GI AQUA TECH
Water & Wastewater Solutions

Domestic Wastewater Treatment

Industry Report

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A Word From The Chairman

Today we are faced with the painful fact that the countries and cities will unlikely be able to reach goal number 6 of the United Nations Sustainable Development Goals - to ensure water and sanitation for all by 2030, unless decision-makers carry out strong coordinated efforts to increase investment in water use efficiency and wastewater treatment and reuse.

As part of such efforts, GI Aqua Tech was established to provide innovative solutions for wastewater management based on a new generation of wastewater treatment technology, industrial, greywater, and petroleum with unique nanotechnology and unique products.

In this context of increased water pressures, GI Aqua Tech aims to contribute solutions for the long term and leave behind a much better world for the younger generations to come. We strive for our products to make a breakthrough in wastewater and pollution management solutions and create new broad markets by providing intelligent products for wastewater treatment that are economical, cost-effective, achieve financial profits, and genuine sustainable development.

Sh. Desouky

Sherif Desouky, Phd
Executive Chairman
GP HOLDING

Domestic Wastewater Treatment

» What is Domestic WWT & Why Do We Need It?

Domestic Wastewater is usually generated from human activities in houses or residential and office buildings such as bathing, laundry, dishwashing, waste disposal, toilets, etc. Compared to Industrial Wastewater, it often includes relatively modest levels of pollution. Disease-causing bacteria, infectious viruses, household chemicals, and excess nutrients such as nitrate are potential pollutants in residential Wastewater.

As a result, home sewage systems are developed to handle all liquid waste generated from a household. Furthermore, a properly designed and maintained domestic sewage treatment system for processing and disposing of household wastewater reduces the impact on groundwater and surface water.

A lot of problems face wastewater treatment industrials and this problems forbidden the improvement in this sector. the fluctuation of wastewater inlet, oders, handling, cost, management and others is problems faced the growth in this sectors.

A lot of technology work in this sector and all try to decreases the suffering from domestic wastewater. the weakness of the benefit from this sector of from the main problems in this sectors.

Traditional wastewater technology and new technologies work to decrease the problems in wastewater treatment but in another hand differents problem didnt solved until now may be because of coast or technology problems.

On the other hand, some plant face another problems to cover the request according to the regulation or the growth in populations like increasing the capacity of plant or increasing the efficiency of plant.

Domestic waste comprises two major elements: gray water from kitchen sinks, washbasins, laundry washing, showers, baths, etc., and black water from toilets and urinals. A traditional household sewage treatment plant breaks down domestic wastes via three main phases;

Primary Treatment: It is the initial step of sewage/wastewater treatment, and it eliminates around 40-60% of the suspended particulates. In addition, it entails screening to eliminate big particles like sticks, stones, and other debris that might harm tank inlets.

During initial treatment, Wastewater is briefly kept in a settling tank, typically composed of concrete and in which heavier materials, known as sludge, sink to the bottom and lighter solids float to the surface. These large tanks are also frequently outfitted with motorized scrapers, which continuously move accumulated sludge in a tank's base to a hopper from whence it is pumped to sludge treatment facilities. When the sediments have settled, the residual liquid is released or advanced to the more strict secondary phase of wastewater treatment.

Secondary Treatment: The stage at which the biological (aerobic/anaerobic) treatment of wastewater from the primary stage begins, removing up to 90% of organic debris. It employs an activated sludge technique that uses dissolved oxygen to stimulate the establishment of biological flocks that significantly remove organic materials.

Bacteria consume dissolved and finely split suspended particles that are not eliminated by primary sedimentation. The water is then sent through settling tanks, where the sludge settles once again, leaving the water 90 to 95 percent pollutant-free.

Secondary wastewater treatment works on a deeper level than primary treatment and is intended to significantly degrade the biological component of the waste through aerobic biological processes. As a result, secondary wastewater treatment provides safer discharge into the local environment by lowering typical biodegradable pollutants to acceptable levels.

Tertiary Treatment: The tertiary wastewater treatment aims to improve water quality to satisfy home and industrial standards or fulfill particular criteria for safe water disposal. In the case of municipally treated water, the tertiary treatment also includes the elimination of pathogens, ensuring that the water is safe to consume.

Domestic Wastewater Treatment Process

Current Wastewater Treatment Methods & Their Challenges[1]

I. Activated sludge method:

An efficient technique that was developed in the United Kingdom and is one of the most extensively utilized wastewater treatment systems in the world.

This system is referred to as "active" because it includes packed particles of bacteria, protozoa, and fungus and generates sludge. The sludge, which settles at the bottom of the aeration tank, is created due to the proliferation of these organisms.
While such a method is used in domestic and industrial wastewater treatment, most industrial effluent wastewaters are treated using these systems because they remove most biodegradable pollutants in black, gray, and brown water.

The system generally consists of the following components:

- An aeration tank where biological reactions occur
- An aeration source that supplies oxygen and supports the proper mixing of suspended organic matter and microorganisms
- A clarifier for easy settlement and separation of solid waste from wastewater.
- A settling compartment where solid sludge is collected for disposal or return to the system.

Source
[1]https://www.deswater.com/DWT_articles/vol_177_papers/177_2020_416.pdf

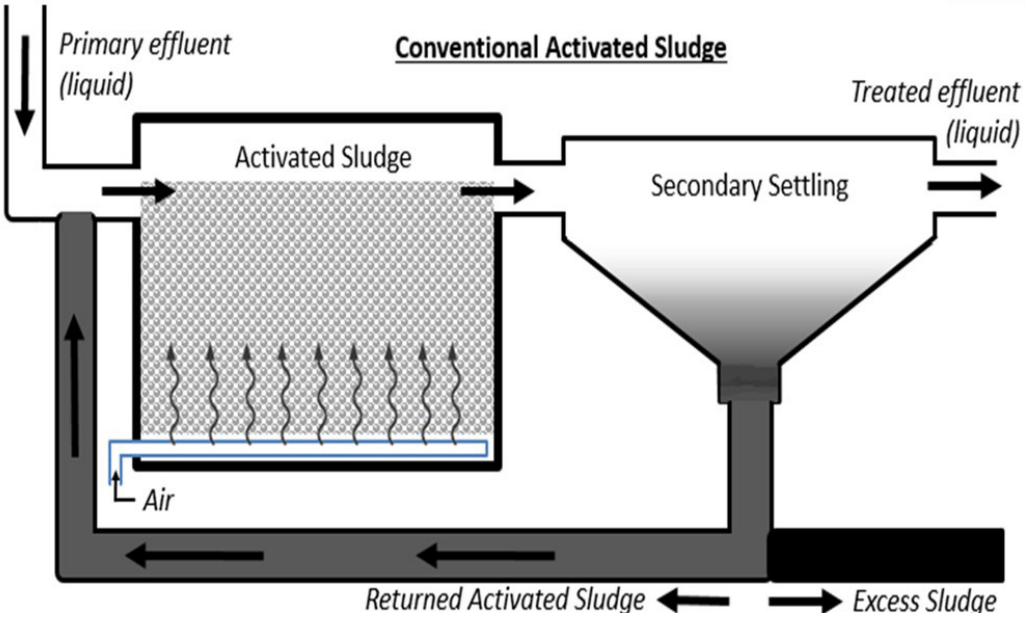
Advantages

When compared to alternative wastewater treatment technologies, which are more natural systems and appear to be more viable solutions than the AS system, the system offers low cost-effective technology, produces excellent quality effluent, needs minimal land area, and is free of flies and odor nuisance.

Disadvantages

The AS system is not a flexible approach, has higher operational expenses, big land occupation and results in bad odor.

Another downside is the issue of Filamentous bulking and foaming (A bulking sludge can result in the loss of sludge inventory to the effluent, causing environmental damage and effluent violations.



Activated Sludge Method
https://www.waterpathogens.org/book/activated-sludge

II. Nano-filtration method:

A newly designed pressure-driven liquid-phase membrane technique with increased flux that can be used in various applications instead of reverse osmosis (RO), a technology used to remove most contaminants from water by pushing the water under pressure through a semi-permeable membrane. In the Nano-filtration system, the NF membrane is located between the ultrafiltration and RO membranes.

The membrane's sieving process is utilized to remove organic debris, while the charge effect of the membranes and ions is employed to remove inorganic contaminants. Because of the advancement of Nano-filtration technology, many pharmaceutical, textile, and dairy companies apply it in the treatment of effluents thanks to its reduced energy consumption, capacity to recover metals from wastewater, and virus elimination effectiveness.

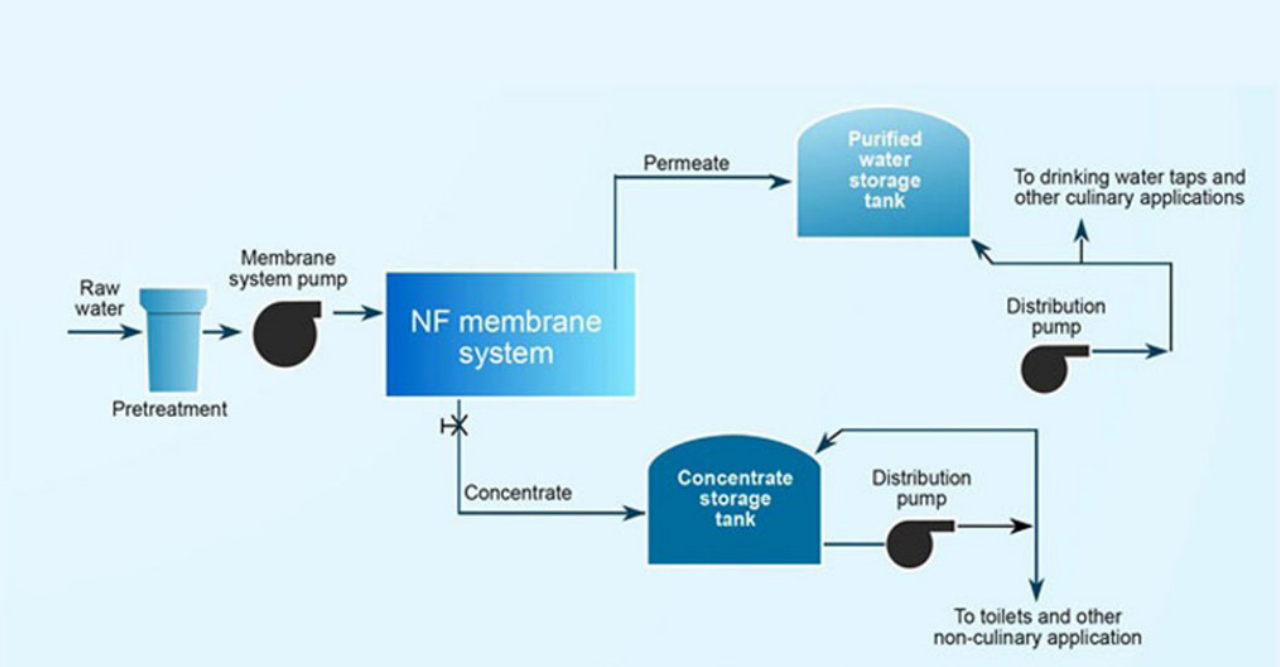
Nano-filtration Plant
https://ig7.ir/en/water-treatment-by-nf-nano-filtration-method/

Advantages

NF technology is promising due to its low energy consumption, capacity to recover metals from wastewater, and virus elimination effectiveness and efficiency.

Disadvantages

The disadvantages of this system are largely linked with fouling and huge quantities and concentrated sludge output, all of which have an impact on groundwater quality and performance as temperatures rise.



Nano-filtration Method

III. Membrane bioreactor method:

Membrane bioreactor method (MBR) technology is becoming a more popular method of liquid–solid separation among water treatment technologies and is gaining more attention from numerous researchers in the field of water and wastewater engineering.

This system is used in treating both domestic and industrial wastewater, as it is quite similar in operations with conventional activated sludge process, with the only difference being the membrane module.

Fine screens are installed before the membrane as a pre-treatment step for MBRs to perform efficiently and limit the quantity of solids that make their way into the membrane tanks. In addition, this method shields the membrane from solid particles and debris, lowering the system's operational and maintenance costs while also assuring better sludge quality.

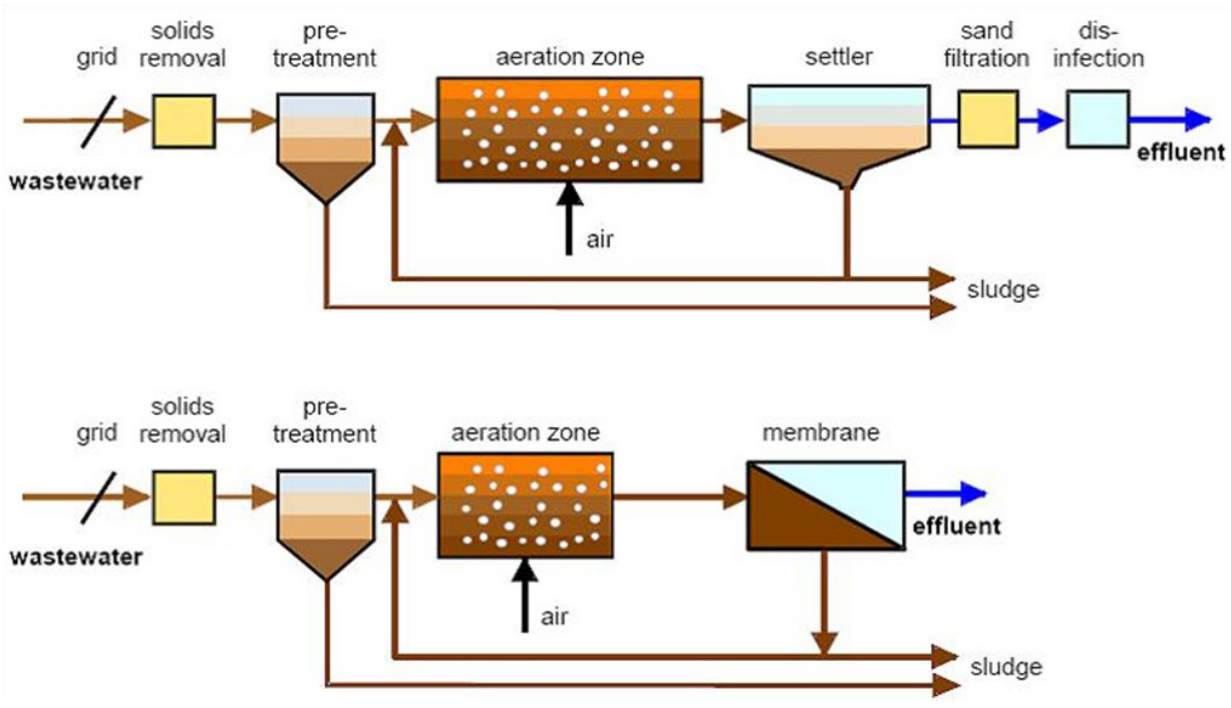
Membrane bioreactor

Advantages

Plant footprint reduction, removal of secondary, and tertiary filtering, increased efficiency and decreased sludge output.

Disadvantages

High energy costs, membrane complexity, and fouling, as well as high membrane operation and capital expenses



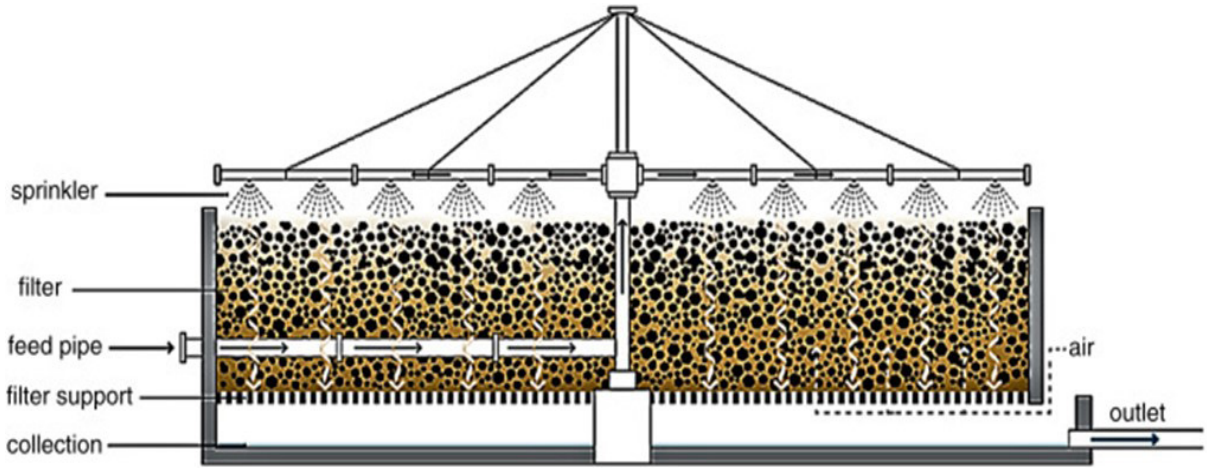
Activated Sludge vs MBR Technology
https://www.wikiwand.com/en/Membrane_bioreactor

IV. Trickling technology:

Biological trickling filters have a reputation for dependability and effectiveness in secondary wastewater treatment applications, making them ideal for small to medium-sized towns. It is a continuous process that distributes wastewater from a revolving influent distributor to a filter medium containing microorganisms for simple digestion.

Packing materials, such as synthetic materials, rocks, gravel sands, and various polymers, are employed for this type of wastewater treatment system. These packing materials are utilized to create a high surface area to volume ratio for the system's best operation.

Absorption and adsorption of organic molecules are the two fundamental processes that occur in a trickling filter for simple pollution removal. Bacteria are permitted to grow on the filter media, which is made of either rocks or plastics, in the system. The treated wastewater is subsequently distributed from the filter's top through the spinning influent distributor or a stationary distribution mechanism. Air is then fed from behind the filter through the nozzles for optimal organic breakdown. As the wastewater flows through the filter media, organic matter is adsorbed onto the film, allowing the organic matter and aerobic bacteria to mingle.



Trickling Technology
https://www.sciencedirect.com/science/article/pii/B9780128244630000045#!

Advantages

Small footprint: the filter medium can hold a greater amount of biomass in a smaller space.

Excellent organics removal: trickling filters are ideal for rapidly reducing biological oxygen demand (BOD).

Trickling systems utilize less energy than other aerobic treatment procedures.

Disadvantages

Clogging can occur in trickling systems when sediments enter the system and become stuck in the distributor mechanism, filter medium, or underdrain system.

Inflexible flow rate: trickling filters rely on a continuous flow of water through the system. This keeps the biofilm wet and aerated at all times, allowing it to continue to operate as planned.

V. Waste stabilization ponds:

It is ideal for treating wastewater in both advanced and developing countries. Moreover, it is the most frequent method of choice for municipal sewage treatment by many countries worldwide because of its adaptability, particularly in the tropics where temperatures range from 20°C to 35°C.

Natural treatment takes place in a broad, shallow basin containing numerous bacteria, fungus, and algae, which is also known as a “sewage lagoon” or “facultative lagoon.”

The three series of a traditional WSP are anaerobic pond, facultative pond (FP), and maturation pond (MP), which differ geometrically in terms of biochemical processes, hydraulic fluxes, and carbon, nutrient, and pathogen elimination.

The initial phase of any WSP is designed to increase the system’s settling activity and supports organic load removal. The second phase, which occurs in the FP requires more time and ground as it focuses on BOD, pathogens, and nutrient reduction. Finally, in the third phase, eliminating pathogens from wastewater occurs in shallow basins known as MPs.

Advantages

In tropical and subtropical locations, low-cost wastewater treatment technologies achieve high enteric pathogen (disease-causing organism) elimination.

Simple to run with little technology investment, low cost, cheap/unskilled labor, and low maintenance expenses.

Because it includes nutrients like nitrogen and phosphate, effluent water can be reused for irrigation.

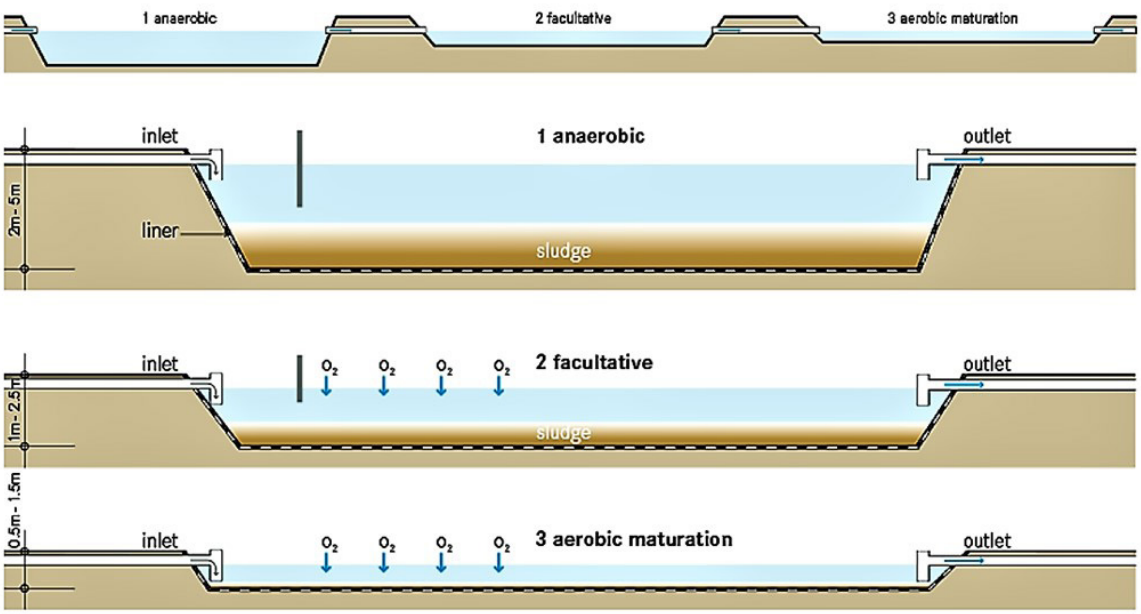
Disadvantages

WSP systems need more acreage than other types of treatment.

They are less effective in cold climes and may need more acreage or longer holding durations.

They can serve as a breeding ground for mosquitoes and other insects if not properly managed.

They are inefficient in removing heavy metals from wastewater.



Typical scheme of a Waste Stabilisation System (WSP)
https://sswm.info/taxonomy/term/3932/waste-stabilization-ponds-%28wsp%29

GI Aqua Tech

With years of experience and continued research and developments keeping in mind circular Economy, sustainability, effectiveness, cost efficiency we were able to develop our own innovative wastewater treatment plants.

We have managed to address our objectives by building a new generation of WWT plants in both domestic and industrial sectors and include the following key features:

- The highest international standards and quality of WWT to ensure sufficient water reuse.
- Capability to make complete treatment in one step with high efficiency.
- We can solve some problems like oxidation when another technology cannot do it.
- Complete automation controllable system work in batch and continuous.
- Cost efficiency, lower energy consumption, and minimum space.
- Environmental-friendly production and no emissions of odors or bad smells from the plants.
- The ability to integrate with the circular economy process.

Our Solution in Domestic Wastewater Treatment

- A new generation of wastewater plant enables local authorities to apply wastewater treatment with any capacity using compat technology that can reduce the used area to less than half of the areas used by the existing traditional plants.
- Domestic and Industrial Wastewater treatment plants which are compact designed, plug and play, durable and highly efficient domestic wastewater treatment plants that use an innovative treatment process and nanotechnology. With flexible capacities from 50 to 100,000 m^3/day wastewater treatment and the ability to cover different market segments. The plug and play solutions saves time and the hassle of contracting and construction operations.
- Complete automation system the provides optimum energy consumption and minimal labor required for the plant operation reducing health and safety risks. The plant's system can work as a batch or continuous according to input's requests.
- The outlet of the wastewater plant is completely controllable, meaning it can produce water for discharge or recylic according to the input's request.
- Unlike traditional wastewater treatment plants, our plants are isolated, odorless, hygienic, enivormentally friendly and help achieve green sustainable targets. Additionally, plants work with wide range of wastewater characterization such as low or high organic load.

- The plant’s technology is highly effective in reducing heavy metals from wastewater alongiwth the amount of nitrogen and phosphorus. Moreover, it allows the plant produce condensed sludge that can be matched with our system or other systems in sludge treatment.

- Closed loop feedback system is introduced in our plants to control chemical mixing, first stage filtering and second stage filtering; According to the condition of the input wastewater the system’s parameters are adjusted.

Our Products in Domestic Wastewater Treatment

Rapid wastewater treatment process through compact plants unit.

a. Portable wastewater plant 50 to 1000m3.
b. Prefabricated wastewater plant (50 to 100k m3).
c. Attachment unit to increase the efficiency of existing units.
d. Attachment unit to increase the capacity of existing units (2 to 4 times capacity of existing plant).

GI AQUA TECH
Water & Wastewater Solutions

GI AQUA TECH is a strategic partnership company between several multinational companies and research centers to provide innovative solutions for wastewater management based on a new generation of wastewater treatment technology, industrial, gray water, and petroleum with the unique nanotechnology and unique products offered by GI AQUA TECH for the first time in the world.

We strive for our products to make a breakthrough in wastewater and pollution management solutions and create new broad markets by providing intelligent products for wastewater treatment that are economical, cost-effective, achieve financial profits and achieve actual development. And to make these markets among the most attractive to our partners, customers, and those wishing to acquire economical, humane, and environmental benefits.

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