

BioComb®

Integrated Wastewater Treatment Equipment

Bioreactor-Clarifier Combo

Beijing BHT Environmental Technology Co., Ltd



Introduction of BioComb



BioComb (Bioreactor Clarifier Combo) is a high-end compact integrated wastewater treatment equipment designed by the R&D team of BHT specifically for **small or mobile distributed** wastewater treatment systems. All equipment is integrated into a standard container.

BioComb effluent can reach a variety of discharge standards such as Class A or Class B emission standard in GB18918-2002.

Applications:

- Concentrated communities under 10,000 population size, rural areas, high-speed service areas, remote villa areas, nursing homes, military barracks, schools and hotels, etc.;
- Point source interception along rivers and black-smelling water bodies;
- Discharge of domestic sewage under **2000m³/d**;
- Industrial or other wastewater with equivalent target pollutants;
- All other small de-centralized or decentralized wastewater treatment stations.

Process Technology Profile

Process technology:

AO mixed oxidation or MBBR process.

Shell form:

Standard ISO shipping container, compliant with international ISO requirements for strength and corrosion resistance.

Key Components:

Aeration System: German-made NDI membrane diffusers (10+ years lifespan).

Bio-Filler: Japanese TBR series woven filler (PP + vinylon, 10+ years lifespan).

Blower: Japanese-made Shih-Kang or Best rotary blowers.

Filtration: Static sand filter with automatic backwash module.

Disinfection: Chlorine tablet or UV disinfection.



Effluent Water Quality Standards



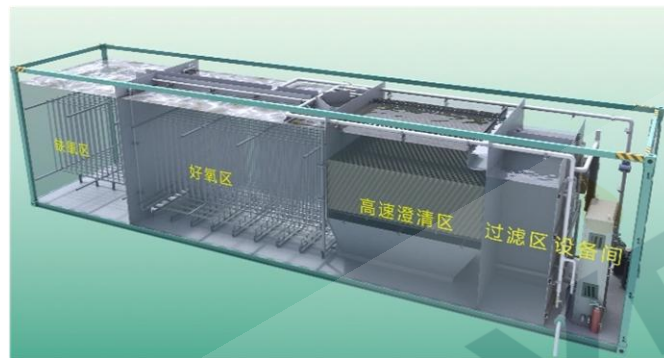
| Index | BioComb (Standard Container, Class B) | BioComb (Raised Container, Class A) |
|---------------------------------|---------------------------------------|-------------------------------------|
| COD | < 60 mg/L | < 50 mg/L |
| BOD | < 20 mg/L | < 10 mg/L |
| NH ₄ ⁺ -N | < 10mg/L | < 5 (8) mg/L |
| TN | < 20mg/L | < 15mg/L |
| TSS | < 20 mg/L | < 10 mg/L |
| TP | < 1.0mg/L | < 0.5mg/L |

Equipment Advantages

BioComb®



Standardized manufacturing,
outstanding quality,
long service life



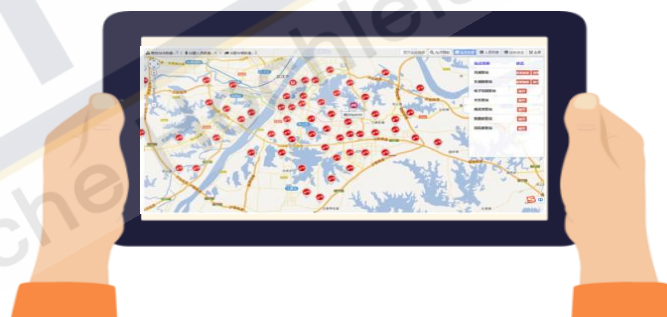
Advanced technology,
ultra-low energy consumption,
stable and **reliable** operation



Integrated design,
customized appearance



Containerized transportation,
convenient and **quick** transfer



Intelligent control,
easy operation and **maintenance**



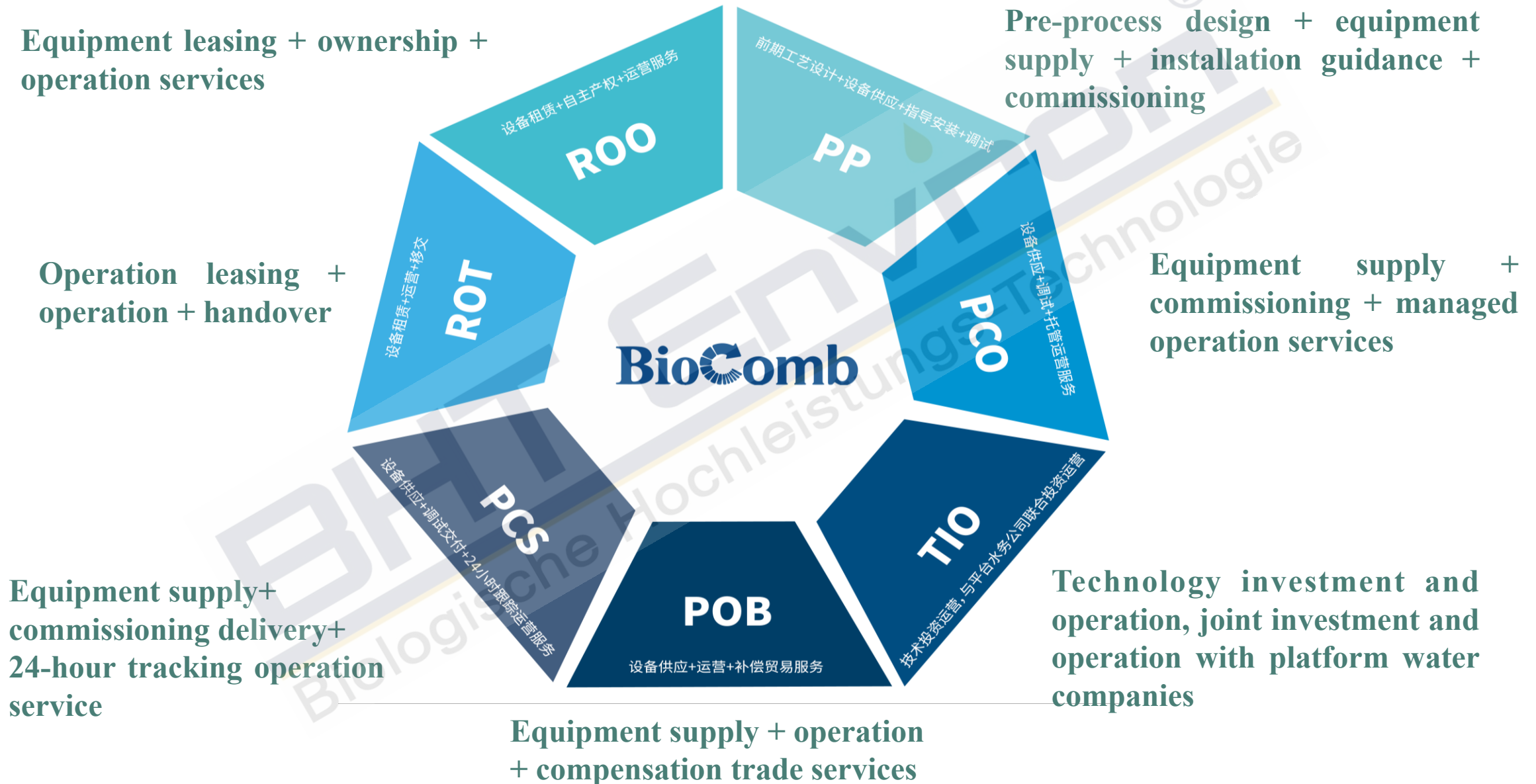
Small floor area,
low civil construction costs

BioComb®

- [illegible]

Business Model

BioComb®



Technical Details - Enclosure (Structure & Corrosion Protection)

The **BioComb** shell is a standard shipping container manufactured by CIMC Specialized Container Factory on an OEM basis. Its metal frame adopts SS400 weathering steel (with a minimum tensile strength of 400 MPa), achieving a maximum deformation of ≤ 5 mm when fully water-loaded.

The inner anti-corrosion treatment (including the bottom surface) consists of :

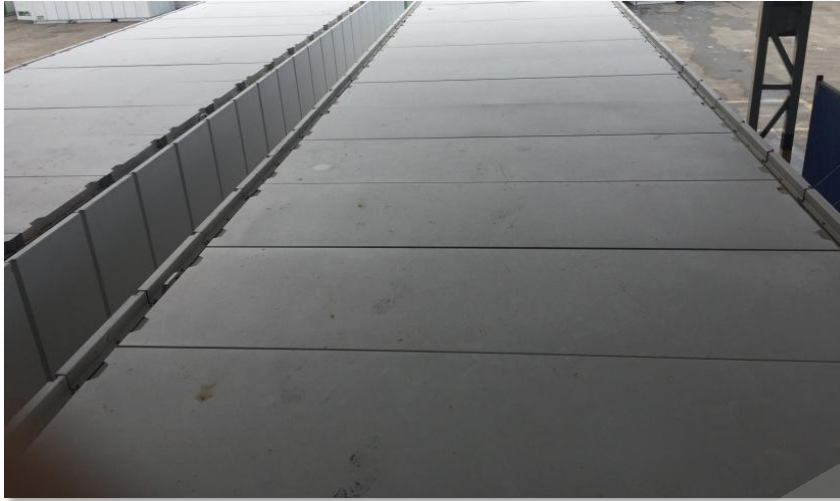
one layer of zinc-rich primer (30 μ m) + two layers of marine-grade heavy-duty anti-corrosive topcoat (total 320 μ m).

The external anti-corrosion system comprises three coatings:

Zinc-rich primer (40 μ m); Epoxy mica iron oxide intermediate coat (50 μ m); Acrylic topcoat (50 μ m). In regions with intense ultraviolet radiation, a fluoro-polyurethane topcoat is used instead.



Technical Details - Enclosure (Thermal & Acoustic Insulation)

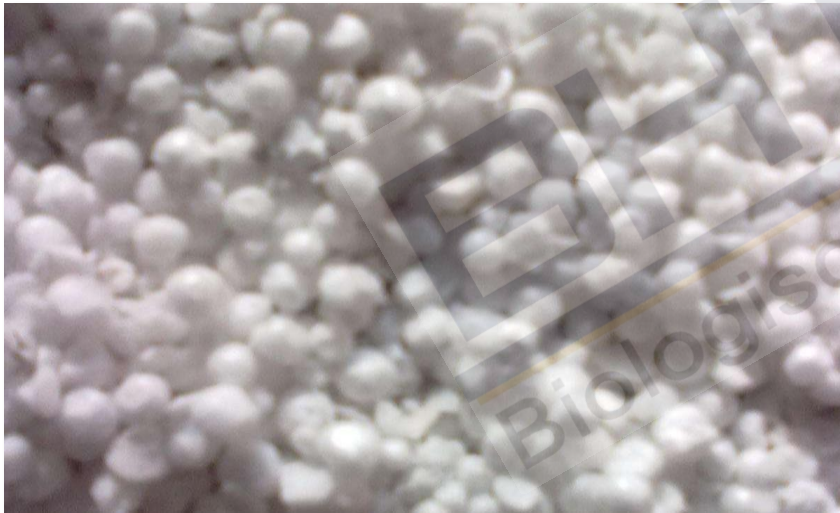


For Cold Climate Applications:

The BioComb shell adopts an insulated sandwich structure when deployed in frigid regions, ensuring the influent temperature remains stable throughout the treatment process. Thermal insulation is achieved by injecting expanded polystyrene (EPS) beads or polyurethane foam panels, featuring: 100mm thick insulation layer & sandwich core, Sealed top structure.

Noise Control Measures:

Equipment compartments (blower rooms) are lined with acoustic panels, effectively reducing noise to ≤ 50 dB(A) at 20 meters during nighttime operations in environmentally sensitive areas.



Technical Details - Aeration System (MAT System)

MAT aeration is a micro-porous aeration technology with low air ventilation volume. It adopts a high-density uniform distribution and a special perforation method. The bubbles are small and rise slowly, ensuring that they have enough time for mass transfer through contact with the water body. This effectively increases the oxygen transfer efficiency. At the same time, it eliminates the aeration blind areas and creates a fully contacting environment for the mixing of sludge and water, ensuring a good oxygen utilization rate.

High oxygen transfer efficiency

MAT pores made of special composite plastics can form tiny bubbles with a size of about 1mm, and the average oxygen transfer efficiency per meter of water depth is as high as 9% under the optimal ventilation rate.

Oxygen utilization is constant

The MAT system is self-cleaning and guarantees a constant oxygen utilization.

Low running costs

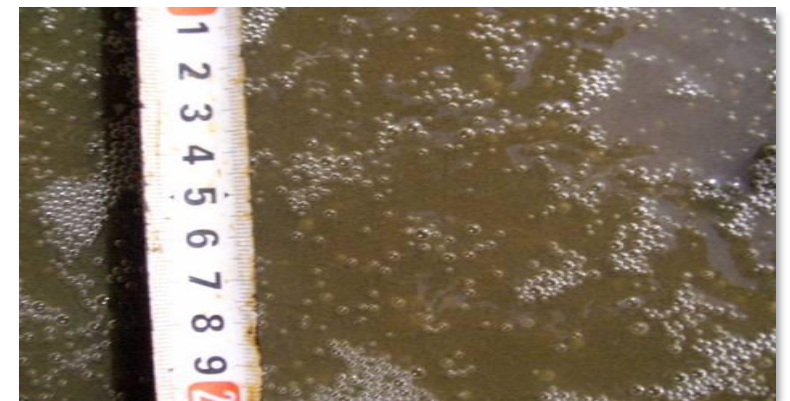
The wall thickness of the aeration pipe is only 0.3~0.4mm, and the air overflow resistance $\leq 1800\text{Pa}$. Choose a low-power blower to meet the amount of oxygen required for biochemical processes.

Long service life

MAT base metal is added with special additives, which has high deformation resistance and tear index, and the life of the aeration pipeline is guaranteed for 10 years under normal use.



Microbubbles produced by MAT



The bubbles produced by MAT are small and uniform

Technical Details - Aeration System (MAT System)



| Application Environment | BioDopp MAT | EPDM | Silicone |
|------------------------------------|-------------|------|----------|
| Soft and anti-cracking | ● | △ | ● |
| Resistant to organic oils and fats | ● | △ | ◎ |
| Resistant to mineral oil | ● | △ | ◎ |
| Smooth surface | ● | △ | ● |
| Biodegradable resistant | ● | △ | ● |
| Resistant to hydrolysis | ● | ◎ | △ |
| Continuous tensile performance | ● | ◎ | ◎ |
| UV resistance | ● | △ | ● |
| Resistant to strong oxidants | ● | △ | ● |

● Strong tolerance; ◎ Weak tolerance; △ Intolerance

| Soaking solvent | BioDopp MAT | EPDM | Silicone |
|-----------------------|-------------|------|----------|
| 60% Sulfuric acid | ● | ● | ● |
| 10% Hydrochloric acid | ● | ● | ● |
| 5% Acetic acid | ● | ● | ● |
| 50% Charged base | ● | ● | △ |
| 95% Ethanol | ● | ● | ● |
| Acetone | ● | △ | ◎ |
| Benzene | ● | △ | ● |
| Ethyl acetate | ● | △ | ● |
| Concentrated ammonia | ● | ● | ◎ |
| Formaldehyde | ● | ● | ● |
| 3% Hydrogen peroxide | ● | ● | ◎ |
| Detergent | ● | ● | ● |
| White lamp oil | ● | ◎ | ● |
| Unleaded gasoline | ● | △ | ● |
| Brake fluid | ● | △ | ● |
| Machinery oil | ● | ◎ | ● |
| 50% Ethanol | ● | ● | ● |

Soak at room temperature for one month. ● Insoluble; ◎ Swelling; △ Soluble

Technical Details - Biological Filler (TBR)



The BioComb system employs soft woven media from Japan TBR Corporation, replacing conventional fill materials. Key specifications include:

- Media length: 1,500 mm
- Installation grid: 100×100 mm or 150×150 mm

Parameters of the selected media are detailed in the table below:

| Project | Units | Data |
|-----------------------------------|---|--------------------|
| Fracture pull | N | > 2400 |
| Specific surface area | m ² /m ³ | 2000~4000 |
| Hanging time | d | 3~5 |
| Dissolved oxygen | state | anaerobic\ aerobic |
| Film-forming weight | kgDs/m | ≤0.2 |
| Total nitrogen load | kgTN/m ³ d | 0.38~0.54 |
| Nitrification load | kgTKN(NH ₃ -N)/m ³ ·d | 0.40~0.60 |
| BOD ₅ volumetric load | kgBOD ₅ /m ³ ·d | 1.51 |
| BOD ₅ sludge load | kgBOD ₅ /kg·MLSS·d | 0.058~0.072 |
| COD _{Cr} volumetric load | kgCOD _{Cr} /m ³ ·d | 1.89 |
| COD _{Cr} sludge load | kgCOD _{Cr} /kg·MLSS·d | 0.073~0.090 |
| Service life | year | ≥10 |



BioComb integrates an electrophosphate dephosphorization system in the aeration zone inside the container. Aluminum plates are used for electrophosphorization dephosphonation, which avoids the problems of high polarization voltage of ferroelectrodes, corrosion when parking, and poor energy efficiency.

Phosphorus removal method

Electrolytic phosphorus removal

- a. When the total phosphorus (TP) of the influent water is $\leq 3\text{mg/L}$ or the treatment capacity is $\leq 50\text{m}^3/\text{d}$.
- b. 1kg Al consumption can remove 0.7~0.8kg TP, and $2 \times 25\text{kg}$ aluminum plate electrodes are generally configured.

Chemical phosphorus removal

When the TP of the influent water is $> 3\text{mg/L}$ or the treatment capacity is $> 50\text{m}^3/\text{d}$.

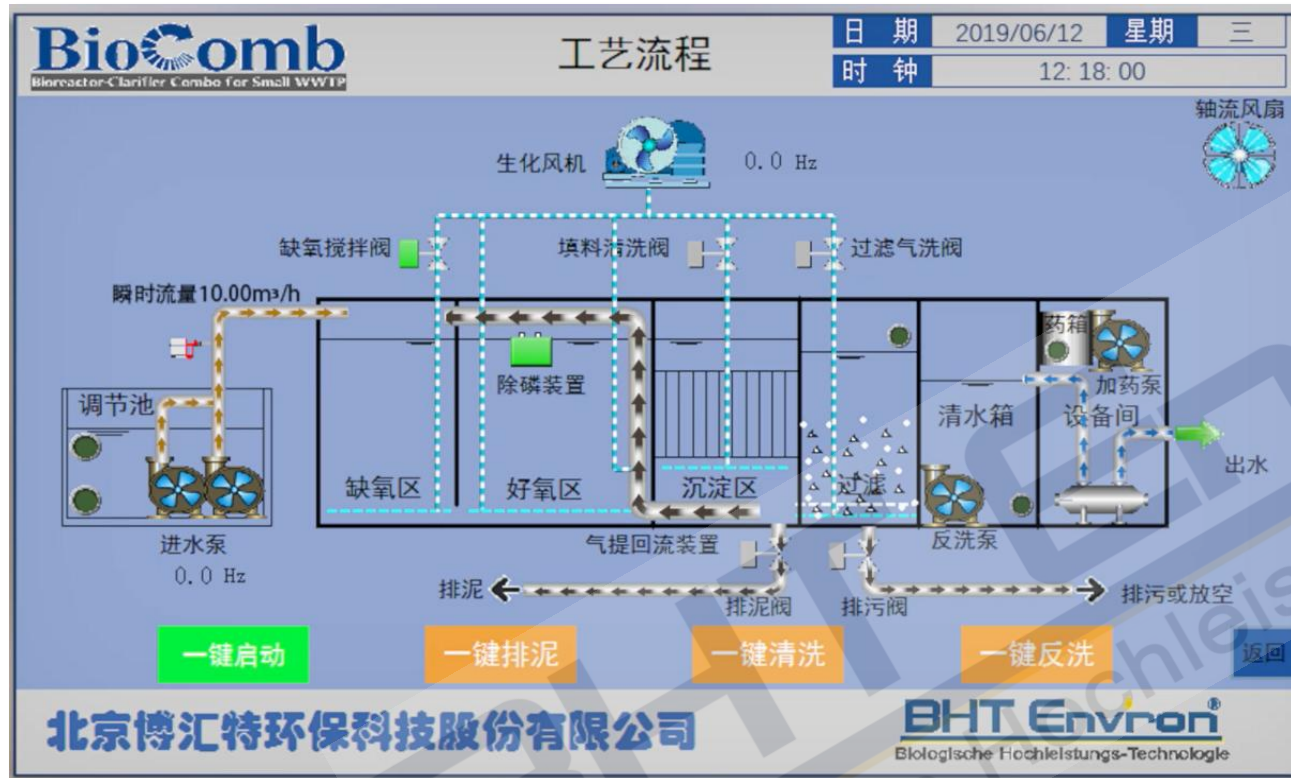




The **BioComb** system incorporates an equipment room located at one end of the container or within a dedicated standalone container. This integrated space houses auxiliary components including a grit remover, blower, disinfection system, flow metering system, sand filter backwash pump, control cabinet, piping valves, and other supporting equipment.

All pipelines are equipped with electric (solenoid) valves, with all electrical devices centrally controlled through a unified control system. Nearly all operational functions can be executed via the touchscreen interface on the control cabinet, while remote monitoring and control are additionally achievable through a mobile APP.

Technical Details - Multiple Modes of Operation



1) Under sufficient influent flow:

Conventional continuous operation mode.

2) Under insufficient influent flow:

Adopts an intermittent operation mode similar to SBR.

3) During low winter temperatures:

Extends sludge age, increases sludge concentration, and enriches nitrifying bacteria populations.

Equipment
startup

Water inlet
pump starts

Normal
operation

Water inlet
pump stopped

Equipment
stops

Backwash filter
area



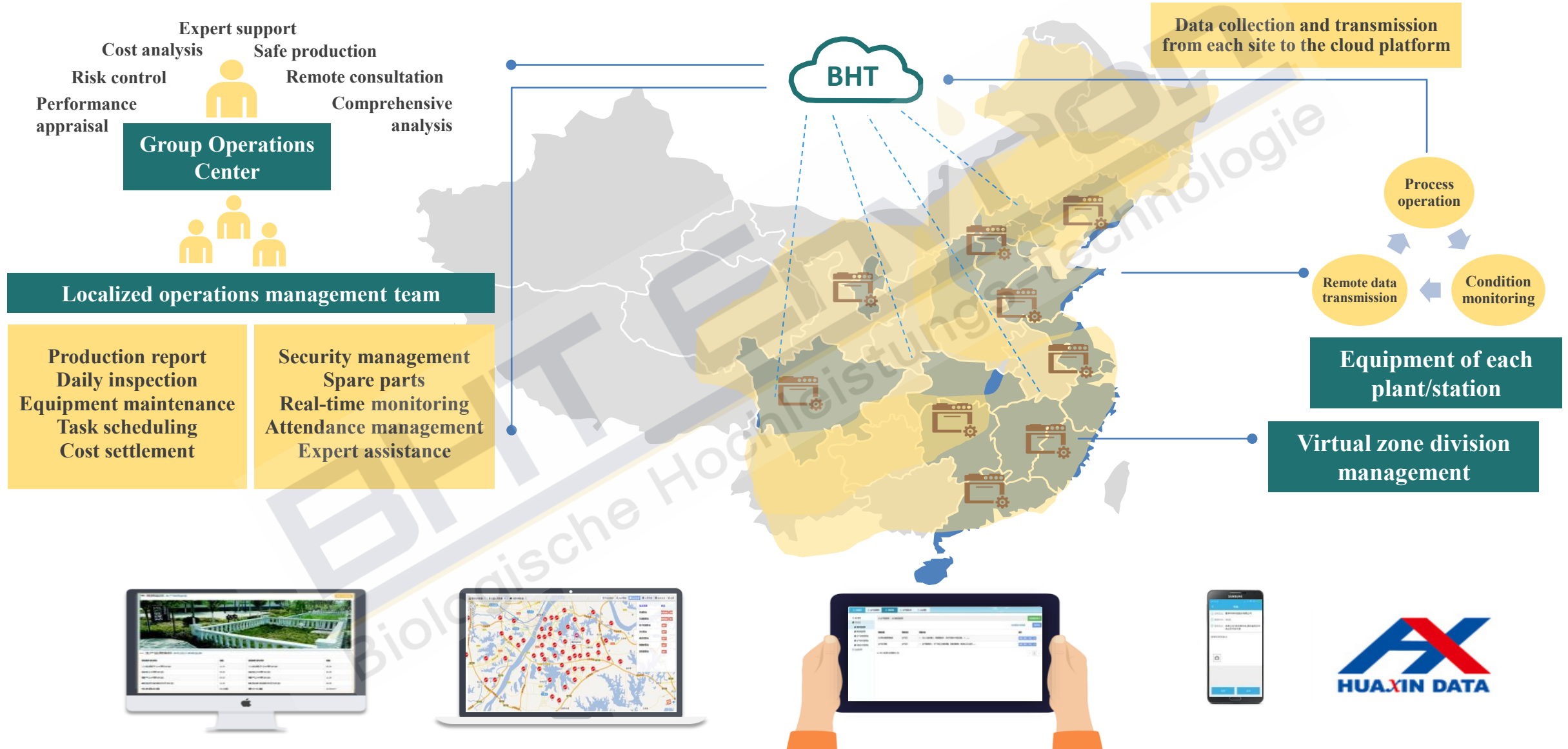
Remote visual management of the site

Implement remote monitoring of subordinate sewage treatment sites, display their distribution and specific project locations via a GIS-based map, and obtain overview information of subordinate sites. Enable real-time comprehensive monitoring of the operational status across all sites, including sewage flow data, equipment activation status, and personnel/vehicle attendance.

Real-time control of production safety

Allow real-time viewing of video stream data from cameras at each site and control camera pan-tilt mechanisms based on operational conditions to observe site operations. Continuously monitor real-time operational parameters of sewage treatment facilities.

Technical Details - Station Centralized O&M Management Platform



Technical Details - Optional System

Prefabricated pumping station



Bacteria agent package



Stainless steel liner



Small-scale wind-solar hybrid power generation system



Multi-water quality online monitoring system



Whole process deodorization and dosing system



BioComb Application Scenarios and Cases

BHT invested in the innovation and research and development of the BioComb integrated sewage treatment equipment in 2011. It achieved extensive development and promotion in 2017. As of June 2023, more than **800 sets of BioComb** integrated equipment have been put into use, with a cumulative treated water volume reaching **160,000 m³/d**. It involves more than **100** sewage treatment projects and covers **20 provincial administrative regions** across the country, as well as overseas countries such as **Sharjah** in the United Arab Emirates and Mongolia.



Villa area



Township and rural sewage



High-speed service areas



Treatment of black-smelling water bodies



Container emergency treatment



Sewage plant overflow sewage

Case 1: Continuous Governance

Environmental Comprehensive Improvement Project for Water Sources in Dinghu District, Zhaoqing City



The project is located in Zhaoqing City, Guangdong Province, and is responsible for treating the rural domestic sewage around the drinking water source area. The cumulative total treatment capacity of 22 stations is 1000 m³ per day. According to the local environmental and climatic characteristics, integrated sewage treatment equipment is provided for centralized treatment, which is combined with artificial wetlands to achieve landscape benefits. The effluent water quality is shown in the following table:

| Index | COD | BOD ₅ | NH ₃ -N | TN | SS | TP |
|----------|-----|------------------|--------------------|----|-----|-----|
| Influent | 300 | 120 | 30 | 40 | 100 | 5 |
| Effluent | 40 | 10 | 5(8) | 15 | 10 | 0.5 |



Case 2: Rural Domestic Sewage



Rural Domestic Sewage Project in Taohua Village and Litao Village, Hainan Province



The amount of rural sewage fluctuates greatly with different seasons and regions, so it is difficult to make statistics. The discharge is relatively dispersed, the individual water volume is small, and the state is discontinuous.

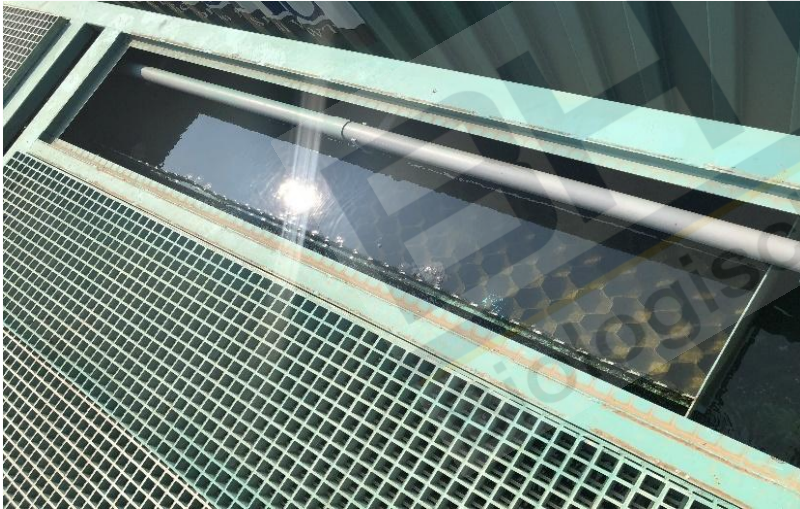
The project is located in Taoyuan Village and Litao Village, Hainan Province, to treat rural domestic sewage, We provide 2 sets of BioComb for Taoyuan Village with a treatment scale of 400 m³/d, and 1 set of BioComb for Litao Village with a treatment scale of 50 m³/d, all of which meet the class A standard.

| Index | COD | BOD ₅ | NH ₃ -N | TN | SS | TP |
|----------|-----|------------------|--------------------|----|-----|-----|
| Influent | 250 | 120 | 30 | 40 | 200 | 4 |
| Effluent | 50 | 10 | 5(8) | 15 | 10 | 0.5 |



Case 3: Emergency Assistance for River Pollution Interception

Fuchuang Creek Water Environment Treatment Project in Haikou City



The BioComb integrated sewage treatment equipment is located in the PPP project for the comprehensive management of the water environment of Fuchuangxi-Yidapai Ditch in Haikou City. 27 sets of integrated sewage treatment equipment and supporting regulating tanks are installed, and the treatment capacity of each single equipment is not less than 200 m³/d. Among them, the treatment scale of the Guilin Yang Station is 4,000 m³/d, and 20 sets of equipment are used; the treatment scale of the Fuchuangxi Station is 1,200 m³/d, and 7 sets of equipment are used.



Case 4: High-speed Service Area Project

Shandong High-speed Service Area Wastewater Treatment Project

The project involves 20 pairs of service areas such as Jingtai Road, Qingyin Road, Rilan Road, Rongwei Road and Linzao Road, **spanning more than 800 kilometers and upgrading and expansion of 34 sewage treatment stations**. The total treatment scale is **9160 m³/d**, and the effluent quality meets the "Pollutant Discharge Standard for Urban Sewage Treatment Plant" GB18918-2002 Class A standard. BHT invests and operates this project in BOT (Build-Operate-Transfer) mode, with an operating period of 15 years.



Case 4: High-speed Service Area Project

Shandong High-speed Service Area Wastewater Treatment Project

The project is located in the Shandong high-speed service area, mainly treating domestic sewage and miscellaneous water in the service area, with the characteristics of scattered stations, discharge water quality and large fluctuations in water quantity. The project involves 22 pairs of service areas such as Jingtai Road, Qingyin Road, Rilan Road, Rongwei Road and Linzao Road, spanning more than 800 kilometers, and upgrading and expansion of 34 sewage treatment stations. The total treatment scale is 9160m³/d, and the effluent quality meets the "Pollutant Discharge Standard for Urban Sewage Treatment Plants" GB18918-2002 Class A standard.

| Index | COD | BOD ₅ | NH ₃ -N | TN | SS | TP |
|-----------------|------|------------------|--------------------|------|------|------|
| Influent | ≤300 | ≤240 | ≤40 | ≤40 | ≤200 | ≤3 |
| Design effluent | 40 | - | 5 (8) | 15 | 10 | 0.5 |
| Design effluent | 28 | - | 3.24 | 10.2 | 7 | 0.42 |



Case 5: Wind-solar hybrid power generation

Collective Township Sewage Demonstration Project in Dingnan County, Jiangxi Province

The demonstration sites in Longtang Town and Kuimeishan Town, Dingnan County Jiangxi Province, rely on BioComb to build a smart environmental protection theme park. There is 1 set of demonstration site at the town level (with a treatment scale of 55 m³/d), and 3 sets in each of the other two townships (the treatment scale of each single set is not less than 150 m³/d). The demonstration sites are equipped with wind-solar hybrid power generation equipment, which comprehensively utilizes solar energy to convert it into electricity, saving electricity consumption.

| Index | COD | BOD ₅ | NH ₃ -N | TN | SS | TP |
|----------|-----|------------------|--------------------|----|----|-----|
| Influent | 250 | 100 | 35 | 40 | 90 | 5 |
| Effluent | 50 | 10 | 5(8) | 15 | 10 | 0.5 |

Smart environmental protection theme park composition:

Ultra-low energy consumption BioComb integrated wastewater treatment plant + Modern countryside leisure park + Photovoltaic power station to provide power + BioComb intelligent control system for real-time remote monitoring and emergency response + Environmental education corridor



Case 6: Overflow Wastewater

Emergency Urban Sewage Treatment Project in Nanbu County

The project is located in Nanbu County, Sichuan Province. In order to improve the urban sewage treatment rate in Nanbu County, an additional 5000m³/d emergency auxiliary engineering treatment was added to the municipal domestic sewage plant in Nanbu County, and the effluent quality reached Grade A standard.

Service period of 18 months, using 30 BioComb-40HC equipment.

The operation has now ended and all equipment has been withdrawn.

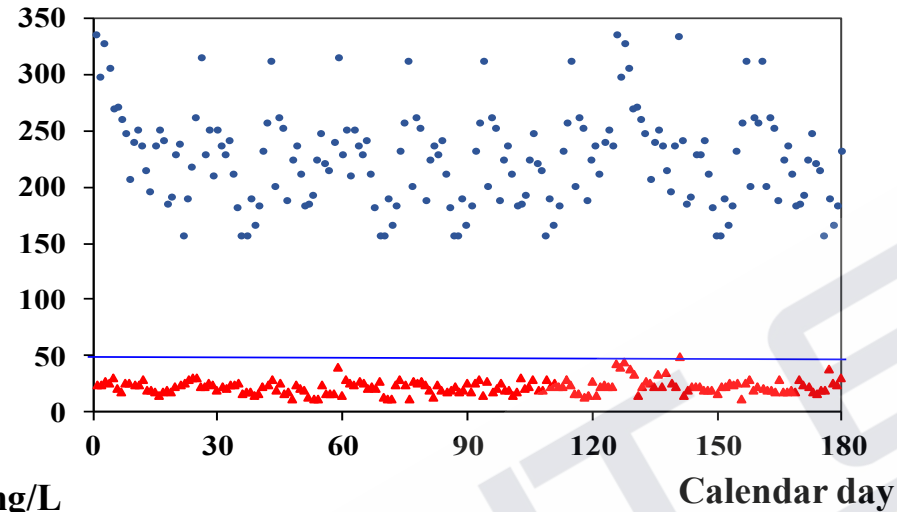
| Index | COD | BOD ₅ | NH ₃ -N | TN | SS | TP |
|-----------------|------|------------------|--------------------|------|------|------|
| | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| Design inlet | ≤350 | ≤150 | ≤20 | ≤40 | ≤350 | ≤3 |
| Design effluent | 50 | 10 | 5 (8) | 15 | 10 | 0.5 |
| Design effluent | 14 | 4.5 | 0.992 | 5.35 | 7 | 0.28 |



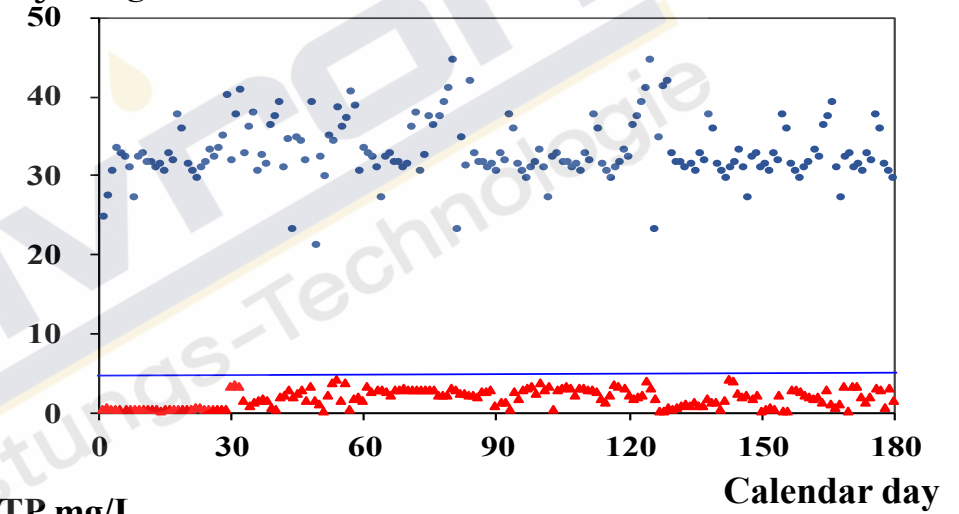
Case 6: Overflow Sewage

Emergency Urban Sewage Treatment Project in Nanbu County

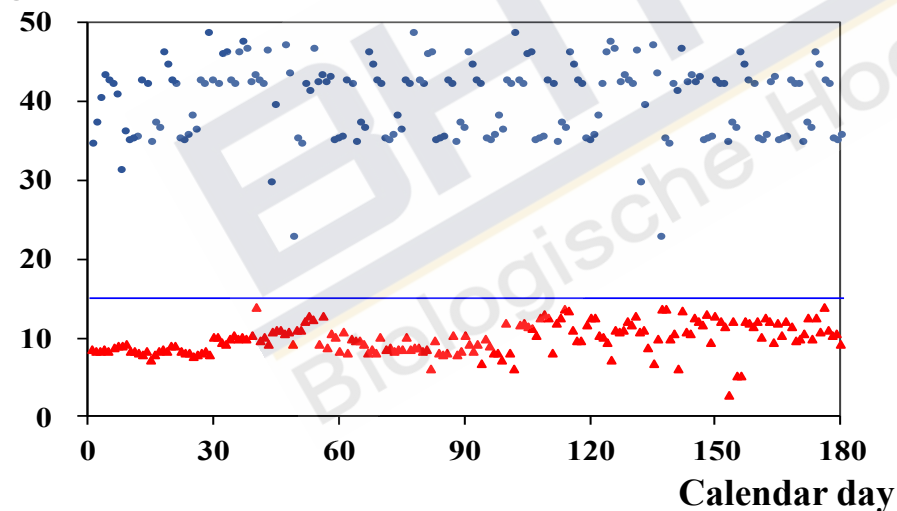
COD mg/L



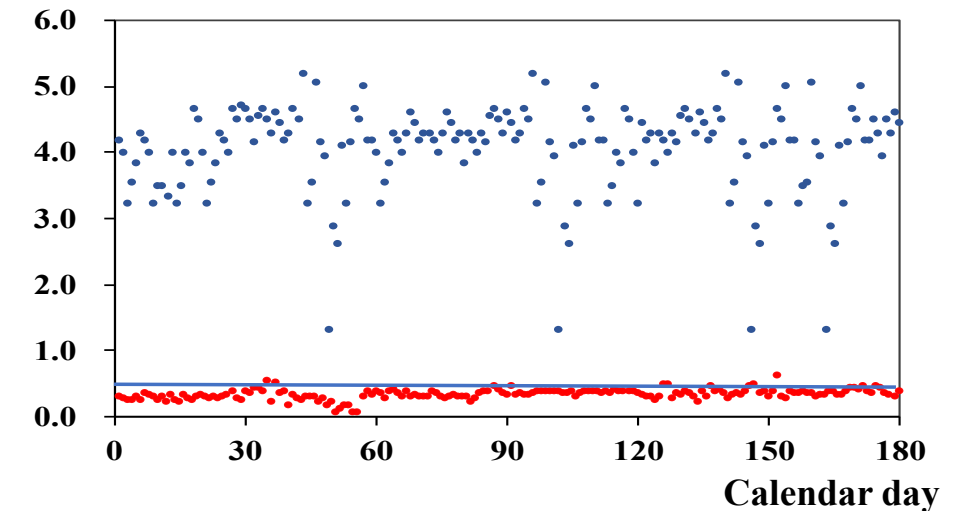
NH₃-N mg/L



TN mg/L



TP mg/L



Case 7: Buried Form

Beautiful Countryside Demonstration Project in Dingyuan County, Anhui Province

This project is a beautiful village demonstration project in Dingyuan County, with a total of 17 sites, with a treatment scale ranging from 50 m³/d-200 m³/d, a total of 2540 m³/d, using multiple mobile integrated equipment.

Equipment size: 16.1m*3.0m*2.9m

COD_{Cr} volume load: 1.35kg COD_{Cr} /(m³·d)

| Processing unit | COD _{Cr} | BOD ₅ | NH ₃ -N | SS | TP |
|-----------------|-------------------|------------------|--------------------|------|------|
| | mg/L | mg/L | mg/L | mg/L | mg/L |
| Influent | 150 | 80 | 20 | 200 | 5 |
| Effluent | 50 | 10 | 5 | 20 | 0.5 |



Case 8: Customised Appearance

Rural Sewage Treatment Project in Zijin County, Guangdong Province

The project treats rural sewage in Zijin Town, Guangdong Province, with 5 new stations, with a total treatment scale of 6400 m³/d. Feng'an station adopts independent integrated equipment with a total length of 16.4 m, and the remaining four stations adopt tandem integrated equipment. The front end is the equipment room, anoxic area and anaerobic area, the equipment is 7.2 m long; the back end is aerobic area and sedimentation area, the equipment is 10.9 m long.

Process: coarse grating + cyclone sand filter + regulating tank + BioComb + fibre rotary filter + disinfection

| Index | COD _{Cr} | BOD ₅ | NH ₃ -N | TN | SS | TP |
|----------|-------------------|------------------|--------------------|------|------|------|
| | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| Influent | ≤300 | ≤130 | ≤30 | ≤35 | ≤250 | ≤5 |
| Effluent | ≤40 | ≤10 | ≤5 (8) | ≤15 | ≤10 | ≤0.5 |



Baipu Station, Yirong Station 1500m³/d



Shuidun station 1000m³/d



Jingzi station 1500m³/d



Feng'an Station 400m³/d

Case 9: Building Xiongan

Rural Sewage Treatment Station in Xiongan New Area, Hebei Province

The project is located in the rural domestic sewage treatment project in Zhugezhuang Town, Xiongan New Area. It collects the domestic sewage of residents and constructs three new sewage treatment stations with a total treatment scale of 250 tons per day. After treatment, the sewage is discharged into the Daqing River or nearby ponds. The effluent water quality meets the Grade A standard of the first level in the "Discharge Standard of Rural Domestic Sewage in Hebei Province" (DB13/2171-2015) and the agricultural irrigation standard.

As the winter temperature in Hebei is low, in order to ensure that the effluent water quality stably meets the standard, an insulation layer is added outside the equipment to ensure that the equipment above the ground maintains an appropriate water temperature, which is conducive to the removal of pollutants.

| Index | SS | COD | BOD ₅ | NH ₃ -N | TN | TP |
|----------|------|------|------------------|--------------------|-----|------|
| Influent | ≤200 | ≤350 | ≤200 | ≤30 | ≤40 | ≤4 |
| Effluent | ≤10 | ≤50 | ≤10 | ≤5(8) | ≤15 | ≤0.5 |



Case 10: Demonstration Project

Sewage Treatment Project in Jingshan Town, Zhejiang Province



Jingshan Town, Zhejiang Province is located in the Tiaoxi River Basin. The integrated rural pollution control technology and large-scale demonstration project is one of the major national water projects during the 12th Five-Year Plan period. It provides 4 sets of BioComb integrated sewage treatment equipment and supporting regulating tanks. The effluent water quality meets the first-level standard of the local standard in Zhejiang Province, namely "DB33/973-2015 Discharge Standard of Water Pollution from Rural Domestic Sewage Treatment Facilities".

Shaozi River basin has a long history and culture, unique natural scenery, and has a national AAAA level scenic spot. Based on this, **the rustic ink painting look** was customized for BioComb, subverting the traditional image of sewage treatment equipment. BioComb **not only consumes less energy and produces better water, but also becomes a beautiful sight on country roads.**



Case 11: House Insulation

Hebei Fuping rural sewage treatment project



The project is located in Fuping County, Hebei Province, treating rural domestic wastewater. 8 sets of BioComb-53HC were supplied to the owner. the project is divided into 3 sites, namely, Shijiazhai: 600t/d, Tianshengqiao: 300t/d, Longquanguan: 300t/d, and the effluent quality meets the standard of quasi IV on the surface. Adopting the method of erecting civil housing, we can choose heating or add air-conditioning to guarantee the stable operation of the system under the extremely low temperature in winter.

| Index | COD _{Cr} | BOD ₅ | SS | NH ₃ -N | TN | TP |
|----------|-------------------|------------------|------|--------------------|------|------|
| | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| Influent | ≤350 | ≤200 | ≤165 | ≤36 | ≤50 | ≤4 |
| Effluent | ≤30 | ≤6 | ≤10 | ≤1.5 (2.5) | ≤15 | ≤0.3 |



Case 12: Research and Development Projects

Zhouzhuang Village Sewage Treatment Project in Fangshan District, Beijing

The designed treatment scale of the Sewage Treatment Station in Zhouzhuang Village, Fangshan District, is 150 m³ per day. After reuse, the remaining produced water is discharged in accordance with the Grade A standard of the second level of the local standard in Beijing, namely "Discharge Standard of Water Pollutants from Rural Domestic Sewage Treatment Facilities" (DB11/1612-2019). The Sewage Treatment Station in Zhouzhuang Village, Fangshan District, **is subordinate to the National Key Research and Development Program Project on the Research and Application of New Technologies for Water Resources Recycling in Fangshan District, Beijing.**



The overall goal of this project is to improve the utilization efficiency of water resources and reduce the amount of newly sourced water. It aims to construct a comprehensive water-saving technology system applicable to villages and towns of different scales, **achieving the objectives of basically full reuse of domestic wastewater in the demonstration area, a 10% increase in water use efficiency, zero growth in the total water consumption, and a 10% reduction in the amount of fresh freshwater resources sourced.** This project can significantly enhance the technical level of ensuring the safety of drinking water in villages and towns, improve the efficiency of domestic water use, solve the problem of domestic sewage treatment, and carry out resource-based reuse. Overall, it realizes comprehensive water saving throughout the whole process. This not only alleviates the shortage of water resources but also effectively improves the ecological environment.

THANK YOU

Beijing BHT Environment Technology Co., Ltd.



For more information, please visit our website: www.bhtwater.com