Gwangju Institute of Science and Technology
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Professor In S. Kim's research team develops next-generation source technology for industrial desalination plants

□ GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) School of Earth Sciences and Environmental Engineering Professor In S. Kim secured the world's first source technology for forward osmosis-reverse osmosis technology, a next-generation eco-friendly low-carbon process technology that combines sewage treatment water reuse and seawater desalination.

◦ The research team succeeded in reducing the energy produced by 1 ton to 2.2 kW/h through stable long-term operation at an actual site in the field.

□ The reverse osmosis process* has been monopolizing the seawater desalination market for more than 50 years since its initial development in the 1950s, but its energy use has been an obstacle. Since the 2000s, the technology has reached maturity, and it is difficult to expect further energy savings. In recent years, the 'forward osmosis-reverse osmosis process,' which combines the process of diluting seawater with sewage treated water through the forward osmosis process** with the existing reverse osmosis process, is drawing attention.

◦ Pressurized forward osmosis*** is a technology that can increase the production quantity more than twice using light pressure, and it was expected to significantly reduce the membrane area, which is the most important in the economics of a membrane-based water treatment plant. It has been pointed out

that it is not practical because the degree of membrane contamination is severe due to pressurization.

* reverse osmosis process: membrane-based desalination technology that produces fresh water by applying high pressure in the opposite direction of the osmosis phenomenon

** forward osmosis process: a process in which water is filtered by the difference in osmotic pressure by placing a non-porous membrane between two solutions having different concentrations

*** pressurized forward osmosis: technology that dramatically increases the production quantity by applying trans-membrane pressure of 4 bar or less in the forward osmosis process

□ Through long-term operation of the pressurized-forward osmosis reverse osmosis demonstration pilot facility using actual sewage and seawater, the core operating conditions (sewer flow rate, seawater flow rate, membrane permeation pressure) caused performance degradation due to membrane contamination. The impact was experimentally evaluated, and overall energy consumption and economics were compared and analyzed through actual data and process simulation.

◦ According to the analysis, the increase in energy consumption due to membrane contamination of pressurized forward osmosis was similar to that of forward osmosis in the entire process. Considering the energy required of the overall process and the required film area, it was confirmed to be more economical.

□ Professor In S. Kim said, "The results of this research are highly likely to be applied to industrial complexes that lack industrial water in Korea, and the Desalination Technology Research Institute (DTRI) under the Saline Water Conversion Corporation (SWCC) in Saudi Arabia is also proposing a joint study on the installation and operation of demonstration facilities. In the future, this is expected to open a market for overseas export of domestic technology in the industrial water desalination fusion process plant market."

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