

Promoting Wastewater Reuse for Water Curtain Cultivation in Gwangju, Gyeonggi-Do

Gwangju is nearby Seoul, and facility cultivation agriculture is activated due to various location regulations to preserve Paldang-lake. To reduce production costs, it is mainly dominated by non-circulating water curtain cultivation using surface groundwater. However, water curtain cultivation (WCC) faced difficulties due to groundwater depletion, and as consequence, farmers are suffering from high heating costs.

This study was conducted to find a way to replace water required for WCC with effluent of sewage treatment plant (STP), targeting facility cultivation complex in Seoha-ri, Gwangju which is struggling with WCC. And the following results were derived.

The facility cultivation area in Seoha-ri, Gwangju is 114ha, of which WCC area is 72ha, accounting for a high portion of 63.2%. And all of the WCC facilities adopt non-circulating agricultural method using surface groundwater, so it is impossible to cultivate water curtain due to groundwater depletion except for some farms located along the river.

The target of this project is greenhouse 413 currently being operated as WCC facilities, and the period is 150 days from November to March. And water must be stably supplied for 17 hours during daily supply time, so it turned out that 54,000m³/17 hours is required.

Target STPs that can supply required quantity of water were determined to be Kyeongan STP (facility capacity of 71,000m³/day) and Gwangju STP in consideration of water supply and economic feasibility.

Facilities that can supply required quantity of water can only be used with Kyeongan STP. But, as a result of reviewing Gwangju STP in consideration of emergencies, the four-year operating water quality was found to be suitable for 'river management flow' and 'agricultural water' of Water Reutilization Invigoration Act.

As a result of modeling under low water temperature and high concentration conditions to analyze the stability of water quality, it was found that the T-N exceeded the discharge

standard due to nitric oxidation caused by low water temperature. However, the result was performed under bad conditions, and since it is used as water for the water curtain, it is assumed that there will be no impact on agriculture.

The current sewage treatment water temperature is around 10 degrees Celsius, and the amount of water sprayed per minute used for water curtain facilities is planned to be 125L, so the impact on the growth of low-temperature vegetable crops in Seoha-ri is expected to be insignificant.

Although it was considered to install a reservoir to supply stability for WCC water, it is difficult to secure a space for reservoir installation in Kyeongan STP and it takes a lot of construction costs. Thus, in this study, it was planned to supply water to facility cultivation complex by installing pump stations in Kyeongan STP.

The pump capacity is 14,250m³/day, and four units were planned to be installed. Considering friction loss coefficient, pumping head was determined to be 30m and 90kWh and the pipeline length was planned to be 5.5km in total.

When installing water supply facilities for WCC, the approximate construction will cost about 10.3 billion won, and the facility cost is about 1.4 billion won, so the total construction cost is expected to cost about 11.7 billion won, and according to the government subsidy rate, financing will be set at 70% government expenses and 30% local expenses.

When effluent of STP is used as WCC water, the heating cost is 1.75 million won which is 99% less compared to diesel boiler usage, and carbon emissions are expected to be 421tCO₂, reducing more than 70,000tCO₂, and expected profits from carbon dioxide emissions (73,071t) transaction are expected to reach about 2.1 billion won.

Keyword Wastewater Reuse, Water Curtain Cultivation, Carbon Dioxide Reduction
