

# CASE STUDY

RO | NF | UF | MBR

Municipal Wastewater Reuse  
Gongju, Korea

# TORAY

Innovation by Chemistry

## Toray's Ultrafiltration Technology Purifies Wastewater at Korea's First Large-Scale Membrane Filtration Plant in Gongju

### INTRODUCTION

The Gongju Water Treatment Plant came online in 2003 using conventional treatment processes to purify wastewater for municipal reuse. The conventional treatment comprised of powdered activated carbon (PAC), coagulation and flocculation, sedimentation, and rapid sand filtration. However, stable production of high-quality permeate was needed, and in 2004, advanced membrane technology was introduced by K-water, a renowned engineering firm in Korea. K-water would design a pilot plant to begin operation in September 2005.

The feed water is lake/pond water collected from the Daecheong Dam and has an average of 1.5 NTU turbidity, with the highest being 12.1 NTU. Furthermore, this surface water experiences spikes in taste and odor during summer and autumn due to fluctuations in algae and other odor inducers. The membrane filtration process aimed to reduce turbidity and pathogenic micro-organisms despite the temporary occurrence of taste and odor problems.

### EVALUATION

K-water conducted a seven-month pilot study of three different UF membrane manufacturers where. K-water selected Toray based on evaluations of operating safety and economic feasibility.

As illustrated in Figure 2, ultrafiltration replaced the sedimentation and rapid sand filtration processes. Coagulation and flocculation were reduced from 3 stages to 1 to minimize membrane contamination caused by micro-floc formation. The PAC injection process helped control the taste and odor during high algae season in summer and autumn.



Figure 1: UF membrane system at Gongju WTP

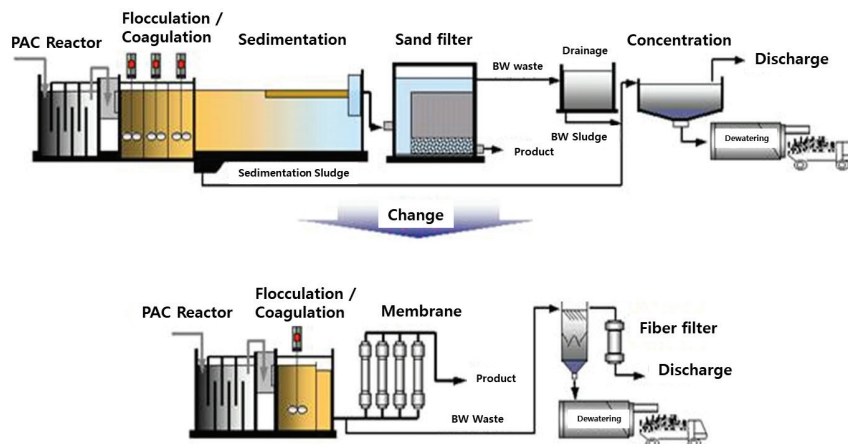


Figure 2: Conventional treatment scheme (top) vs. Advanced membrane filtration system design (bottom)

Table 1 – Quick Facts

Location	Gongju, South Korea
Capacity	30,000 m <sup>3</sup> /d
Membrane type	pressurized UF
No. of trains	4
No. of modules	480
Toray UF model	HFS-2020
Flux	40.8 LMH
Recovery	94.6%
Commissioned	July 2009
Filtrate turbidity	≤ 0.05 NTU

Note: one train (120 modules) was replaced in 2019 from Toray's HFS-2020 to HFU-2020 model.

**Table 2 – Target and Actual Water Qualities**

Parameter	Drinking Water Quality Standard*	Target Water Quality Value	Site Analysis Results (2018)
Turbidity	1.0 NTU (tap water = 0.5 NTU)	≤ 0.1 NTU, 95% max. ≤ 0.3 NTU avg. ≤ 0.05 NTU	< 0.08 NTU
Trihalomethane (THM)	≤ 0.1 mg/L	≤ 0.08 mg/L	< 0.051 mg/L
Haloacetic acids (HAA)	≤ 0.1 mg/L	≤ 0.06 mg/L	< 0.004 mg/L
Chloral hydrate (CH)	≤ 0.03 mg/L	≤ 0.02 mg/L	< 0.0058 mg/L
Taste & odor	Odorless (excluding disinfectants)	≤ 10 TON (odor) ≤ Geosmin, 2-MIB 15 mg/L each	ND
pH	5.8–8.5	6.5–8.5	7.1–7.8
Iron (Fe)	≤ 0.3 mg/L	≤ 0.2 mg/L	ND
Manganese (Mn)	≤ 0.05 mg/L	≤ 0.2 mg/L	< 0.008 mg/L
Residual chlorine	≤ 4.0 mg/L	≤ 1.0 mg/L	< 0.75 mg/L

\*As set by the Ministry of Environment, Korea



Figure 3: UF train at Gongju WTP

### IMPLICATIONS

The Gongju Water Treatment Plant produces 30,000 cubic meters per day and is currently the largest in South Korea that utilizes pressurized UF membranes. Table 2 shows how Toray's UF modules help meet water quality requirements and continue to produce stable operation for over ten years since its commissioning in 2009. The Gongju WTP has become a standard model for membrane plants in South Korea.

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