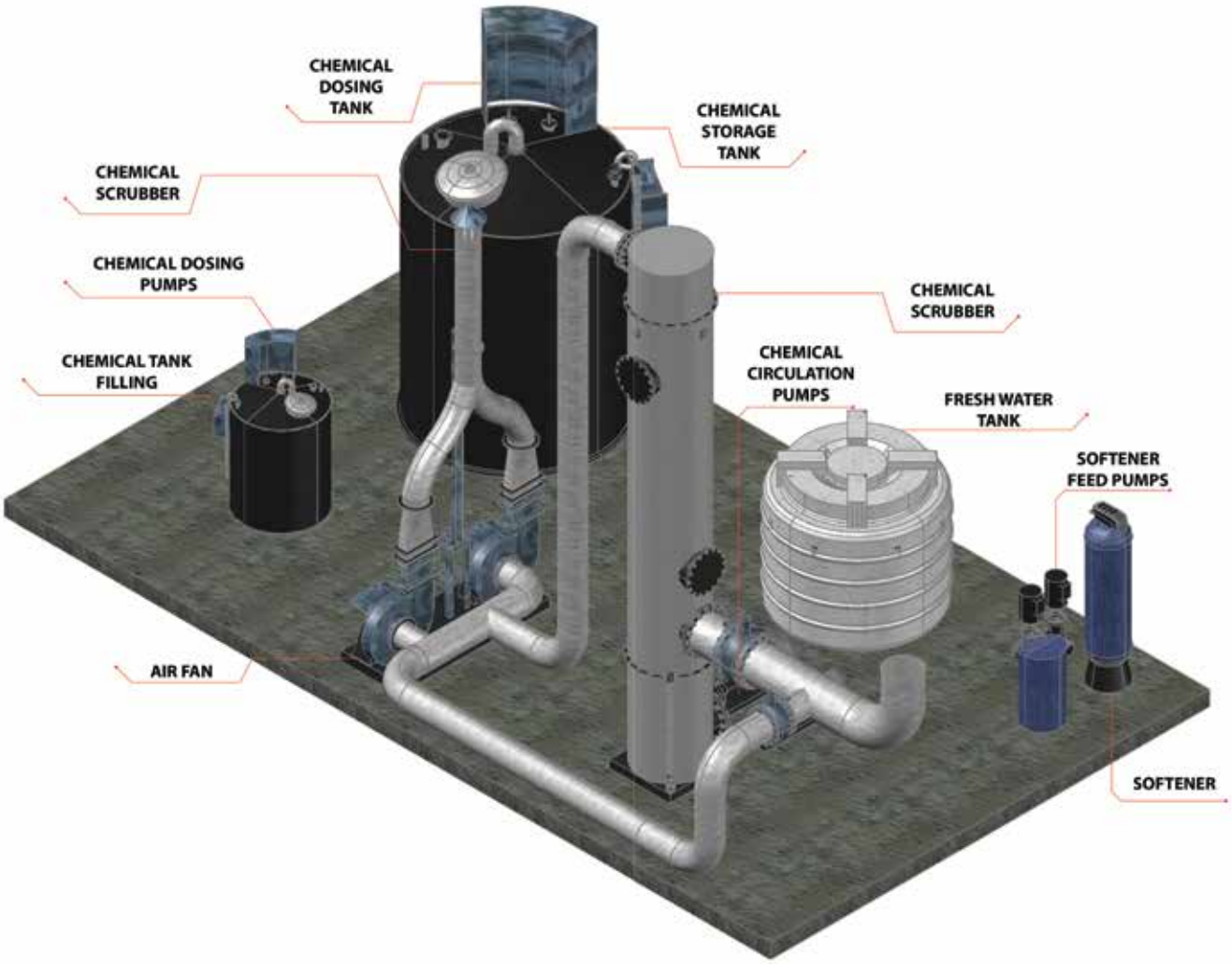
## Chemical Scrubbers

The most common method of control for $H_2S$ gas is to pass the odorous gas through a vertical, packed bed wet scrubber. The air passes up the tower as the scrubbing liquid, containing caustic (NaOH) and an oxidizing agent (most often bleach or NaOCl, sodium hypochlorite) flows down the tower in counter-current fashion.

The high pH provided by the caustic drives the mass transfer from gas to liquid by solubilizing H2S as HS bisulfide and S ions. Once in solution, the reaction between hydrogen sulfide and the oxidizing agent is almost instantaneous. This reaction converts the sulfide to sulfate ($SO_4^{-2}$) ion.

The overall chemical reaction is described by the following equation:

$$H_2S + 4NaOCl + 2NaOH \rightarrow Na_2SO_4 + 4NaCl + 2H_2O$$



## Biological Odor Control

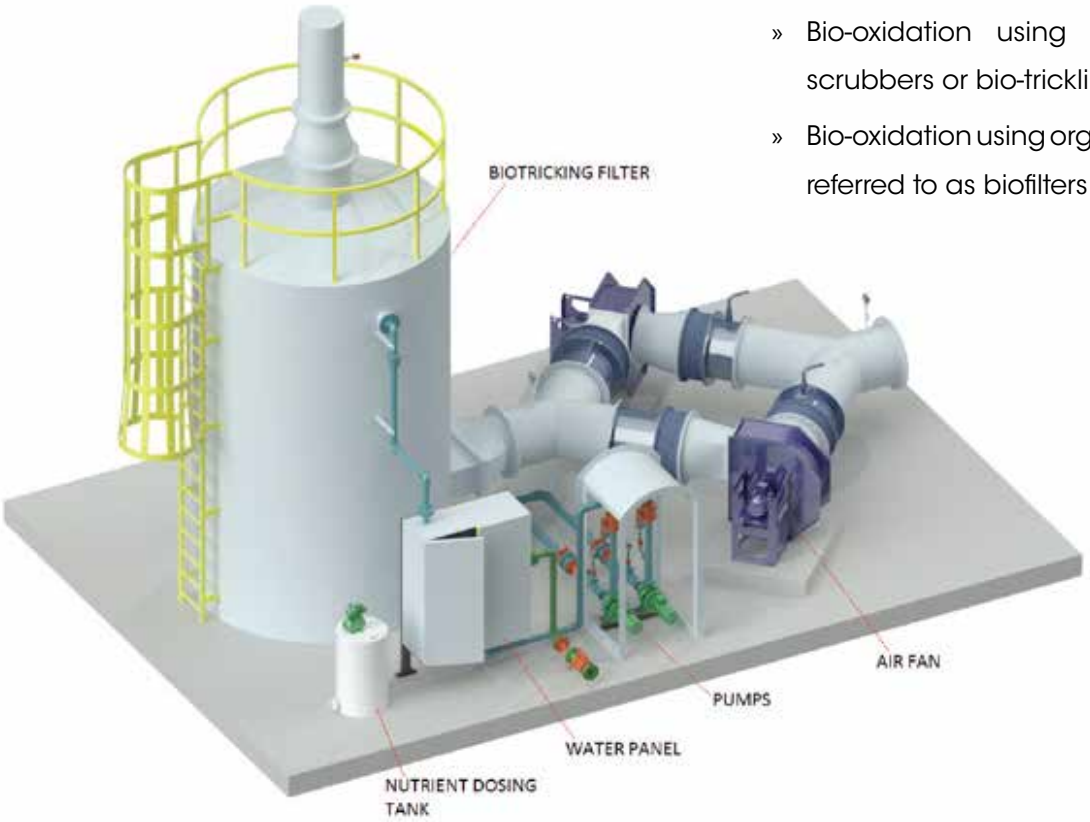

Biological oxidation is a process by which the micro-organisms consume dissolved oxygen and organic/inorganic substances in foul air streams, using the energy released to convert carbon into carbon dioxide and cellular materials. Biological systems achieve odor removal by a two - step process:

1. Mass Transfer Absorption via contact of the air stream with biofilm on the packing material in the vessel, followed by
2. Biological Oxidation of the odor compounds by the biomass.

Biological oxidation is broken into two broad categories:

» Bio-oxidation using inorganic media: Bio-scrubbers or bio-trickling filters

» Bio-oxidation using organic media:Traditionally referred to as biofilters

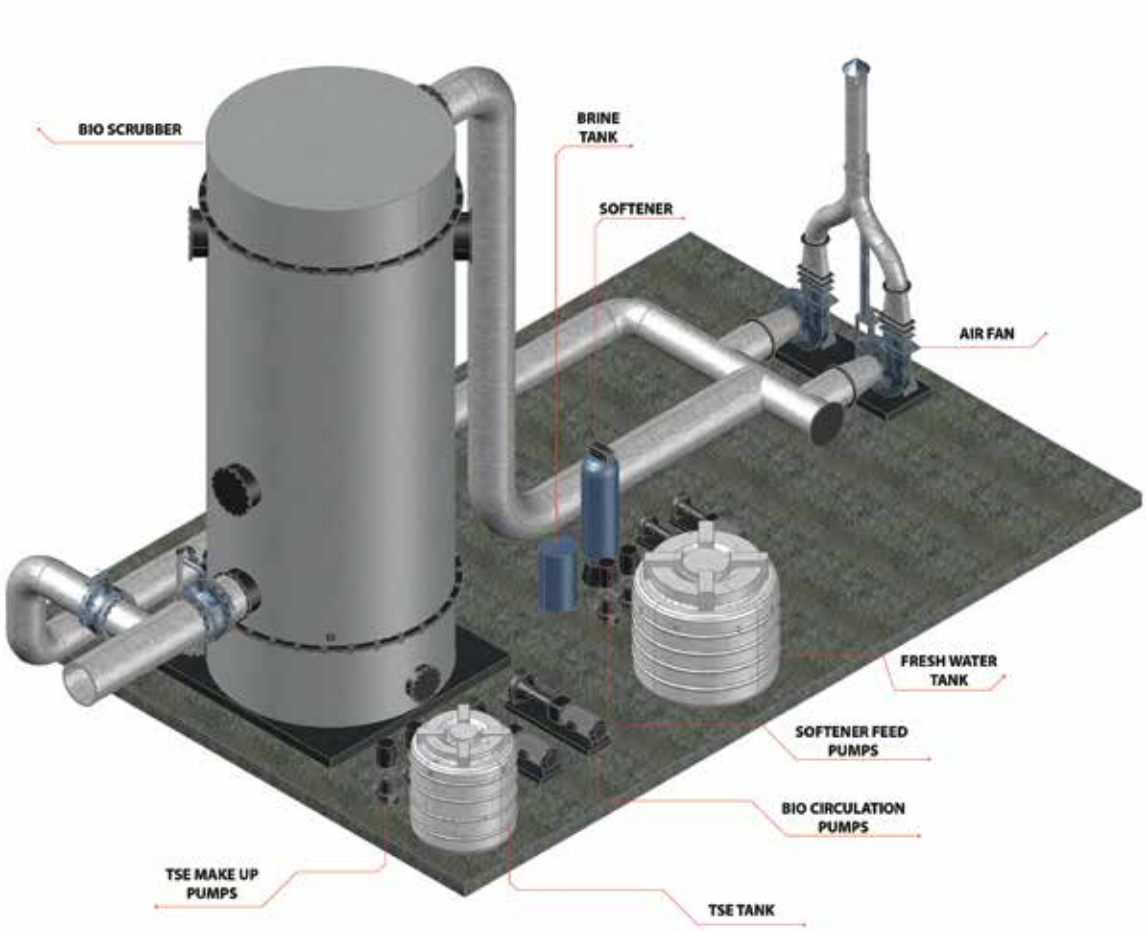


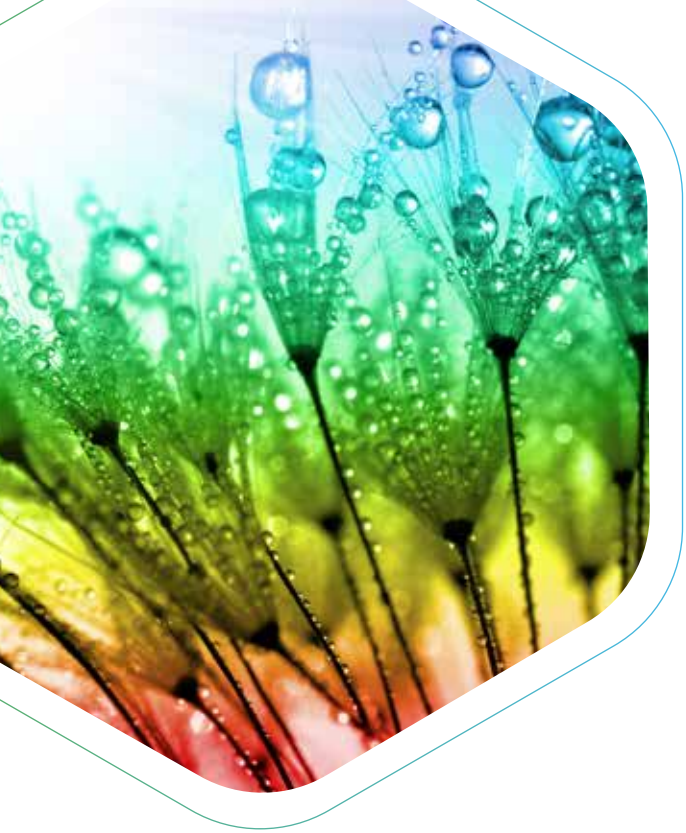
## Activated Carbon Filters

Adsorption is a surface-based process, where atoms, ions or molecules from a gas, liquid or dissolved solid adhere to a surface. The exact nature of the bonding depends on the details of the species involved, but the adsorption process is generally classified as physisorption (characteristic of weak Van Der Waals forces) or chemisorption (characteristic of covalent bonding). In terms of odor control, adsorption typically refers to the use of activated carbon to adsorb odorous compounds into the activated carbon material. This is usually accomplished by passing the odorous air across a bed of activated carbon, allowing the adsorptive process to occur, and releasing the now clean air into the atmosphere into several classes.

Biological oxidation is broken into:

- Standard activated carbon utilizing physical adsorption
- Caustically impregnated carbon utilizing chemisorption
- Blended medias utilizing chemisorption
- Catalytically enhanced carbons: water regenerable carbon





# Providing Access to **Safe Water**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