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

Design Example of a Provincial Industrial Park Sewage Treatment Plant in the Haiyan Section of the Yangtze River Economic Belt, China

Yahuan Tan[1], Peiren Feng[2] & Zhuang Qian[3]

[1&3] Central and Southern China Municipal Engineering Design and Research Institute,Wuhan China, 430000

[2] Haiyan County Water Investment Group Co., Ltd. Jiaxing China, 314300

Received: May 27, 2025 Accepted: July 12, 2025 Online Published: July 31, 2025

doi:10.22158/assc.v7n4p82 URL: http://dx.doi.org/10.22158/assc.v7n4p82

Abstract

A new 17,000 tons/day printing and dyeing wastewater treatment facility and related supporting facilities were constructed in the Haiyan section of the Yangtze River Economic Belt. Equipment installation was based on the initial scale of 13,000 tons/day for the enterprises entering the park. This paper introduces the designed influent and effluent water quality indicators, the process selection for major structures, and the parameter design of the wastewater treatment plant. The plant features a dedicated acid precipitation pretreatment line for a small amount of high-concentration wastewater. The main treatment process handles the integrated wastewater, which is a mixture of low-concentration wastewater and the filtrate from the high-concentration pretreatment. Under extremely constrained land conditions, stacked arrangement of wastewater treatment facilities was designed, providing a reference for similar plant designs.

Keywords

Printing and dyeing wastewater treatment, Integrated sewage treatment process, Stacked arrangement, Design parameters, Application example

1. Introduction

To meet the production demands of Haiyan County's new printing and dyeing industrial park, a new wastewater treatment facility, reclaimed water treatment facility, and other related supporting facilities were constructed, with a design capacity of 17,000 tons/day. This includes a small amount of high-concentration desizing and weight reduction (including in-tank reduction) wastewater. Equipment installation was based on the initial scale of 13,000 m³/d for the enterprises entering the park.

2. Design Parameters

2.1 Design Influent Quality

Based on surveys, there are 3 printing and dyeing enterprises entering the park, 2 of which currently have production facilities. Sampling tests were conducted on the wastewater from these 2 enterprises' existing production lines in December 2024, combined with data analysis (since no desizing or weight reduction high-concentration wastewater was present, high-concentration quality was estimated based on empirical values). Results are summarized below:

Table 2.1-1 Influent Water Quality Data Analysis (Unit: mg/L)

No.	Discharging Enterprise	High-Concentration (t/d)	COD(mg/L)	Low-Concentration (t/d)	COD (mg/L)	Low-ConcentrationTN(mg/L)
1	Yucheng	1000	20000	7400	1062	50
2	Yuanyang	200	20000	4200	1325.3	105.5
3	Minyang	0	20000	3900	1325.3	50.0
4	Average	/	20000	/	1199.6	65.0

Based on data provided by the park, sampling survey results, and similar project data, the design influent quality is as follows:

Table 2.1-2 Low-Concentration Integrated Wastewater Influent Quality

No.	Item	Design Influent Quality
1	Q(t/d)	15,800 (Long-term) / 13,000 (Initial)
2	CODcr(mg/L)	1500
3	pH	6-10
4	SS(mg/L)	≤300
5	NH(mg/L)	≤40
6	TN(mg/L)	≤70
7	Sb(mg/L)	≤1
8	Color(Dilution Multiple)	≤400
9	Conductivity (μS/cm)	≤5000

10	Temperature (°C)	≤60

Table 2.1-3 High-Concentration Integrated Wastewater Influent Quality

No.	Item	Design Influent Quality
1	Q(t/d)	1200 (Long-term)
2	CODcr(mg/L)	≤20000
3	pH	12-14
4	SS(mg/L)	≤600
5	NH(mg/L)	≤20
6	TN(mg/L)	≤40
7	Sb(mg/L)	≤2
8	Color(Dilution Multiple)	≤400

2.2 Design Effluent Quality

Effluent quality (for discharge into sewer) complies with the "Discharge Standard of Water Pollutants for Dyeing and Finishing of Textile Industry (GB 4287-2012)" Indirect Discharge Standard. According to the "Specification Conditions for Printing and Dyeing Industry (2023 Edition)", comprehensive energy consumption per unit product and fresh water intake of printing and dyeing enterprises must meet specified requirements, and water reuse rate should reach above 45%. Therefore, this project also involves primary reclaimed water and high-quality reclaimed water. Reuse water quality targets were determined considering the water quality requirements of surveyed enterprises and standards for textile dyeing and finishing reclaimed water for dyeing purposes.

Table 2.2-1 Design Effluent Quality for Sewer Discharge

No.	Pollutant	Treated Water Quality
1	Q(t/d)	7500
2	COD(mg/L)	200
3	BOD5(mg/L)	50
4	pH	6～9
5	SS(mg/L)	100
6	NH(mg/L)	20
7	Color(Dilution Multiple)	80
8	TP(mg/L)	1.5

No.	Pollutant	Treated Water Quality
9	TN(mg/L)	30
10	Antimony (Sb)	0.1
11	Aniline (mg/L)	1.0
GB4287-2012 Table 2 & 14 indicators in amendment sheet		

3. Main Structures and Parameter Design

This project involves the construction of a new 17,000 m³/d wastewater treatment plant. Analysis of the influent quality indicates it is printing and dyeing wastewater, characterized by large fluctuations in quality and quantity, high temperature, oil content, high color, and poor biodegradability (Tian & Zhou, 2024). Additionally, the influent contains a small amount of high-concentration desizing and weight reduction wastewater with COD as high as 20,000 mg/L. The effluent quality (for sewer discharge) strictly complies with the "Discharge Standard of Water Pollutants for Dyeing and Finishing of Textile Industry (GB 4287-2012)" Indirect Discharge Standard. The project also involves primary reclaimed water (COD < 150 mg/L) and high-quality reclaimed water (COD < 30 mg/L, with high requirements for conductivity and hardness).

Based on the above, the project features a dedicated acid precipitation pretreatment line for the small amount of high-concentration wastewater. The main treatment process handles the integrated wastewater, which is a mixture of low-concentration wastewater and the filtrate from the high-concentration pretreatment. The effluent has three destinations: 1) Secondary sedimentation tank effluent goes to the primary reuse treatment unit for physico-chemical treatment and direct reuse; 2) Secondary sedimentation tank effluent undergoes ultrafiltration (UF) + reverse osmosis (RO) membrane treatment for high-quality reuse; 3) RO concentrate undergoes advanced oxidation treatment, mixes with UF concentrate, and is treated in a magnetic coagulation sedimentation tank before meeting standards for sewer discharge.

3.1 Spatial Layout

3.1.1 Spatial Layout Principles

Due to site constraints, the spatial layout had to be stacked within structures (tanks). The overall plant layout followed these principles:

Functional zoning as much as possible, compact arrangement of structures to reduce footprint.

Full consideration of relationships with existing structures/buildings and compliance with land planning setback requirements.

Organic integration and connection of wastewater treatment structures within the tanks for ease of operation and management.

Short, smooth flow paths avoiding repetition and backtracking.

Power distribution center located near structures with high power consumption to save energy.

Buildings arranged on the same side as much as possible; control rooms concentrated on the first floor.

Green area meets planning requirements; overall layout meets fire safety standards.

Smooth traffic flow for construction and management.

Emergency discharge pipes and bypass pipes provided; all structures can be gravity-drained.

Layout considers prevailing wind direction, influent direction, receiving water body location, process characteristics, site topography, and geological conditions, balancing process rationality, management convenience, economy, architectural form, greening, and harmony with surroundings.

3.1.2 Spatial Relationship with Existing Conditions

The project site is located within a town, bordered by an existing factory building to the east, Zhenxing Road to the south, and the printing and dyeing park's factory under construction to the west (see figure below). According to the "Planning Conditions for the Yangtze River Economic Belt Haiyan Section Provincial Industrial Park Wastewater Treatment Plant Project", the land use attribute is public utility land (limited to drainage use), with an area of 9,154 m². Upon completion, it will share the perimeter wall, roads, and entrances/exits with the under-construction Haiyan County New Printing and Dyeing Industrial Park.

The designed total capacity of the plant is 17,000 m³/d, with equipment installed for the initial scale of 13,000 m³/d. After treatment to indirect discharge standards, the effluent is discharged into the existing municipal sewer pipe under Zhenxing Road to the south.

3.1.3 Overall Layout

The new wastewater treatment plant is located in Yucheng Town, Haiyan County, Zhejiang Province. The site is bordered by an existing factory building to the east and the under-construction Haiyan County New Printing and Dyeing Industrial Park to the west. The land area is 9,154 m², which is relatively tight, necessitating an intensive layout for the plant.

Figure 3.1 Plant Rendering

The tops of the tank structures are partially covered with roofs and odor control covers. Arranged from north to south are: Flotation Tank, Primary Sedimentation Tank, Hydrolysis Tank, and Two-Stage AO Tank. Odor control equipment and closed-circuit cooling towers are placed on the top of #1 Combined Tank.

3.2 Wastewater Treatment Structure Design

3.2.1 High-Concentration Equalization Tank

Quantity: 1 Structure. Dimensions: 24m (L) × 12.5m (W) × 4m (H), Effective depth: 3.5m. Civil scale: 1,200 m^3/d.

Function: Collects high-concentration wastewater from enterprises, mainly weight reduction and desizing wastewater.

3.2.2 Acid Precipitation Reaction Tank

Quantity: 1 Structure (2 compartments). Single compartment dimensions: 4.55m (L) × 4m (W) × 4.5m (H), Effective depth: 4.0m. Civil scale: 1,200 m^3/d.

Function: Acid is added to precipitate terephthalic acid from high-concentration wastewater, reducing pollutant concentration.

3.2.3 Acid Precipitation Filter Press

White Sludge Press Room: 1 Building. Dimensions: 18.8m (L) × 9.5m (W) × 7m (H). Civil scale: 1,200 m^3/d.

White Sludge Discharge Room: 1 Building. Dimensions: 18.8m (L) × 9.25m (W) × 3.9m (H). Civil scale: 1,500 m^3/d.

Function: The sludge-water mixture from the Acid Precipitation Reaction Tank undergoes solid-liquid separation via plate frame filter press. White sludge falls into ton bags. Filtrate enters the Filtrate Collection Tank.

3.2.4 Filtrate Collection Tank

Quantity: 1 Structure. Dimensions: 24m (L) × 2m (W) × 4.1m (H), Effective depth: 3.6m. Civil scale: 1,200 m^3/d.

Function: Collects filtrate from the White Sludge Filter Press and feeds it steadily into the Integrated Equalization Tank.

3.2.5 Integrated Equalization Tank + Cooling Tower

Quantity: 1 Structure. Irregular shape. Dimensions: Area 2,562 m^2 × Height 4.1m, Effective depth: 3.6m. Civil scale: 17,000 m^3/d. Equipment scale: 13,000 m^3/d (Initial).

Function: Collects low-concentration wastewater from enterprises. Influent is metered separately for each of the 3 enterprises. Low-concentration wastewater passes through a mechanical screen to remove large debris and short fibers before entering the tank. Acid precipitation filtrate also enters this tank. After equalization and homogenization, the wastewater is cooled in the cooling tower.

3.2.6 Reaction Flotation Tank

Package equipment. Equipment scale: 13,000 m^3/d (Initial). Quantity: 2 sets. Single set capacity: 300 m^3/h.

Function: pH is adjusted under instrument control. Polyaluminum ferric chloride (PAFC) coagulant is added to destabilize colloids and form flocs. Polyacrylamide (PAM) flocculant aid is added to enlarge the flocs, which are then separated from the water in the flotation zone.

3.2.7 Primary Sedimentation Tank

Primary Sedimentation Reaction Tank: 3 Structures. Single dimensions: 4.4m (L) × 4.7m (W) × 4.5m (H), Effective depth: 4.0m. Civil scale: 17,000 m^3/d. Equipment scale: 13,000 m^3/d (Initial).

Primary Sedimentation Tank: 3 Structures. Single dimensions: 16m (L) × 16m (W) × 4.5m (H), Effective depth: 4.0m. Civil scale: 17,000 m^3/d. Equipment scale: 13,000 m^3/d (Initial).

Function: pH is readjusted in the reaction tank, and PAM is added to enlarge flocs, which are then separated in the sedimentation tank.

3.2.8 Hydrolysis Tank

Quantity: 3 Structures. Single dimensions: 24.4m (L) × 18.1m (W) × 11m (H), Effective depth: 10.0m. Civil scale: 17,000 m^3/d. Equipment scale: 13,000 m^3/d (Initial).

Function: Pretreated wastewater flows into the hydrolysis tank through a distribution system, ensuring even spread across the tank bottom. Wastewater mixes thoroughly with sludge under agitation. With the combined action of specific composite bacteria and enzymes, the reaction rates of hydrolytic and acidogenic bacteria are enhanced; macromolecular organics are converted into smaller molecules; insoluble organics become soluble and are removed, simultaneously improving the B/C ratio (WU & LUO, 2020).

3.2.9 Two-Stage AO Tank (Anoxic/Oxic)

Quantity: 3 Structures. Single dimensions: 46.8m (L) × 18.7m (W) × 9.5m (H), Effective depth: 9.0m. Civil scale: 17,000 m^3/d. Equipment scale: 13,000 m^3/d (Initial).

Function: Utilizes the different functions of the anoxic and oxic zones for biological nitrogen removal (nitrification and denitrification), while simultaneously removing COD and BOD₅.

3.2.10 Secondary Sedimentation Tank

Quantity: 6 Structures. Single dimensions: 27.4m (L) × 5.7m (W) × 5m (H), Effective depth: 4.5m. Civil scale: 17,000 m^3/d. Equipment scale: 13,000 m^3/d (Initial).

Function: Performs solid-liquid separation on the mixed liquor from the Two-Stage AO Tank. Provides sludge return to the Hydrolysis Tank or AO Tank.

3.2.11 RO Concentrate Tank

Quantity: 1 Structure. Dimensions: 5.1m (L) × 18.7m (W) × 4.5m (H), Effective depth: 4.0m. Civil & Equipment scale: 4,900 m^3/d.

Function: Stores RO concentrate and lifts it steadily to the Fenton Tank.

3.2.12 Fenton + Magnetic Coagulation Sedimentation

Fenton Tank: 1 Structure for RO concentrate treatment. Dimensions: 6.2m (L) × 18.7m (W) × 4.0m (H), Effective depth: 3.5m. Civil & Equipment scale: 4,900 m^3/d.

Magnetic Coagulation Sedimentation Tank: 1 Structure. Dimensions: 6.6m (L) × 13.9m (W) × 4.0m (H), Effective depth: 3.5m, Divided into 2 groups. Civil & Equipment scale: 17,000 m^3/d.

Function: In the Fenton Tank, sulfuric acid, ferrous sulfate, and hydrogen peroxide are added to generate ·OH radicals, which react with the wastewater to oxidize refractory organics and reduce pollutant concentration. Alkali is added to adjust pH, forming flocs. PAM is added to enhance flocculation. Effluent enters the Magnetic Coagulation Sedimentation Tank where magnetic powder is added to accelerate particle settling and achieve solid-liquid separation (Xu; Shao, Zhang, & Guan, 2020).

3.2.13 Final Effluent Tank

Quantity: 1 Structure. Dimensions: 7.1m (L) × 18.7m (W) × 4.0m (H), Effective depth: 3.5m. Civil & Equipment scale: 17,000 m^3/d.

3.2.14 Emergency/Initial Rainwater Tank

Quantity: 1 Structure. Dimensions: 47.35m (L) × 18.7m (W) × 4.1m (H), Effective depth: 3.6m. Civil & Equipment scale: 17,000 m^3/d.

3.2.15 Sludge Treatment System

Sludge Storage Tank: 1 Structure. Dimensions: 9.1m (L) × 18.8m (W) × 5.0m (H), Effective depth: 4.5m. Divided into Acidic Sludge Tank and Neutral Sludge Tank. Civil & Equipment scale: 17,000 m^3/d.

Sludge Conditioning Tank: 2 Structures. Single dimensions: 4.7m (L) × 7.65m (W) × 3.9m (H), Effective depth: 3.4m.

Sludge Press Room: 1 Building. Dimensions: 26m (L) × 18.8m (W) × 9.0m (H).

Sludge Silo Room: 1 Building. Dimensions: 26m (L) × 18.8m (W) × 6.9m (H).

Function: Wet sludge storage and thickening.

3.2.16 Intermediate Tank

Quantity: 1 Structure. Irregular shape. Dimensions: 21.7m (L) × 3.1m (W) × 4.1m (H), Effective depth: 3.6m. Civil & Equipment scale: 17,000 m^3/d.

Function: Distributes water to the Submerged Ultrafiltration Tank, Primary Coagulation Sedimentation Tank, and Magnetic Coagulation Sedimentation Tank.

3.2.17 Primary Coagulation Sedimentation

Quantity: 1 Structure. Dimensions: 6.2m (L) × 13.7m (W) × 6.6m (H), Effective depth: 6.1m. Civil & Equipment scale: 2,400 m^3/d.

Function: Adds PAC and PAM to remove SS and a small amount of COD from the secondary sedimentation tank effluent.

3.2.18 Secondary Decolorization Sedimentation

Quantity: 1 Structure. Dimensions: 6.1m (L) × 18.7m (W) × 6.1m (H), Effective depth: 5.6m. Civil & Equipment scale: 2,400 m³/d.

Function: Adds powdered activated carbon (PAC), PAC, and PAM to further remove color and a small amount of COD.

3.2.19 Primary Reclaimed Water Tank

Quantity: 1 Structure. Dimensions: 14m (L) × 14.8m (W) × 4.1m (H), Effective depth: 3.6m. Civil & Equipment scale: 2,400 m³/d.

Function: Stores primary reclaimed water and supplies it to enterprises.

3.2.20 Submerged Ultrafiltration (UF) Tank

UF Membrane Tank: 3 Structures. Single dimensions: 20.4m (L) × 3.2m (W) × 4.1m (H), Effective depth: 3.6m. Civil scale: 12,000 m³/d, Equipment scale: 8,000 m³/d.

UF Product Water Tank: 1 Structure. Dimensions: 14m (L) × 14.35m (W) × 4.1m (H), Effective depth: 3.6m. Civil scale: 12,000 m³/d, Equipment scale: 8,000 m³/d (Initial).

Function: Uses ultrafiltration membranes to filter secondary sedimentation tank effluent, removing SS to protect downstream RO units.

3.2.21 Membrane Workshop

Membrane Workshop: 1 Building. Dimensions: 30m (L) × 18.7m (W) × 8.9m (H). Civil scale: Product water 7,100 m³/d (arranged for 3 trains), Equipment scale: Product water 4,733 m³/d (2 trains installed).

Reclaimed Water Tank: 1 Structure. Dimensions: 31.75m (L) × 14m (W) × 4.1m (H), Effective depth: 3.6m. Civil scale: Product water 7,100 m³/d, Equipment scale: Matches Membrane Workshop.

Function: Uses reverse osmosis membranes to desalinate UF product water, producing high-quality reclaimed water.

3.2.22 Chemical Dosing House

PAFC Storage Tank: 1 Structure. Dimensions: 9.6m (L) × 4.4m (W) × 5m (H), Effective depth: 4.5m. Effective volume: 190 m³. Storage days: 6~9d.

Liquid Caustic Soda Storage Tank: 1 Structure. Dimensions: 9.6m (L) × 3.55m (W) × 5m (H), Effective depth: 4.5m. Effective volume: 153 m³. Storage days: 8~10d.

Waste Acid Storage Tank: 1 Structure. Dimensions: 9.6m (L) × 3.55m (W) × 5m (H), Effective depth: 4.5m. Effective volume: 153 m³. Storage days: ~5d.

PAC Dissolution Tank: 2 Structures. Single dimensions: 3.1m (L) × 2.2m (W) × 4.5m (H), Effective depth: 4.0m.

Ferrous Sulfate Dissolution Tank: 2 Structures. Single dimensions: 3.1m (L) × 2.2m (W) × 4.5m (H), Effective depth: 4.0m.

3.2.23 Odor Control Process Design

All structural units are covered for collection, with seamless connections between covers and tank walls. Collected odorous gases are treated sequentially in a sodium hypochlorite oxidation tower and a caustic scrubbing tower. The design uses a two-stage scrubbing system: "NaClO Scrubber + Alkali Spray Tower".

4. Process Design Features

4.1 Design Influent Quality Analysis

The design influent quality for this project was primarily determined based on measured wastewater quality data from the entering enterprises and influent quality data from similar printing and dyeing industrial wastewater treatment centers.

Printing and dyeing wastewater is characterized by large volume, high organic pollutant content, deep color, high alkalinity, and significant fluctuations in quality, making it difficult to treat. The production lines of the entering enterprises involve fabrics approximately 35% cotton and 65% synthetic fibers, including both woven and knitted types, such as warp-knitted fabrics, yarn dyeing, cotton knitting, digital printing, and others (chenille, polyester elastic fabric); pretreatment processes include desizing, bleaching, and scouring.

Based on industry experience, the main characteristics of textile printing and dyeing wastewater are:

1) Significant fluctuations in water quality and quantity: Affected by market, season, holidays, and raw material changes.

2) Complex and high-concentration organic components: Pollutants are mostly organic, varying with fiber type and processing technology. Wastewater comes from eight main processes: Desizing, Scouring, Bleaching, Mercerizing, Dyeing, Printing, Finishing, and Alkali Weight Reduction.

Desizing Wastewater: Organic, pale yellow, contains sizing decomposition products, fiber scraps, enzymes, alkaline (high pH), high organic content, BOD accounts for ~45% of total. Use of PVA or CMC sizing reduces BOD but increases COD_{Cr}, making treatment harder. PVA is a major factor in treatment difficulty.

Scouring Wastewater: Large volume, high temperature, dark brown. Contains cellulose, pectin, waxes, oils, alkali, surfactants, nitrogen compounds. High BOD and COD_{Cr} (thousands mg/L).

Bleaching Wastewater: Large volume, low pollution level, low BOD and COD_{Cr}. Relatively clean, can be discharged directly or reused after treatment.

Dyeing Wastewater: Generally strongly alkaline, large volume. Contains sizes, dyes, auxiliaries, surfactants. High color (400-600 times), high COD_{Cr}, low BOD, poor biodegradability.

Printing Wastewater: Contains large amounts of paste besides dyes and auxiliaries. High BOD_5 and COD_{Cr}. Large volume, high color, high ammonia nitrogen, high pollution level.

3)LowBOD_5/COD_{cr}: Generally around 0.25, indicating wastewater is biodegradable but difficult to biodegrade BOD_5/COD_{cr} > 0.45 = good; > 0.3 = biodegradable; < 0.3 = difficult; < 0.25 = hard).

4)High Color: Due to residual dyes and colorants from natural and synthetic organics. Use of new auxiliaries and sizes reduces biodegradability.

5)Large pH Variations: Different processes require different pH conditions. Cotton processing often uses alkali, resulting in high pH wastewater.

6)High Temperature: Many processes run at high temperatures. High temperature is unfavorable for biological treatment. Temperature and flow vary with fabric type and process.

4.2 Water Treatment Process Adapted to Water Quality Characteristics

4.2.1 Wastewater Treatment Process Selection Principles

The construction and operation of WWTPs involve significant investment and are constrained by many factors. Process selection is crucial for investment and O&M costs. Therefore, considering maturity, stability, safety, economy, local conditions, wastewater nature, and effluent requirements, the optimal process must be selected.

Principles:

Consider project phasing for reasonable connection and unified management.

Mature, reliable technology meeting effluent requirements.

Easy O&M, flexible operation, resistant to influent fluctuations.

Economically reasonable, minimizing capital and O&M costs.

Advanced, reliable, widely available supporting equipment.

High automation level to reduce labor intensity.

4.2.2 Advanced Treatment Process Selection Principles

Based on influent quality/quantity and effluent requirements, prioritize processes with low investment, small footprint, low energy consumption, low O&M cost, and easy management after technical-economic comparison. Adopt proven new technologies, processes, materials, and equipment cautiously. Layout should be compact and consider future phases.

4.2.3 Sludge Treatment Process Selection Principles

Sludge treatment focuses on reduction. Sludge is dewatered and then incinerated for disposal.

4.2.4 Odor Control Process Selection Principles

Select mature, effective, low-investment, low-O&M cost technology ensuring (standard-compliant emission), minimizing secondary pollution. Integrate with overall plant layout, greening, and aesthetics. Minimize investment and footprint where possible. Design for energy efficiency, high automation, easy maintenance and operation. Use low-pressure drop packing for energy saving.

Based on the above and treatment data for similar wastewater, the following processes were selected:

☑ High-Concentration Wastewater Treatment Process:

"Screen + High-Concentration EQ Tank + Acid Precipitation + White Sludge Filter Press".

☑ Integrated Wastewater Treatment Process:

"Screen + Integrated EQ Tank + Cooling Tower + Reaction Flotation Tank + Primary Sedimentation Tank + Hydrolysis Tank + Two-Stage A/O Tank + Secondary Sedimentation Tank + Magnetic Coagulation Sedimentation Tank + Final Effluent Tank".

☑ RO Concentrate Treatment Process:

"Fenton" as the main process.

5. Conclusion

Implementing enterprise relocation and renovation into the park aligns with national, provincial, and municipal industrial policies and socio-economic development plans, driving the circular economy industrial park, fostering rapid development and industrial agglomeration, and enhancing development strength. For printing and dyeing enterprises, centralized pretreatment within the park concentrates resources, achieves economies of scale, reduces individual pretreatment costs, and facilitates regulatory supervision. This project selected advanced, economically sound, stable, and proven mature processes. Through the treatment train "Screen + Integrated EQ Tank + Cooling Tower + Reaction Flotation Tank + Primary Sedimentation Tank + Hydrolysis Tank + Two-Stage A/O Tank + Secondary Sedimentation Tank + Magnetic Coagulation Sedimentation Tank", effluent meets the "Discharge Standard of Water Pollutants for Dyeing and Finishing of Textile Industry (GB 4287-2012)" Indirect Discharge Standard for discharge to the downstream municipal WWTP. By selecting suitable processes, optimizing tank structures, and controlling equipment costs, the project achieved optimization of investment, cost, and benefits (ZHENG, WANG, & ZOU, 2023).

References

Tian, L., & Zhou, J. (2024). Discussion on energy-saving and emission reduction measures of printing and dyeing enterprises under the double carbon target. *International journal of textile*, *2024*(04).

WU, Y., & LUO, Z. J. (2020). A project example of printing and dyeing wastewater treatment by air flotation-hydrolysis acidification-aerobic combined process. *Industrial Water & Wastewater*, *2020*(04).

Xu, F. G. (2025). Analysis of Alkali Reduction Printing and Dyeing Wastewater Treatment Technology. *Leather Manufacture and Environmental Technology*, *2025*(05).

Xu, F., Shao, J. L., Zhang, C. J., & Guan, G. Q. (2020). Dyeing wastewater advanced treatment project by Fenton fluidized bed process. *Water & Wastewater Engineering*, *2020*(03).

ZHENG, C. Y., WANG, Y. H., & ZOU, L. (2023). Analysis on the Investment and Cost of Large-scale Printing and Dyeing Wastewater Treatment Project. *Engineering and Technological Research*, 2023(10).