Construction Method of Multi-media Biological Filter Tank in Sewage Treatment Plant

Qinfei Lv, Xiang Xu, YouGan Xiao, Lixin Li, Zeyou Zhou, Jinbin Qin, Xiong Zhuo

Abstract— **The current sewage treatment problem has become a shortcoming that restricts green construction and development. Innovative research and development of construction technology for multimedia biofilters in sewage treatment plants. This technology has the characteristics of strong impact resistance, good treatment effect, high low temperature tolerance, ability to reuse reclaimed water, simple management and maintenance, low operating energy consumption and cost, no need for additional bacterial strains, small footprint, and good ecological landscape effect. Compared with similar technologies at home and abroad, it has obvious advantages in protecting water environment, intensively utilizing water resources, and saving operating costs.**

Index Terms— **Wastewater treatment; multi-media biofilter; multi-media artificial wetland; construction method**

I. INTRODUCTION

According to the research results of China's sewage treatment plants, only a few treatment equipment can operate normally for a long time. Almost all the treatment equipment in cold areas cannot be treated to the standard due to poor low temperature microbial activity and low biochemical treatment efficiency in winter. Sewage treatment is mainly contact oxidation, A / O, etc., and the operation cost is generally higher than 1 yuan / ton, which can only reach the comprehensive discharge level 1 standard. The normal working temperature range is 15-25 ℃, and mud needs to be discharged once in 2-3 months, so there are problems such as unstable effluent quality and complex management and maintenance. It is difficult for the constructed wetland with both landscape effect and water recycling effect to apply directly due to the low removal efficiency of ammonia nitrogen, large floor area and poor low temperature operation effect. With the implementation of the new environmental protection law and environmental protection tax law, the intensity of sewage discharge punishment continues to increase, and the sewage problem has become an important impact of the current sewage treatment plant, and become a short board restricting green construction and development.

In order to solve the above problems, the applicant unit has developed the multi-media biological filter construction technology of the sewage treatment plant based on the specific engineering application cases. The technology has strong impact resistance ability, good treatment effect, high low temperature tolerance, can realize water reuse, simple management maintenance, running energy consumption and low cost, no need to add bacteria, small area, ecological landscape effect, compared with similar technology at home and abroad, in the protection of water environment, intensive use of water resources, saving operation cost has obvious advantages.

II. CHARACTERISTICS OF WORKING LAW

2.0.1 Treatment effect is good. The effluent quality is excellent. This construction method is 1-3 grades higher than the conventional technical treatment standard, which can reach the water standard of grade B to class III surface of urban sewage plant, and realize the reuse of reclaimed water.

.0.22. Convenient construction. Adopt modular design to realize unified production in the base, rapid assembly on site, and the construction period can be controlled within one month.

2.0.3 Low-temperature is used. With a very high impact load resistance, the winter low temperature operation effect is good, the operating temperature is reduced from 15℃ to 5℃.

2.0.4 Low operating cost. The energy consumption is saved by 50%, the amount of organic sludge is reduced by 90%, and the direct operation cost is less than 0.3 yuan / t, which is 1 / 4 of the conventional technology.

2.0.5 Simple management and maintenance. No need to backwash, automatic operation, only in February to check once, 1 time a year of mud discharge, to achieve unattended. Do not need to add bacteria, stop within half a year.

III. SCOPE OF APPLICATION

Suitable for sewage treatment plant, railway stations, tourist attractions, rural drainage, port, airport, expressway service area, toll station, maintenance area and other ancillary

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facilities sewage treatment projects.

IV. PRINCIPLE OF PROCESS

4.0.1 Multi-media sewage bio-ecological cooperative treatment technology. The industrial method takes the multi-medium biological filter and multi-media constructed wetland organic combination as the core treatment process, and the medium adsorption, microbial oxidation, fixation and biological extraction are organically combined.

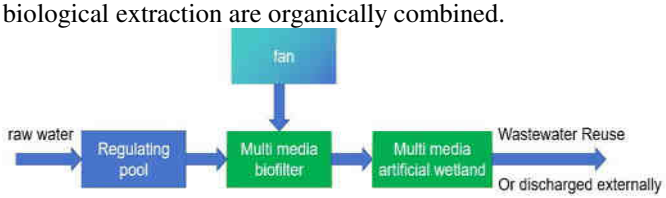

Fig.1 Flowchart of multi-media sewage bio-ecological collaborative treatment technology

4.0.2 Anaerobic and aerobic units are set in the multi-media filter to realize deep adsorption, organic matter degradation, synchronous nitrification, denitrification, phosphorus removal, oleophage degradation, and deep removal of COD, NH3-N, TP, animal and plant oil and oil.

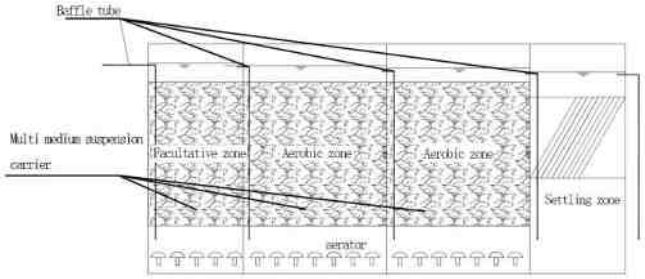

Fig. 2 Structure diagram of the multi-media biological filter

4.0.3 The synergistic action of microorganisms, matrix and plants in the multi-media constructed wetland can achieve the deep prolapse of organic matter, phosphorus and suspended matter. The front multi-media biological filter in the multi-media constructed wetland not only solves the problem that the wetland unit is easy to block for a long time, but also greatly reduces the wetland area and plays the role of removing suspended matter and phosphorus.

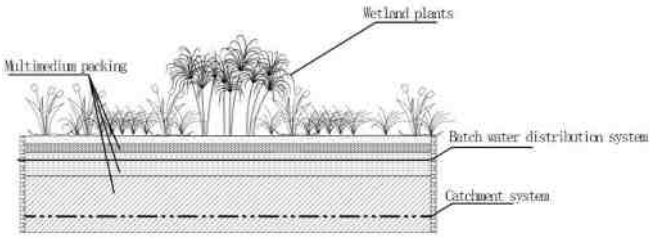

Fig. 3 Structural diagram of multi-media constructed wetland

V. CONSTRUCTION PROCESS AND OPERATION POINTS

5.1 Construction process flow

The construction process flow chart of this construction method is as follows:

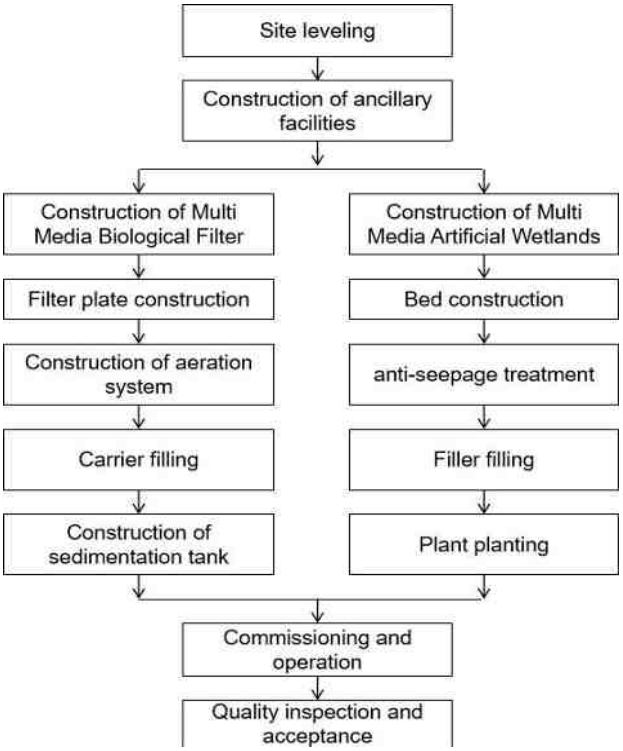

Fig. 4 Construction flow chart of multi-media bio-ecological cooperative treatment of sewage treatment plant

5.2 Operation points

5.2.1 Construction of ancillary facilities

The auxiliary facilities of multi-media sewage bio-ecological cooperative treatment include grid well, regulating pool, primary sedimentation tank, collecting pool and equipment room, etc., which are routine civil construction contents. The construction of ancillary facilities should strengthen the construction process control of building materials, to prevent cracks and leakage, leakage should be combined with the design and other relevant aspects to determine the solution, thoroughly solve the problem.

Fig. 5 Construction of the primary sedimentation tank

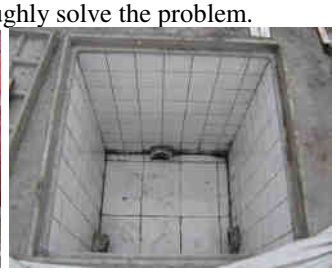

Fig. 6 Construction of the collecting pool

Before the construction of auxiliary facilities, the design drawings and the civil construction requirements of equipment installation should be carefully read to understand the accurate position and practices of reserved holes and embedded parts, and the equipment foundation with elevation and plane position requirements should be strictly controlled within the error range of equipment requirements. The civil construction of ancillary facilities shall strictly implement the relevant provisions of the Code for Acceptance of Concrete Structure Engineering (GB50204). If the cast-in-place sedimentation tank and collecting pool reinforced concrete structure are adopted, the allowable error of the construction shall comply with the relevant provisions of Tab.1:

Tab.1 Almitted error in construction

order number	project		allowable deviation (mm)
1	Axis position	baseboard	15
		Pool wall, column, beam	8
2	altitude	Cushion layer, floor plate, pool wall, column and beam	±10
3	Flat size	L≤20m	±20
		20m < L≤50m	±L/1000
		50m < L≤250m	±50
4	sectional dimension	Pool wall, column, beam, roof plate	+10 -5
		Hole, groove, ditch clearance	±10
5	verticality	H≤5m	8
		5m < H≤20m	1.5H/1000
6	surface evenness		10
7	centric position	Embedded parts and embedded pipes	5
		Reserved hole	10

Note: 1. Table L is the length, width or diameter of the bottom plate and the pool body, and H is the height of the pool wall and column.

2. If the equipment has special requirements for the allowable deviation of the construction of reinforced concrete pool, the equipment requirements shall prevail.

5.2.2 filter plate construction

Before installing the filter plate of the multi-medium biological filter tank, check whether the levelness, straightness, parallel degree, width and verticality of the top surface of the filter beam meet the design requirements. The levelness error of the top surface of the whole pool filter beam should be less than ± 5mm, straightness error ± 10mm, parallel error ± 5mm, width error ± 5mm, verticality error ± 5mm.

Check whether the outcrop size, straightness, parallelism and verticarity of the embedded bolts meet the design requirements. The embedded bolts should be made of stainless steel 304 and above, and the outcrop size should generally be 150-160mm, straightness, parallelism and verticality requirements can refer to the design technical requirements of the filter beam.

Whether the installation level error of the top surface of the multi-media biological filter plate meets the requirements.

After the filter plate leveling should be fixed with stainless steel fixed parts, the fixing method should ensure that the filter plate work force is uniform and firm, the selected material should have a certain strength, corrosion resistance, easy installation and construction, etc., generally stainless steel pressure plate should be used.

The sealing material of the filter plate joint shall be uniform, tight and reliable without any leakage. After the sealing, it shall be maintained according to the regulations. Other operations in the pool are strictly prohibited during the maintenance period.

After the curing of the joint of the filter plate, the filter plate should be carried out, and no leakage should be allowed. The integrity of the fan equipment control system should be checked, the test pressure should generally be 0.02-0.03Mpa, and the test time should generally be selected for 3-5min.

Fig. 6 Construction of multi-media biological filter pool body

Fig. 7 Construction of the filter board

5.2.3 Construction of aeration system

The aeration system shall be constructed and installed in accordance with the process design drawings and technical requirements.

Before the installation of the aeration system, the aeration pipeline and the air diffuser should be checked and cleaned.

The installation direction of the single hole film air diffuser should be vertical to the filter plate, and the connection between the aeration branch pipe and the main pipe should be firm and sealed.

When installing the aeration system, avoid damage to the filter head. After the installation of the aeration system, the water surface height should be 150mm beyond the single-hole membrane air diffuser, start the normal aeration fan, observe whether the water surface bubbles are uniform, and fill the carrier qualified. The aeration system shall be water into the filter after installation.

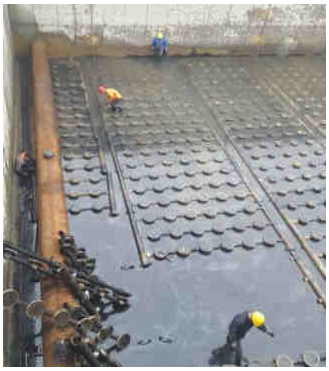

Fig.8 Construction of aeration system 1

Fig. 9 Construction of aeration system 2

5.2.4 Carrier filling

Carrier choose modified porous mesh bubble carrier, hole 1-10mm, water holding 2500%, void ratio 90-98%, wet density 1.00 g/cm3,100m2 / g specific surface, more than three different specifications composite filling.

The carrier shall be filled in empty pools and layered from bottom to small according to the design grading, and the filling ratio shall be 45-50% of the effective volume of the multi-media biological filter.

Avoid damaging the filter plate and aeration system when filling the carrier.

Fill the biological filter material according to the design grading and height. After filling, water injection should be injected to form natural grading to ensure the uniform and smooth material surface.

After the carrier is completed, the top filter plate should be closed to ensure that the carrier does not leak.

The microorganisms fixed in the carrier should meet the following conditions: a bacterial content of 5 billion CFU / g and an abundance of 107¬9copies / g, tolerance temperature of 5-30℃, ammonia nitrogen removal rate of more than 80%, containing exclusive oleophagy.

Fig.10 Carrier filling

5.2.5 Construction of sedimentation tank

The multi-media biological filter tank and sedimentation tank are integrated into the integrated equipment, located at the end of the equipment, and are composed of inclined plate sedimentation tank and folded flow sedimentation tank. The construction of the sedimentation tank shall comply with the relevant provisions of the Design Code for Outdoor Drainage (GB50014).

The net distance of the inclined plate sedimentation tank should be 80-100mm, the inclined length should be 1.0-1.2m, the horizontal inclination should be 60°, and all levels should be constructed in strict accordance with the design to prevent the phenomenon of poor mud discharge.

The aperture, length and installation height of the folding tube of the folding flow sedimentation tank shall be constructed in strict accordance with the design to ensure that the sedimentation effect and biological residues are not cohesive.

Fig.11 Construction of the sedimentation tank

Fig. 12 Construction of the insulated outer wall

Fig.13 Aeration biological filter completed photo 1

Fig. 12 Completed photo of the aeration biological filter 2

5.2.6 Construction of wetland bed body

Before the construction of multi-media constructed wetland, the garbage, trees and other obstacles in the site should be transported away, and the site should be leveled.

The bed body elevation and bottom slope should meet the design requirements, and the next construction can be carried out after the elevation check.

Multi-media constructed wetland bed body can be made of underground concrete, brick or clay structure, which shall comply with the relevant provisions of GB50003, and the height of the ground cofferdam should be 0.2~0.4m.

4 Multi-media constructed wetland foundation should have certain stability. If the original soil where the foundation is located is organic soil or the soil with high clay content, the soil should be removed and the solid foundation material should be backfilled.

When the constructed wetland enclosure structure adopts concrete structure, brick structure or geotextile structure, its construction shall meet the requirements of relevant technical specifications such as the Code for Construction and Acceptance of Water Supply and Drainage Structures.

The slope protection around the multi-media constructed wetland should be compacted and the soil reaches GB50286, and the slope should be 4:1~2:1. Tming should consider soil humidity to avoid rainy construction. After the cofferdam is built, the surface protection shall be performed.

The original soil layer should be maintained during the excavation of multi-media constructed wetland, and seepage prevention measures should be taken on the original soil layer.

Fig.11 Construction of wetland bed body

5.2.7 Wetland seepage prevention treatment

The foundation layer below the anti-seepage layer should be flat, compacted, without cracks and soil, and the surface should be free of water, stones, roots and sharp debris.

The constructed wetland should do a good job of underground seepage prevention work to ensure that the floor, side wall and their joints do not leak.

Anti-seepage layer can be used cement mortar or concrete, clay layer, polyethylene film and other construction engineering waterproof materials, permeability coefficient should not be greater than 10-8 m/s, can refer to CJJ 17 implementation.

When the anti-seepage material adopts polyethylene film, professional welding should be carried out. After welding, the penetration test and the next construction can be carried out after the quality acceptance.

Fig.12 Wetland imprevention treatment

5.2.8 Wetland packing filling

The laying process of packing should be controlled from four aspects: material selection, washing, stacking and spreading.

Fillers with large specific surface area, high strength, strong adsorption performance, good stability and convenient materials should be selected for multi-media constructed wetland. The packing should provide a good growth environment for plants and microorganisms, and have good water permeability, and the initial porosity of the packing layer should not be less than 35%.

The packing should be graded and cleaned to ensure that the amount of mud (sand) and the powder content of the filling material are less than the design requirements, so as to ensure good filtration and water permeability. If the laid packing does not meet the quality requirements, it must be reworked.

Different fillers should be placed in different areas of multi-media constructed wetland, which should be distributed according to the packing grade. Due to the high concentration of nitrogen and phosphorus in sewage produced in highway service areas, it is advisable to use functional matrix such as cinder, charat soil and steel slag at appropriate locations such as inlet and outlet of multi-media constructed wetlands to improve the efficiency of nitrogen and phosphorus treatment.

The filling can be unloaded into the site by the excavation bucket, and then it must be completely manual construction, and cannot be compacted.

The filling pipe and collecting pipe should not be damaged during packing and filling.

The bottom of the water distribution pipe and water collection pipe trench should be flat, and the pipes should be filled with sand or stone powder. Construction muck and stone shall not be used for backfill.

Fig.13 Wetland packing and fill

5.2.9 Plant cultivation in the wetland

Native plants with developed root system, good decontamination effect, pest and disease resistance, easy management and landscape effect should be selected. Multi-media constructed wetland plants should be purchased from special aquatic plant bases, and should be guided by professional personnel when planting. The size of the same batch of plants should be uniform, and should not be too small.

Multi-media constructed wetland plant species include canna, iris, reed, calamus, qianqu vegetables, rushes, rushes, cattail, etc. One or more plants can be selected as the dominant species to increase the diversity of plants and have landscape effect.

Before wetland plant planting, surface cleaning, site leveling, seedling division, plant planting, plant planting and plant maintenance should be carried out. During the construction, wetland plant planting should be planted according to the ecological characteristics of plant materials to ensure the growth state of plants.

Planting time should be chosen in the spring. At the early stage of plant planting, they should be watered regularly to ensure the survival rate of plants. Plant roots must be carefully implanted on the surface layer of the packing to prevent disturbance.

When the plants are planted, the overlay should be kept wet, the operation frame or pedal should be built, and the constructed wetland and plant seedlings should not be trampled directly on.

The planting density of plants can be adjusted according to the plant species and engineering requirements, and the planting density of multi-media constructed wetland plants should be 9 plants / m2~25 plants / m2, The planting depth should be 10-20cm underground.

In order to promote the development of plant roots, the water supply of the plant system should ensure the density and benign growth of aquatic plants; according to the growth of

the plants, seedling seeding, weed removal, timely harvesting and pest control should be managed, and herbicides and pesticides should not be used.

Fig.14 Plant planting in wetland

5.2.10 Commissioning and operation

The debugging process of this method can be divided into single equipment debugging, clean water debugging, system linkage debugging, biofilm culture and trial operation. The commissioning scheme shall be prepared before commissioning.

The single debugging of the equipment is to check the integrity and continuous operation performance of the equipment. The emergency plan must be made in the debugging process. The main equipment is automatic control equipment, inlet pump, fan and clear water pump (including corresponding pipeline, valves, etc.). The commissioning is completed after normal operation for more than 3 hours.

The debugging process of water is to check the running condition of the single structure under the design requirements, stabilize it for 12 hours after filling with water, and observe no leakage in the places of the pool wall, water outlet and pipeline of each structure, and repair the problems in time.

Fig. 15 Clear water test run

The system linkage debugging is to check the performance of the equipment and the respective control system under the design conditions, and simulate the trial operation under the design conditions.

Biofilm culture can be inocwith directional microorganisms according to different water quality, and the culture process should be carried out under the appropriate water temperature conditions. In 7 days as a cycle, the water flow is gradually increased in three times until it reaches the design scale. Directional microorganisms are added separately in the first two days, and added again when the water quantity reaches the designed scale. The specific added amount is determined by the treatment scale and microbial species.

Figure 5.2.10-2 Admicrobes

The water inlet pump is equipped with the time and water level controller, which can adjust the water quantity. The water inlet time shall set the pulse water inlet time series according to the specific flow rate of the start-up operation stage. In the first 2 weeks of continuous operation, 15 minutes as a cycle; in the 3-4 weeks, 30 minutes as a cycle controls the operation cycle after the actual operation results of the fourth week.

The aerator is equipped with a time switch that can adjust the aeration volume and allow for intermittent air intake. In the first 2 weeks of the operation phase, the aeration mode of 7 / 15 time, 7min-shutdown-8min-7min-shutdown-8min, is adopted to control the dissolved oxygen concentration of the aerobic section at 2-4 mg/L.

The water level of the constructed wetland shall be adjustable. During the startup period of the constructed wetland, the inlet water load should be gradually increased to the normal operating load.

Before the trial operation, the water indicators and the working parameters should be detected, counted and analyzed.

If the concentration of pollutants such as COD and ammonia nitrogen exceeds the design value and is too high, the measures such as reflux should be considered to ensure that the system is not greatly impacted.

5.3 Workforce organization

Tab.2 Labor force Organization Table

type of work in production	**number of people**	**Tasks and job responsibilities**
administrative staff	1	Theoretical analysis, measurement and control network layout and transmission, technical data compilation.
gauger	2	Responsible for measuring the set-out line.
Construction Crew	2	Responsible for the deployment of site resources, coordinate the cross operation among teams, and guide workers in construction.
General Worker	8	Responsible for the construction of auxiliary facilities, carrier filling and packing filling.

Debugging workers	2	Responsible for system debugging

VI. MATERIALS AND EQUIPMENT

6.1 Material preparation

The materials and performance requirements used in this construction method are shown in Tab.3.

Tab.3 Main Construction Materials Table

order number	Material name	Specification and performance requirements
1	concrete	Equipment foundation, secondary grouting, of the concrete
2	Multi-media biological filter pool body	304 Stainless steel or carbon steel corrosion
3	anti0corrosive paint	The water part of the equipment is coated with three zhangtan primer and three phthal205 magnetic paint, and the underwater part of the equipment with three iron red epoxy resin paint (H06-2) and three epoxy asphalt paint (H014)
4	Multimedia biological vectors	Modified porous mesh bubble carrier, hole 1-10mm hole, 2500% water holding, 90-98% void, wet density 1.00g / cm^3, 100m more than the $surface^2$/ G, more than three different specifications of composite filling.
5	Microbial preparations	The bacterial content was 5 billion CFU / g with an abundance of $10^{7\neg9}$copies / g, tolerance temperature of 5-30℃, ammonia nitrogen removal rate of more than 80%, containing exclusive oleophagy.
6	filter board	Hard plastic or stainless steel, grid of 20-30mm
7	Exposure head	Microporous air disk, 300mm diameter
8	Precipitation inclined plate packing	Plastic plate, 1mm thick
9	Seepage-resistant wetland geotextile	Two cloth and one membrane were used for 400g
10	Wetland media-media in wetland	Strengthen the phosphorus removal modification, pore diameter 1-20mm, more than three kinds, layered filling
11	Wetland plants	Windmill grass, qianqu vegetables, canna, etc
12	Pipes and valves	Drainage of UPVC pipes and valves

6.2 Main construction equipment

See Tab.4 for the main construction equipment.

Tab.4 Main construction equipment

order number	device name	ts	quantity	power rating (kw)	productive power
1	truk-mounted crane	QY8	1		8t
2	lorry	EQ140	1		
3	Self-unloading transport vehicle	20t	1		
4	jenny	1t	2	2.25	
5	chain block	3t	4		
6	veneer reeling machine	W11-12Y2000	1	10	
7	hydraulic	3^n	2	2.2	

order number	device name	ts	quantity	power rating (kw)	productive power
	pipe bender				
8	die head threading machine	QT4-B	2	0.75	
9	air compressor	0.6/0.8Mpa	1	2	
10	drilling machine with jointed arm	ZY536	1	3	
11	Electric pressure test pump	15.68 Mpa	1	3	
12	electric cutting machine	KG300-2	2	1.25	
13	Inverter DC welding machine	ZX7-400ST	3	16	
14	sonigauge	CTS-30	1		

VII. QUALITY CONTROL

7.1Quality control specification

The current specifications, regulations and standards of this construction method mainly include:

Determination of Water Temperature-thermometer or reverse thermometer method (GB / T 13195-1991)

Determination of Water Quality pH-Glass Electrode Method (GB 6920-1986)

Determination of dissolved Oxygen in Water Quality-Electrochemical Probe Method (HJ 506-2017)

Determination of dissolved dissolved oxygen in Water Quality-Iodine Method (GB / T 7489-1987)

Determination of Chemical oxygen Demand for Water Quality-dichromate Method (HJ 828-2017)

Determination of Chemical OxyDemand for Water Quality-spectrophotometric Method (HJ _ T 399-2007)

Water Quality five-day biochemical oxygen demand (BOD5) Determination-Dilution and inoculation method (HJ 505- -2009)

Determination of Water Quality and Biochemical Oxygen Demand (BOD) -Rapid Measurement of Microbial Sensors (HJ 86-2002)

Determination of Suspended Objects with Water Quality-Weight Method (GB 11901-89)

Determination of Ammonia nitrogen in Water Quality-Gas Phase Molecular Absorption Spectroscopy (HJ / T 2005)

Determination of Ammonia nitrogen in Water Quality-spectrophotometric Method of NA Reagent (HJ535 2009)

Determination of Ammonia nitrogen in Water Quality-Method (GB 7481-87)

Determination of Total Nitrogen in Water Quality-Gas Phase Molecular Absorption Spectrometry (HJ-T 199-2005)

Determination of Total Nitrogen in Water Quality-UV for Potassium Persulfate (HJ 636-2012)

Determination of Total Phosphorus in Water Quality-Ammonium Molybdate (GB 11893-89)

7.2Quality assurance measures

7.2.1 After the civil construction of the pool, the full water test shall be carried out in accordance with the provisions of GB50141, and the water seepage below the ground shall meet the design requirements, and the maximum shall not exceed 2L / (m2•d)。

7.2.2 The pump station and fan shall be tested for 48h according to the designed maximum number of open sets, the flow of the pump and the power of the unit shall be measured, and the characteristic curve shall be determined if possible.

7.2.3 The installation of the aeration system shall be flat and firm and evenly arranged, the aeration head shall be free of water leakage, there shall be no impurities in the aeration pipe, the aeration capacity shall meet the design requirements, and the aeration shall be stable and uniform.

7.2.4 The bottom elevation of the inlet and outlet pipe of the treatment facility and the normal water level elevation of the discharged water should be connected with each other to avoid slope inversion, poor drainage and water accumulation in the pipe.

7.2.5 The drainage pipe should be tested with closed water, the upstream filling pipe should be kept 2m above the pipe top, the appearance inspection should be 24h leakage free, and the valve shall not leak.

7.2.6 Strength and air tightness test shall be conducted for the air pipeline, and the pressure drop of 24h shall not exceed the allowable value.

7.2.7 The foundation of the constructed wetland shall have a certain stability. If the original soil where the foundation is located is organic soil or the soil with high clay content, the soil should be removed and the solid foundation material should be backfilled.

7.2.8 The constructed wetland packing should be well graded, clean and without soil residue, with good filtration and water permeability. The filling can be unloaded into the site by the excavation bucket, and then it must be fully manually constructed and cannot be compacted. If the laid packing does not meet the quality requirements, it must be reworked.

7.2.9 Underground seepage prevention should be done in the constructed wetland to ensure that the floor, side wall and joints do not leak.

7.2.10 The bottom of the buried pipeline trench should be flat, and sand or stone powder should be filled around the pipeline. Construction muck and stone shall not be used for backfill.

7.2.11 The water quality of the inlet and outlet water of the sewage treatment system shall be monitored regularly, and the monitoring items shall include the water level, water temperature, dissolved oxygen, COD, SS and BOD5, Ammonia nitrogen, total phosphorus, total nitrogen, etc. Water level monitoring should be conducted once a month, and other projects should be monitored once every three months. Sampling and preservation of water quality shall comply with the relevant provisions of HJ 493-2009. If abnormal water quality is found, it should be checked and treated in time.

VIII. SECURITY MEASURES

Safety production is an important work in the project construction, is also a mass work, must take a series of necessary measures from the technology, the organization. Creating a good civilized construction environment and construction order can promote safe production, speed up the construction progress, ensure the quality of the project, reduce the project cost, improve the economic and social benefits of enterprises.

8.1Codeslstandards:

In the process of construction, it will strictly comply with the state "Construction Law of the People's Republic of China", "Production Law of the People's Republic of China on Safety Production", "Construction Project Safety Management Regulations", "Highway Engineering Construction Safety Technical Regulations" and other relevant laws and regulations.

8.2 Safety of construction machinery and construction personnel

8.2.1 All mechanical operators and special equipment operators must hold certificates to work.

8.2.2 Adhere to pre-class safety education and inspection. Personnel entering the construction site must wear reflective vests, and slippers and high heels are strictly prohibited to enter the site.

8.2.3 All construction personnel must take the designated means of transportation when commuting to and from work.

8.2.4 All construction personnel must wear safety helmet and protective clothing when entering the mixing station.

8.2.5 Construction command vehicles, construction transport vehicles and commuting vehicles must strictly abide by the traffic rules and pay attention to the construction warning signs.

8.2.6 It is strictly prohibited to operate or overload the machinery with disease. When working at night, lighting must be set in the operation area to increase the lighting degree. Lighting should cover the whole working area, but should not dazzle the driver of the vehicle.

8.2.7 The construction machinery of the mixing station is easy to cause mechanical injury, and avoid falling objects and falling from high altitude.

8.2.8 The construction machinery cross operation of the mixing station is serious to avoid causing mechanical injury and mechanical collision accidents.

8.3 Do a good job in electricity safety

The electric equipment and power lines on the site must be set up and managed by electricians. The switches should be rain-proof and installed firmly, and equipped with leakage protection device for regular maintenance and good maintenance. The electric equipment and power lines that do not meet the safety requirements shall not be used, and the non-professional electricians are strictly prohibited to connect to the power lines at will to prevent electric shock accidents.

8.4 Do a good job in fire prevention

The distance between the built shed and the material warehouse must meet the requirements of the relevant regulations. Fire-fighting equipment should be set up near the shed and material warehouse, and checked regularly.

8.5 Traffic control and safety

8.5.1 Set up project signs and warning marks at the intersection of the mixing station to guide the traffic.

8.5.2 Full-time safety officers shall be set up at the construction intersection of the closed section to guide the vehicles to pass, and social vehicles are prohibited from entering the construction section. Full-time safety officer shall be a traffic safety officer who has passed the examination.

8.5.3 Cooperate with the transportation department to do safety facilities and layout to ensure the safe passage of transport vehicles.

IX. ENVIRONMENTAL PROTECTION MEASURES

9.1 Strictly implement the regulations of the state, local and construction units on environmental protection, implement the principle of "prevention priority, priority to protection, and equal attention to development and protection", and do a good job in environmental protection for construction.

9.2 in the whole process of sewage treatment, through the functional microbial sewage of harmful odor substances decomposition, and many medium biological filter and artificial wetland itself has the function of eliminating odor, belongs to the green clean process, and regulating pool built underground, and sealed, many medium biological filter treatment facilities placed in the equipment room, and designed a special biological deodorization process, in the processing process will not produce odor, treated sewage is colorless and tasteless.

9.3 Take comprehensive control measures to reduce vibration and noise for noisy equipment such as pump and pump. In addition to the necessary noise reduction of the equipment, the isolation layout is also adopted. Adopt double-layer structure or combined sound insulation components, or equipped with sound insulation room to reduce the impact of noise on people. The low noise vortex fan selected in this method controls the noise to the minimum and within the requirements of the "Noise Sanitary Standard for Industrial Enterprises".

9.4 The amount of sludge in the system is very small, only the sludge is discharged once every June to December, and the volume of water sludge is only 1-2 tons, which can be directly used as green fertilizer at the toll station.

X. BENEFIT ANALYSIS

10.1 Economic benefits

The construction management of multi-media biological filter is extremely simple, the use process does not need daily maintenance, does not need special care, can save a lot of labor costs required by other processes. The direct operation

cost of water, including the cost of electricity and insulation, is less than 0.4 yuan / t, which is far lower than 1.0 yuan / t of the contact oxidation treatment process, which can save a lot of operation cost every year, reduce the economic pressure of the sewage treatment plant operation, and then effectively guarantee the normal operation of the treatment facilities. The technology can realize reclaimed water reuse and reduce the cost of groundwater extraction and promotion. Moreover, the technology can ensure the stable operation of the treatment system throughout the year to meet the standard, greatly reduce the environmental protection tax levied due to the excessive discharge, greatly relieve the operation pressure of the sewage treatment plant, and has obvious economic benefits.

10.2 Social benefits

The construction method of multi-media biological filter in the sewage treatment plant belongs to the environmental protection technology of water pollution control. The construction process adopts low-noise equipment, which does not produce sewage, but only produces a small amount of solid waste such as welding residue and plant residue. Moreover, the technology has comprehensively solved the industrial problem of exceeding the winter discharge of sewage pollutants in the service areas of northeast China, northwest China and northern North China for many years, effectively guaranteed the water environment quality and water quality safety along the highway, and greatly reduced the discharge of various pollutants in the sewage in the service area. The total emission reduction space of the national expressway service area can reach 85,000 tons of COD, and the ammonia nitrogen is 18,000 tons. This method has a huge space for pollution emission reduction, and has obvious social benefits.

XI. Application instances

According to the characteristics of subgrade splicing construction, The subgrade reinforcement and splicing construction is optimized and improved, Active active material in geotextile bags, On the one hand, the expansion cloth bag can achieve the purpose of pressing the soil, On the other hand, it can absorb the ground water, Reduce the moisture content of the original soft soil base, At the same time, due to the higher tensile strength of the cloth bag, Also can make the geotextile cloth bag injection light active material pile to play the role of reinforcing the soil; The construction operation of ring geogrid outsourcing bag active material is safe and mature, And the use of active materials has a higher cost performance, Shorter construction time, Can save the time period, Save the total project cost; Compared to the traditional construction system, This process requires no excavation, Low grouting quantity, It can reduce soil pollution, Construction and environmental protection. After inspection, the application of this method compared with the traditional process comprehensive cost saving of about 17%, the application of this method effectively improve the construction efficiency of splicing section subgrade reinforcement, solve the subgrade subsidence, vacancy, crack and other diseases, has good economic and social benefits.

According to the characteristics of subgrade splicing construction, the project optimizes and improves the active material in the soil bag to make the expansion bag to press the soil, and absorb the water from the foundation and reduce the water content of the original soft soil foundation; the construction of the ring geogrid concrete is safe and mature, which effectively shortens the construction time, saves the construction period and reduces the construction cost. After inspection, the application of this method compared with the traditional process comprehensive cost saving about 21%, the application of this method effectively improve the construction efficiency of the splicing section subgrade reinforcement, has achieved significant economic and social benefits.

According to the characteristics of subgrade construction, The subgrade reinforcement and splicing construction is optimized and improved, By using lead holes for strengthening the foundation and subgrade, Multi-layer multiple high-pressure grouting micro-reinforcement pile, The upper part of the anchor rod is equipped with the adjustable grouting ceiling limit end, The anchor rod sets up three layers of extensible wing plate, A powerful spring in the fender can open actively, As a point of focus for the anchorage, In three grouting, Form a solid plus a solid, The reinforcement effect is excellent; The construction operation of ring geogrid outsourcing bag active material reinforcement pile immersed pipe is safe and mature, And the use of active materials has a higher cost performance, Shorter construction time, Can save the time period, Save the total project cost; Compared to the traditional construction system, This process requires no excavation, Low grouting quantity, It can reduce soil pollution, Construction and environmental protection. After inspection, the application of this method effectively improves the construction efficiency of subgrade reinforcement, solves the subgrade subsidence, vacancy, crack and other diseases, compared with the traditional process comprehensive cost saving about 15%, the economic and social benefits are obvious, it is worth vigorously promoting and applying.

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