

DF-MBR

Public Sewage Treatment Facilities Applying the Fair

Pyeongtaek Cheongbuk Water Restoration Centre

1. Introduction



Pyeongtaek is located in the southwestern part of Gyeonggi Province the development of large-scale residential area was needed due to rapidly increasing population. Therefore, Pyeongtaek cheongbuk district residential area development project (2002-2014) has been carried out throughout 2 stages and as part of this project; Cheongbuk Water Restoration Centre was built for the treatment of sewage generated from the residential district.

Table 1. Overview of Cheongbuk Water Restoration Center

Category	Contents
1. Location	Okgil-ri, Cheongbuk-myeon, Pyeongtaek-si
2. Applied district	Within the residential area
3. Plant area	8,300m ²
4. Plant capacity	8,200m ³ /일
5. Construction method	DF-MBR
6. Construction period	~March, 2010
7. Starting of the operation	March, 2010
8. Discharge of the treated water	Namyang Bay →West Sea

The capacity of Cheongbuk Water Restoration Center is designed to be 8,200m³ / day until 2016. Since the 2nd stage of the residential area development project is in progress currently, the plant is being operated on average capacity of approximate 2,400m³ / day.

Some of the major requirements were BOD 227 mg/L, COD 192 mg/L, SS 254 mg/L, T-N 44.3 mg/L. and T-P 8.3 mg / L iafter reviewing inflow water quality analysis and pollutant load of existing plant

Table 2. Cheongbuk Center Planned Water Quality and Guaranteed Water Quality

Planned	Performance water Quality Standard	Rooms Flow Can be	
		Guarantee	Performance Guarantee
BOD	227.0	≤ 8.0	≤ 5
COD	192	≤ 40	≤ 20
SS	254	≤ 10	≤ 2
T-N	44.3	≤ 20(60)	≤ 15
T-P	8.3	≤ 2(8)	≤ 2
E.coli	-	≤ 3,000	<30

Note:

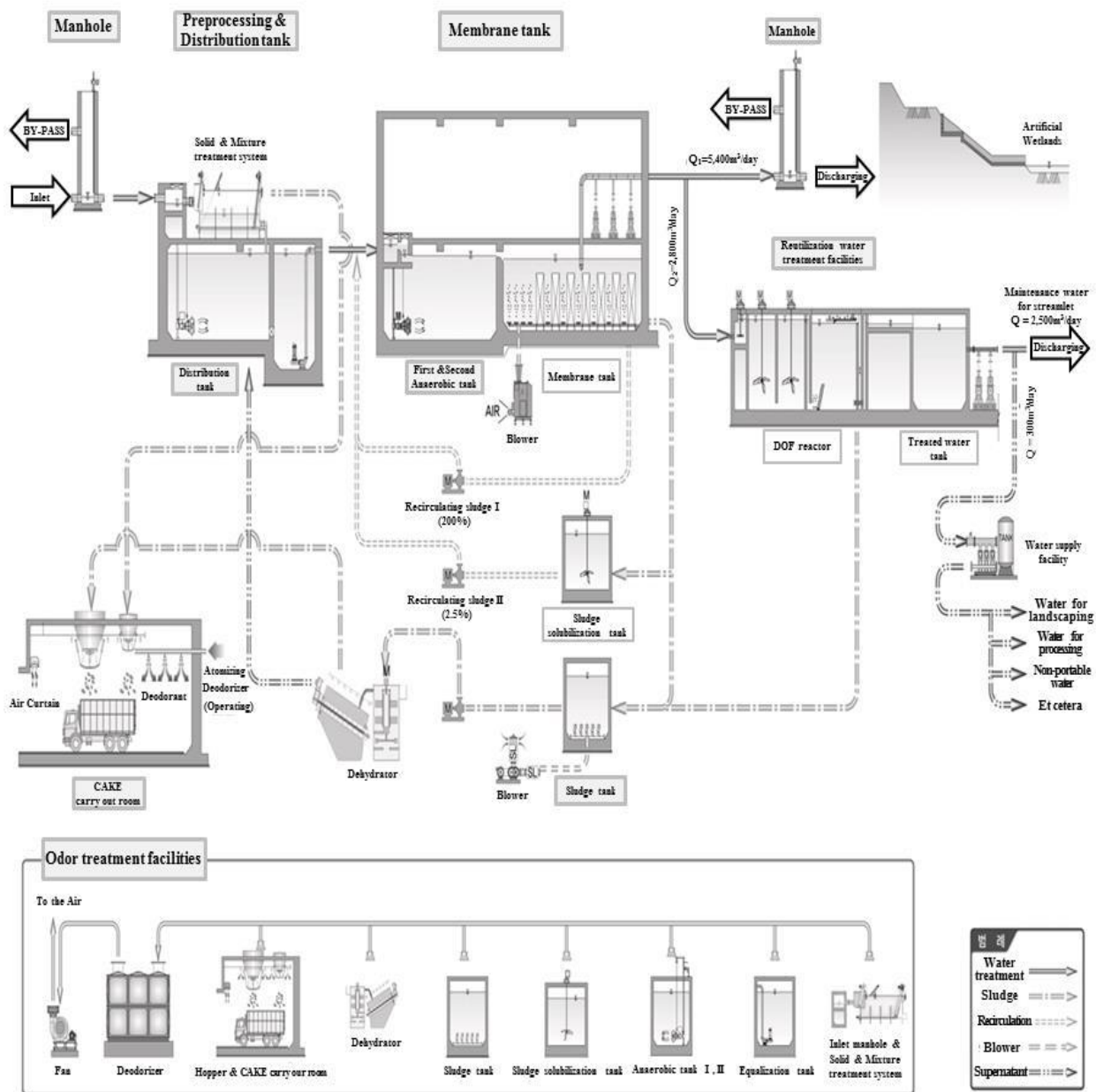
1. Values in parentheses winter performance guarantee water quality
2. Unit: mg / L, more / ml

In addition, the performance guarantee is even more stricter than legal discharged water quality standard which is BOD 5mg / L, COD 20 mg / L, SS 2 mg / L, TN 15 mg / L, and TP ≤ 2mg / L. The water is discharged to Yellow Sea passing through artificial wetland in Namyang Bay.

2. Process and facilities

A durable and economical facility that can be easily maintained by facility manager with

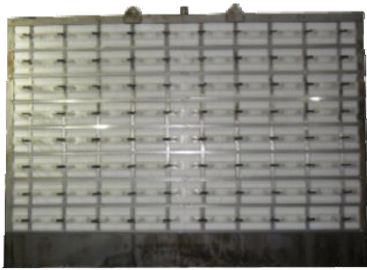
guaranteed performance was selected for Cheongbuk Water Restoration Center (Facilities area 8,300 m²). It is consisted with the preprocess plant, control tank for proper flow, Bio reactor (DF-MBR) to get stabilized amount of treated water, and the system to dewater sewage generated during the process as well as the system to recycle water from the sewage. The overall process is shown in Figure 1. In addition, the bio reactor, which is the main part of the process, is consisted with anaerobic bioreactor for denitrification and releasing phosphorus, 2 non-oxygen tanks, and MBR tank that generates oxidation of both organic substance and phosphorus.



<Figure 1> Process Flow Chart

3. Membrane Specifications

For the large facility like STP, it is necessary to increase the density of membrane per installed area as it requires large quantity of membrane. Pure Envitech's SBM the 8S20L cassette-type was applied to Cheongbuk Water Restoration Center as they needed to minimize the site area at the same time. As shown in Figure 2, They used 14 cassettes that have 160 SBM blocks per cassette which is consisted with 15 C-PVC flat sheets (634W × 300H × 5T (mm) per block, for 1 cassette. Detailed specifications are listed in Table 3.



<Figure 2> SBM Flat Membrane Module (Cassette)

4. Operation of the Membrane Bioreactor Tank


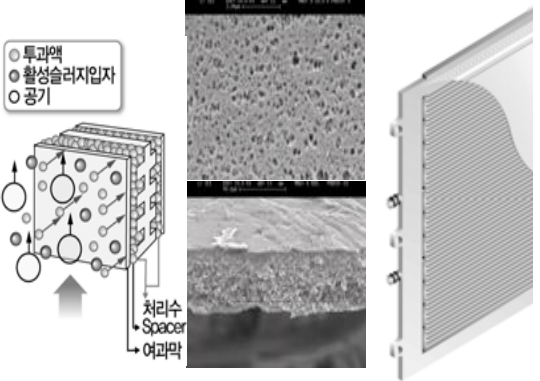

Operating condition of the membrane bioreactor tank is shown in Table 4. It indicates the plant is being operated under the condition of MLSS 7,873 ~ 13,017 mg / L, DO 2.0 ~ 2.2.3 mg / L, TMP ≤ 40 Kpa, Flux 20 ℓ / m² • hr

Table 4. Membrane bioreactor tank operation conditions

Item	Operating Conditions	Average
Temperature (°C)	12.9~26.4	19.4
pH	6.4~7.2	6.8
DO(mg/L)	2.0~2.2.3	2.2
MLSS(mg/L)	7,873~13,017	9,972
TMP(Kpa)	< 40	< 40
Flux(ℓ/m ² -hr)	20	-

The most important factor is permeation flux of the membrane tank and it was operated 20 ℓ / m² • hr. Depending on the operating conditions and type of water, the permeation flux tend to be reduced due to contamination, but the permeation flux is able to be maintained through cleaning using NaOCl citric acid.

Table 3. SBM Type Block Specification

Item	Spec. Details	Shape	Advantage of the MBR Material		
Structure	Submerged Membrane Block		External Pressure Filtration	Fine and Stable Sheet	Supporting frame for higher tensile strength
Block Size	W600 x L 194x H300				
MBR Surface Area	4.5m ² /block				
MBR Element	C-PVC				
Pore Size	0.4μm				
Max Differential Pressure on Membrane	0.5kgf/cm ²				
Operating pressure	0.10~0.45kgf/cm ²				
Max. operating temperature	40°C below	<ul style="list-style-type: none"> · Block consisted with 15 membrane sheets of 0.3m² membrane area · Thermal welding to enhance the chemical resistance 	<ul style="list-style-type: none"> · C-PVC material has high chemical resistance · Internal supporting frame and fixing plate lead higher tensile strength · Long lasting membrane lifespan · Low pressure operation and cyclic aerobic cleaning to reduce fouling 		
Operating pH	2~10				
Cleaning pH	2 ~ 10(≤ 40°C)				
Max. OCl-	1,000,000ppm-hr				

5. Facility Operating Results

water shows the improvement about 50% or more than the guaranteed water quality.

Cheongbuk Water Restoration Center has been operating since March 2010. The recent operating status of last year (2013) is shown in Table 5. Influent water quality is similar to the plan. Although there were difficulties due to comparably small influent quantity for the plant capacity, BOD, COD, SS, TN, TP, respectively 2.8mg / L, 7.2mg / L, 0.5mg / L, 8.0mg / L, 0.7mg / L of treated

Table 5. Water Quality Analysis (2013 Operational Status, Cheongbuk Water Quality Restoration Center)

Item	Influent	Effluent	Plan Water inflow	Performance Warranty
BOD(mg/L)	195.6	2.8	227.0	≤ 5
COD(mg/L)	126.8	7.2	192	≤ 20
SS(mg/L)	235.7	0.5	254	≤ 2
T-N(mg/L)	44.667	8.0	44.3	≤ 15
T-P(mg/L)	4.92	0.7	8.3	≤ 2
E. coli (개/100mL)	139,32	<30	–	<30