Advances in Social Science and Culture
ISSN 2640-9682 (Print) ISSN 2640-9674 (Online)
Vol. 7, No. 4, 2025
www.scholink.org/ojs/index.php/assc

Original Paper

Engineering Design of a Township Sewage Treatment Plant in Eastern China

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Received: May 22, 2025 Accepted: July 07, 2025 Online Published: July 26, 2025

doi:10.22158/assc.v7n4p45 URL: http://dx.doi.org/10.22158/assc.v7n4p45

Abstract

A township in eastern China needs to build a new sewage treatment facility because the existing sewage treatment plant cannot meet the demand for predicted sewage volume. The scale of the new sewage treatment project is 14,000m^3/d, and the effluent quality of the project shall be implemented in accordance with the discharge limit of the main pollutants of the new urban sewage treatment plant in the local standard of Zhejiang Province in the "Pollutant Discharge Standard for Urban Sewage Treatment Plants (DB33/2169-2018)". The process adopts the modified A^2/O biochemical process as the core of secondary treatment to strengthen nitrogen and phosphorus removal. Magnetic coagulation and precipitation filtration are selected for deep treatment to ensure that SS and TP meet the standards; Sodium hypochlorite is used for disinfection, snail dehydrator is used for sludge treatment, and biological soil method is used for deodorization. The factory area has reasonable layout, clear functions, and smooth water flow. The total investment of the project is about 110 million yuan, and the effluent will meet the standard stably after it is put into operation in 2025, effectively improving the regional water environment and providing a demonstration for the expansion of similar township sewage plants.

Keywords

township sewage treatment plant, engineering design,AAO

1. Project Background

A township in eastern China has an administrative area of about 159 square kilometers, and as of 2020, it has a permanent population of about 68,000, with 1,288 industrial enterprises and 72 above designated size.

There is an existing sewage treatment plant in the township, with a design scale of 4000 m^3/d, and the design effluent standard meets the discharge standard of Table 1 of the "Discharge Standard for Major Water Pollutants in Urban Sewage Treatment Plants" (DB 33/2169), and the current sewage treatment process is "sewage - coarse grid well and inlet pump room - CAST tank - intermediate pool - filtration system - disinfection tank - metering well - clean water pool - standard discharge". The actual average daily water output of the current sewage treatment plant is 2870 m^3/d, the operating load rate is about 71.75, the average COD of influent COD is 79.48mg/L, and the average influent BOD_5 is 20.16mg/L.

At present, the combined drainage system and the diversion system coexist in the township, and the sewage pipe network is seriously misconnected and mixed, and the shortcomings of the sewage pipe network collection system are obvious, especially in the rainy season, a large amount of rainwater enters the sewage treatment plant, which has a great impact on the treatment facilities of the sewage treatment plant.

With the construction of township sewage pipe network, the current phenomenon of direct and scattered sewage discharge can be effectively improved, and the amount of sewage collected by the pipe network will gradually increase with the construction of the sewage pipe network. At present, the actual operating load rate of sewage treatment plants has reached more than 70%, and it is inevitable that new sewage treatment plants or sewage treatment capacity will be increased to solve the gap in sewage treatment capacity and improve the water environment.

2. Project Scale and Project Objectives

2.1 Project Scale

According to the water supply plan, the maximum daily sewage volume of the township by 2030 will be 15,000 m^3/d, considering the domestic sewage discharge coefficient of 0.9, the daily change coefficient of water supply is 1.2, the sewage collection rate is 100%, and the groundwater infiltration coefficient is determined by 10% of the sewage volume, and the sewage volume in 2030 is calculated to be 17,820 m^3/d, rounded to 18,000 m^3/d. Considering the current situation of 4,000 m^3/d sewage treatment facilities, the actual scale of this new project is 14,000 m^3/d.

Table 1. Sewage Volume Forecast Table

Index	Parameter
Maximum daily water consumption (m^3/d)	15000
Diurnal coefficient	1.2
Sewage discharge coefficient	0.9
Groundwater infiltration rate (%)	10
Sewage volume (m^3/d)	17820
Sewage scale (m^3/d)	**18000**

2.2 Project Objectives

2.2.1 Design Influent Water Quality

According to the current water quality and quantity survey data of the sewage plant, combined with the design conditions of the surrounding township sewage plants and the design conditions of the influent water quality of sewage plants based on similar township domestic sewage in Zhejiang Province, the following influent standards are obtained:

Table 2. List of Design Influent Water Quality

Index	Parameter	Unit
BOD_5	≤180	mg/L
COD_{Cr}	≤300	mg/L
SS	≤180	mg/L
NH_3-N	≤25	mg/L
TN	≤32	mg/L
TP	≤4	mg/L

2.2.2 Design Effluent Quality

According to the national, provincial and municipal standards and relevant planning requirements, the effluent water quality of this project is in accordance with the discharge limits of the main pollutants of new urban sewage treatment plants in the local standards of Zhejiang Province in the "Pollutant Discharge Standard for Urban Sewage Treatment Plants (DB33/2169-2018)", and other sewage not mentioned shall comply with the first-class A standard of the "Pollutant Discharge Standard for Urban Sewage Treatment Plants (GB18918-2002)". The specific design effluent quality is as follows:

Table 3. Design Effluent Quality Table

Index	Parameter	Unit
BOD_5	≤10	mg/L
COD_{Cr}	≤30	mg/L
SS	≤10	mg/L
TN	≤10（12）	mg/L
NH_3-N	≤1.5（3）	mg/L
TP	≤0.3	mg/L
pH	6～9	

2.2.3 Tailwater Discharge

After the sewage is treated to meet the standards, it is discharged to the nearby water body.

3. Pollutant Removal and Treatment Process Requirements

The purpose of sewage treatment is to remove pollutants from the water and purify the sewage. The main pollutants in sewage are BOD_5, COD_{Cr}, SS, NH_3-N and TP.

According to the inlet and outlet water quality, the pollutant removal rate and influent nutrient ratio required by the project are shown in the following Table:

Table 4. Required Pollutant Removal Rate

Index	Design influent water quality(mg/L)	Design effluent quality(mg/L)	Removal rate (%)
BOD_5	180	≤10	94.44
COD_{Cr}	300	≤30	90.00
SS	180	≤10	94.44
NH_3-N	25	≤1.5	94.00
TN	32	≤10	68.75
TP	4.0	≤0.3	92.50

Table 5. Nutrient Ratio in Influent Water

Items	Ratio
BOD_5/ COD_{Cr}	0.6
BOD_5/TKN	5.63
BOD_5/TP	45

According to the "Outdoor Drainage Design Standard" (GB 50014-2021), when sewage has nitrogen and phosphorus removal requirements, the following conditions should be met:

The ratio of five-day biochemical oxygen demand to total Kjeldahl nitrogen in sewage should be greater than 4.

The ratio of five-day biochemical oxygen demand to total phosphorus in sewage should be greater than 17.

According to the design of the inlet and outflow data of this project, in order to achieve the effluent index required by the sewage treatment plant, the project must adopt the secondary treatment process.

4. Processing Process

4.1 Selection of Conventional Sewage Treatment Process

The engineering influent water quality of the sewage treatment plant was analyzed, and the biological phosphorus removal and nitrogen removal process was suitable for use. According to the water quality of sewage inlet and outlet and the land conditions of the plant, combined with the common treatment technology, engineering experience and local actual situation, the improved A2/O process and the improved Orbal oxidation ditch process can meet the treatment requirements of this project, both have a good nitrogen and phosphorus removal effect, and the total cost of project investment and unit water treatment is basically the same. Due to the limitation of aeration equipment, the design water depth is relatively small, resulting in a slightly larger area of the structure and low equipment utilization. Although the A^2/O process has slightly more equipment, its process is mature and widely used at home and abroad, so as to basically meet the requirements of deep treatment, ensure that the effluent quality meets the first-class A standard of the "Pollutant Discharge Standard for Urban Sewage Treatment Plants", and leave room for quasi-Class IV discharge. The improved A^2/O process is recommended as the secondary treatment process of this project (GB 18918-2002, Pollutant discharge standards for urban sewage treatment plants, 2022; DB 33/ 2169-2018, Discharge standards for major water pollutants in urban sewage treatment plants, 2018; Eternal Red. China Water Supply and Drainage, 2003).

4.2 Selection of Deep Treatment Process

In order to further remove impurities in sewage that cannot be completely removed by conventional secondary treatment, deep treatment measures are required. Some of these unit technologies are transplanted from water supply treatment technology, and some are specifically for sewage treatment, and the basic unit technologies of urban sewage deep treatment are: coagulation (chemical phosphorus removal), sedimentation (clarification, air flotation), filtration, disinfection, etc. Deep treatment unit technologies with higher requirements for water quality include activated carbon adsorption, ion exchange, electrodialysis, and membrane treatment technology, which can be selected in one or several combinations (Wu, Sun, & Jiao, 2008).

To make the effluent of this project meet the standard, this project adopts the addition of coagulant at the outlet end of the biochemical reaction tank to appropriately reduce the load of the secondary sedimentation tank, reduce the filtration speed, and adopt the magnetic coagulation high-efficiency sedimentation tank filtration process for deep treatment.

4.3 Selection of Sewage Disinfection Methods

The final treatment step of urban sewage treatment plants is disinfection, which can be roughly divided into two categories: physical methods and chemical methods. Physical methods mainly include heating, freezing, radiation, ultraviolet light and microwave disinfection. Chemical methods are disinfection using various chemical agents, commonly used chemical agents include chlorine and its compounds, various halogens, ozone, etc. Combined with the disinfection and operation of other sewage treatment plants in the urban, it is recommended to use sodium hypochlorite disinfection method for this project, which is low price, convenient to purchase, does not produce toxic by-products, and is convenient for operation and management (Song, 2006).

4.4 Sludge Treatment Process Selection

Sludge concentration mainly has three process forms: gravity concentration, air flotation concentration and centrifugal concentration. Combined with the actual local situation, the sludge after dehydration of this project is finally sent to the brick and tile factory for unified disposal, so it is temporarily recommended to use a screw stacking machine for sludge disposal in this project.

4.5 Deodorization Process Selection

In order to reduce the impact of odor on the surrounding environment, this project considers the treatment structure with a strong odor to cover and deodorize, the overall operation life of the biological soil method is long, there is no need to replace the filter material during operation, the structure is simple, the operation management is very convenient, the operation cost is low, there is no secondary pollution, the grass planting above the filter body can be integrated with the greening of the plant area, the general layout is flexible, and the pollutant removal efficiency is high. The removal rate of H2S with an average concentration of 10-100ppm is more than 99%, and the overall control of odor concentration, including (mercaptan, sulfide, etc.), the removal rate is more than 95%, so the biological soil method is recommended for the deodorization process of this project.

5. Engineering Design

5.1 Technological Flow

The sewage treatment process adopts secondary treatment and tertiary treatment (i.e., deep treatment) process, of which the secondary sewage treatment process adopts A^2/O-AO process, the tertiary treatment adopts magnetic coagulation high-efficiency sedimentation tank filtration process, the sludge treatment adopts gravity concentration dehydration process, and the disinfection adopts sodium hypochlorite disinfection process. Deodorization adopts biological soil biological deodorization process.

5.2 Layout of the Factory Area

According to the topography of the plant, the road entering the plant, the direction of the inlet and outlet lines, and other factors, the general layout characteristics of the sewage plant are as follows:

(1) The main buildings (structures) of the second phase of the town sewage plant include coarse grille and inlet pump room, fine grille and aeration sand settling tank, A^2/O-AO biochemical reaction tank, secondary sedimentation tank and water distribution and sludge discharge well, high-efficiency sedimentation tank, precision filter, contact disinfection tank, blower room, power distribution room, dosing room, liquid storage tank, sludge concentration tank and mud mixing well, mud storage tank, dehydration machine room, production auxiliary room, deodorization facilities and doormen, etc., of which there are 2 A^2/O-AO biochemical reaction tanks, with a single design scale of 7,000 m^3/d; There are 2 secondary sedimentation tanks, with a single design scale of 7,000 m^3/d; There are 2 sludge concentration tanks, with a single design scale of 7,000 m^3/d. The rest of the buildings (structures) are 1 with a design scale of 14,000 m^3/d, and the civil engineering and equipment of this project are completed at one time according to the scale of 14,000 m^3/d. auxiliary rooms for production and doormen will be built at one time as required.

(2) In order to facilitate management and access, the main entrance is arranged in the north side of the road, the comprehensive building, the doorman and the front area of the factory are arranged in the northwest side of the plant, the sludge treatment system and biochemical reaction tank that are easy to produce odor are arranged on the southeast side of the plant, and the secondary entrance and exit are arranged on the northeast side of the plant.
(3) According to the sewage treatment process and the location of the supervisor entering the plant, the secondary treatment structure → the tertiary treatment structure are arranged from the east to the west of the plant area→ disinfection → water discharge, the starting structure - the inlet pump room is close to the incoming sewage main, and the end structure - the contact pool is close to the Changle River on the north side of the plant.
(4) The substation is close to the blower room, comprehensive building, etc. with large electricity load, and the distribution room and the blower room are jointly built, which can greatly shorten the cable length.
(5) The sludge pumping room is arranged between the biochemical reaction tank and the secondary sedimentation tank, which effectively shortens the length of the production pipeline such as the biochemical reaction tank ~ secondary sedimentation tank connection pipeline, the sludge pipeline of the secondary sedimentation tank, and the sludge external return pipeline, so as to save the project cost and effectively reduce the loss of water head.
(6) The soil deodorization system is close to the coarse grille and inlet pump room, fine grille and aeration sand sinking tank, anaerobic area of the bio-reaction tank, mud storage tank, sludge concentration tank, and sludge dehydration machine room, which can effectively reduce the length of the odor collection pipeline and the scale of the fan.
(7) The width of the road entering the factory area is 8.0m, and the design width of other roads in the factory area is 4.0-6.0m.
(8) Except for the buildings, structures and roads, the rest of the area in the factory is considered to be greened garden landscape, and the greening rate is not less than 25%.
See the figure below for details:

Figure 1. Overall Layout of the Plant

5.3 Design of Structures (Buildings)

(1) Thick grille and inlet pump room

1 building, with a design scale of 14,000 m^3/d, a coarse grille room and an inlet pump room, and civil engineering and equipment are built at a time of 14,000 m^3/d.

Between the thick grilles: the plane size is 8.61×5.20m

Thick grille channels: 2 with a single channel width of 1.50m

Inlet pump room: semi-underground structure, pumping room plane size 11.45×9.20m.

The main equipment is as follows:

Thick grille: 2 sets, grid spacing b=20mm, installation angle 75°, single set N=2.2kW

Submersible sewage pumps: 4 sets, 3 uses and 1 backup. Performance parameters of a single pump: Q=360m3/h, H=17.0m, N=30kW. In order to adapt to the change of flow rate in the pumping room, each set of pumps is equipped with frequency conversion

Belt conveyor: 1 set, single set N=0.75 kW

Electric hoist: 1 set, lifting capacity 2t, N=4.9 kW

(2) Fine grille and aerated sand sinking tank

1 building, with a design scale of 14,000 m^3/d, a fine grille and an aeration sand sinking tank, and civil engineering and equipment are built at a time of 14,000 m^3/d.

Between the fine grilles: the plane size is 10.05×4.60m

Fine grid channels: 2 with a width of 0.95m for a single channel

Aeration settling tank: the hydraulic residence time is 5min, and the plane size is 11.40×6.20m

The main equipment is as follows:

Circulating tooth rake cleaning machine: 2 sets, grid spacing b=5mm, installation angle 75°, single set N=0.75kW

Double Groove Bridge Sand Suction Machine: Lk=4.7m, single tank type, single set of power 1.1kw.

Sand and water separator: 1 set, single set N=0.37kW

Screw conveying press: 1 set, single set N=2.2kW

Blower: 2 sets in total, for gas lifting and sand discharge, single set N=4.0kW

Wall-mounted cast iron copper-inlaid round gate: 2 sets in total, single set N=1.1kW

Roots blower: 3 sets in total, 2 uses and 1 spare set, single set Q=1.68m3/min, P=50kPa, N=5.5kW

(3) A^2/O-AO biochemical reaction tank and sludge pumping room

A^2/O-AO biochemical reaction tank: newly built, divided into 2 groups, symmetrically arranged, a single group scale of 7,000 m^3/d, each grid can be operated and vented independently, reinforced concrete structure, single grid plane size 50.0×25.0m, effective water depth 6.0m.

The biochemical reaction tank was composed of A^2/O-AO biochemical reaction tank, and each group of tanks was composed of a selection zone (pre-anoxic tank), an anaerobic zone, an anoxic zone, an aerobic zone (including an aoxobic zone), a post-anoxic zone and a post-aerobic zone. In order to overcome the influence of nitrate in the reflux sludge on the phosphorus removal effect, a reflux sludge denitrification tank (pre-anoxic tank) is set up in the front section of the anaerobic zone to remove the nitrate rich in the reflux sludge, so as to reduce or eliminate the influence of nitrate on the phosphorus released in the anaerobic zone, so as to ensure the phosphorus removal effect of the system. After the sludge undergoes phosphorus release reaction in the anaerobic zone, it enters the hypoxic zone, uses the carbon source in the sewage to denitrify the nitrogen in the internal reflux, and then enters the aerobic zone for organic matter degradation, nitrification reaction and phosphorus absorption.

1) Main design parameters

The design flow rate is 583.3m^3/h

Design water temperature 15°C

Sludge load 0.07kgBOD$_5$/kgMLSS·d

Sludge concentration 3.6g/L

The total hydraulic residence time is 20.0h

Thereinto:

Pre-hypoxia segment for 1.0 hours

Anaerobic segment 1.5h

hypoxia section 7.0h

Aerobic section 8.5h (including oxygen elimination zone 0.5h)

Post-hypoxic segment 1.5h

Post-aerobic segment 0.5h

Internal return ratio ≥300%

Effective water depth 6.0m

Oxygen supply method Blast aeration

Comprehensive sludge yield 0.6kgVSS/kgBOD$_5$

The total air supply is 81m^3/min

Air-to-water ratio 7.8:1

2) Main equipment:

Submersible agitators: 4 sets of pre-hypoxic zones, 1.1kw of a single set, 4 sets of anaerobic zones with a single power of 1.1kW, 14 sets of hypoxic zones with a single power of 1.5kW, 4 sets of post-hypoxic zones with a power of 1.1kW

Submersible pusher: oxygen dissipation area, a total of 2 sets, a single set of power 1.1kW

Mixed liquid return pump: a total of 6 sets of biochemical tanks, 4 uses and 2 standby, all equipped with frequency conversion, equipped with hangers and slam doors, set in the aerobic area. The performance parameters of a single set of pumps are as follows: Q=440m^3/h, H=0.7~1.5m, N=5.5kW

Disc microporous aerators: 2 sets in total, including 3000 aerators.

(4) Secondary sedimentation tank water distribution and mud discharge well

1 building, with a design scale of 14,000 m^3/d, reinforced concrete structure, plane size diameter of 11.7m, depth of 7.4m, civil engineering and equipment are built at a time of 14,000 m^3/d. The second

sedimentation tank water distribution and discharge well contains sludge return pumping room and the remaining sludge pumping room.

The main equipment is as follows:

Sludge return pump: 3 sets of submersible sewage pumps, 2 uses and 1 backup. The performance parameters of a single set of water pumps are as follows: Q=480m^3/h, H=6.0m, N=22kW.

Remaining sludge pump: submersible sewage pump, a total of 2 sets, 1 for 1 reserve. The performance parameters of a single set of water pumps are as follows: Q=55m^3/h, H=15.0m, N=5.5kW

Submersible agitators: 4 sets, a single set of power 2.5kW.

(5) Second sinking tank

Newly built, a total of 2 groups, a single group scale of 7,000 m^3/d, symmetrical arrangement, reinforced concrete structure, a single pool diameter of 26m, pool depth of 4.0m. Civil engineering and equipment will be completed at a time of 14,000 m^3/d.

1) The main design parameters of the secondary sedimentation tank

The design flow rate is 7000m^3/d

Total coefficient of change 1.84

Surface load 0.9m^3/m^2·h

Design water depth 3.5m

Stay time 4.0h

The concentration of influent sludge is 3.4g/L

The concentration of reflux sludge was 8.0 g/L

Sludge outflow ratio 25~100%

2) Main equipment:

Center drive single-tube mud suction machine, a total of 2 sets, a single set of power 0.37kW. Mud suction machine manufacturers provide secondary sedimentation tank water distribution holes, outlet triangular weirs, scum baffles, water retaining skirts, etc.

(6) High-efficiency sedimentation tank

Newly built, a total of 2 groups, a single group scale of 7,000 m^3/d, symmetrical layout, reinforced concrete structure, single block plane size 14.1×3.0m, civil engineering and equipment are built at a time of 14,000 m^3/d.

1) The main design parameters of the high-efficiency sedimentation tank

Coagulation tank: L×B×H=1.8m×1.8m×3.09m, effective height 2.865m, residence time 1.91min;

Loading pool: L×B×H=1.8m×1.8m×3.09m, effective height 2.815m, residence time 1.88min;

Flocculation tank: L×B×H=2.3m×2.3m×3.09m, effective height 2.815m, residence time 3.06min;

Sedimentation tank: inclined pipe area size L×B=6.78m×2.9m, surface load 14.83m^3/(m^2·h).

2) Main equipment:

Coagulation mixer: 2 sets in total, special paddle for magnetic coagulation, N=1.1kW

Loading mixer: 2 sets in total, special paddle for magnetic coagulation, N=1.5kW, frequency conversion control

Flocculation mixer: 2 sets in total, special paddles for magnetic coagulation, N=2.2kW, frequency conversion control

Chain plate mud scraper: 2 sets in total, bottom mud scraping, v=0~0.6m/min, N=0.18kW

High shear machine: 2 sets in total, N=0.75kW

Magnetic separator: 2 sets in total, core rare earth permanent magnet, B≥5000Gs, N=0.55kW

Remaining sludge pumps: 2 sets in total, submersible sewage pumps, Q=10m3/h, H=10m N=0.75kW

(7) Precision filter

Newly built, a total of 1 building, with a scale of 14,000 m^3/d, adopting an integrated equipment type, a plane size of 12.0×11.5m, and civil engineering and equipment are built at a time of 14,000 m^3/d.

The main equipment is as follows:

Precision filter: 3 sets in total, single set of R100 reducer, N=0.55kW; Single set of recoil pump, N=2.2kW

Electric gate: B×H=1100×1200, electric switchgear N=1.5kW

(8) Contact pool

Newly built, a total of 1 building, with a design scale of 14,000 m^3/d. There are 5 corridors in the contact tank, each with a width of 3.1m, and an overflow weir is set at the outlet end of the contact tank, with a weir height of 3.20m. The water discharge after the weir is discharged to the Changle River on the north side of the plant area in the form of gravity flow on a daily basis, and the pumping station is used when the gravity flow cannot be discharged by itself during the flood period of the Changle River.

1) Main design parameters

Hydraulic residence time: about 30min

Flat size: 20.0×11.0m

Effective water depth: 3.4m

Super height: 0.50m

2) Main equipment:

Submersible sewage pump: 4 sets in total, 3 uses and 1 backup, single set Q=358m^3/h H=7m N=11kW

Electric hoist: 1 set in total, CD12-9D, N=3kW

(9) Sludge concentration tank

Two new sludge concentration tanks with a design scale of 14,000 m^3/d.

Sludge concentration tank diameter: 7m

Main equipment:

Center drive concentrator: 2 sets in total, diameter 7.0m, single set N=1.5kW

(10) Mud storage tank

A total of 1 building, with a design scale of 14,000 m^3/d.

Plane size: 8.75×5.50m

Water depth: 2.5m

The sludge of the mud storage tank is discharged to the sludge decommissioning room through the pressure flow of the sludge screw pump in the dewatering machine room, and the diameter of the mud pipe is DN200. The upper part of the mud storage tank is equipped with two DN200 overflow pipes above the water level to connect to the sewage pipe network of the plant.

Main equipment:

Submersible agitator: 2 sets, single set N=1.5kW

(11) Dewatering machine room

1 building, with a design scale of 14,000 m^3/d, civil engineering was completed at one time, and the machine room was equipped with deodorization equipment (fans, etc.). The amount of dry sludge treated is about 2.0t/d, the moisture content of mud inlet is 98%, and the moisture content of mud out is 78%~80%.

The dehydrator adopts 2 sets of stacked screw sludge dehydrators.

The dehydrator is equipped with stacked screw sludge dewatering, mud feeding screw pump, flocculant preparation device, dosing pump, horizontal scraper conveyor, inclined scraper conveyor, etc.

Plane size: 28.00×13.00m

The main equipment is as follows:

Stacked screw sludge dehydrator: 2 sets, 1 for 1 backup, Q=180-300kg-DS/h, N=3.03kW

Mud inlet progressive cavity pump: 2 sets, 1 for 1 backup, Q=6-17m^3/h, N=4kW

Flocculant preparation device: 2 sets, 1 for 1 use, Q=2000L/h, N=1.9kW

Dosing pump: 2 sets, 1 for 1 spare time, Q=0.8-2.5m^3/h, N=1.5kW, frequency conversion control

Horizontal scraper conveyor: 1 set, L=7m, a=0°, N=3kW

Inclined scraper conveyor: 1 set, L=8m, a=50°, N=3kW

Electric single girder suspended crane: supporting electric hoist, Gn=5T S=10.0m

Axial flow fans: 6 sets

(12) Reservoir

1 building, reinforced concrete structure, civil engineering and equipment scale are 14,000 m^3/d, total plane size 12.0×5.3m, effective water depth 3.0m. The reservoir is divided into three compartments, which store the finished sodium hypochlorite solution, sodium acetate solution and coagulant solution respectively.

Main equipment:

Self-priming pump: 6 sets, 3 uses and 3 spare parts, Q=14m^3/h, H=10.0m, N=3.0kW.

(13) Dosing room

1, civil engineering is built at a time according to the scale of 14,000 m^3/d, and the total plane size of the dosing room is 18.4×12.4m.

The maximum dosage of coagulant is 40mg/L, and 4 sets of coagulant dosing pumps are installed, of which 2 sets (5#, 6#) are used at the outlet end of the biochemical tank; It is used for 1 set (3#) at the inlet end of the efficient sedimentation tank, and 1 for 3 uses.

The maximum dosage of sodium hypochlorite is 15mg/L, and 2 sets of sodium hypochlorite dosing pumps (1#, 2#) are installed, 1 for 1 and 1 for the inlet end of the contact tank.

The maximum dosage of sodium acetate is 40mg/L, and 6 sets of sodium acetate dosing pumps (7#, 8#, 9#, 10#, 11#, 12#) have been installed recently, 4 uses and 2 preparations, and are added to the hypoxic section of the biochemical tank, with a total of 4 dosing points.

The main equipment is as follows:

Coagulant dosing pump: using double diaphragm metering pump, 4 sets, single set of performance parameters: Q=500L/h, H=30.0m, N=0.75kW.

Sodium hypochlorite dosing pump: using double diaphragm metering pump, 2 sets, the performance parameters of a single set are: Q=500L/h, H=30.0m, N=0.75kW.

Sodium acetate dosing pump: using double diaphragm metering pumps, 6 sets, the performance parameters of a single set are: Q=500L/h, H=30.0m, N=0.75kW.

Electric single girder crane: 1 set, Gn=2t, S=8m, N=5kW

Anti-corrosion axial flow fans: 5 sets, Q=7000m^3/h, N=0.37kW

Mixer: 4 sets, N=1.1kW

(14) Blower room

1 building, with a design scale of 14,000 m^3/d, the blower room and the substation are jointly built, and the civil engineering and equipment are completed at a time of 14,000 m^3/d.

Flat size of blower room: 26.2×9.4m

The main equipment is as follows:

Screw fan: 3 sets in total, 2 uses and 1 backup, Q=50m^3/min, H=70kpa, N=75kW

Electric single girder suspended crane: Equipped with electric single girder suspended crane, lifting capacity 3t, S=6.0m

Axial flow fan: 6 sets, single set of parameters Q=3810m^3/h N=0.55KW.

(15) Substation

1 building, jointly built with the blower room, with a design scale of 14,000 m^3/d, civil engineering and equipment are built at a time of 14,000 m^3/d.

(16) Production auxiliary rooms

1 with a construction area of about 388m^2.

(17) Doorman

2 blocks, with a single building area of about 9m^2.

(18) Deodorization system

The biological soil filter system set up in the first phase of the project is mainly used for the odor treatment of coarse grilles and inlet pump rooms, fine grilles and aerated sand settling tanks, anaerobic areas of bio-reaction tanks, sludge storage tanks, sludge concentration tanks, and sludge transportation workshops.

In order to facilitate the layout of the biological soil filter and consider the economic cost, the project is set up with a biological soil filter deodorization system, and the specific layout is detailed in the general plan.

Biological soil filter deodorization system: Q=20000m^3/h, filter area 185m^2, tank depth 1.5m, residence time not less than 50s, including inorganic mineral fillers, strains, air distribution systems, sprinkler systems and lawns and other accessories.

Deodorizing fan: Q=20000m^3/h, N=30Kw, full air pressure: 2500pa, including imported adjustment damper, fan sound insulation box, fan base and shock absorption device, etc.

6. Analysis of Operation Effect

The township sewage plant has a total design investment of about 110 million yuan, and has been officially put into use in 2025 after design, construction and trial operation. After being put into use, the effluent value is stable and up to standard, which has a good demonstration effect.

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