



Gwangju Institute of Science and Technology

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Professor Sanggyu Kang's research team develops a numerical analysis model for alkaline water electrolysis system

- GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) School of Mechanical Engineering Professor Sanggyu Kang's research team analyzed the effects of pressure on the alkaline hydroelectric* system for green hydrogen production.
 - * alkaline water electrolysis: This is a technology that electrolyzes water in a basic environment by using an aqueous solution of KOH or NaOH as an electrolyte. It has been researched for the longest time among representative water electrolysis technologies and has the highest degree of completion.
 - The research team conducted a study on the operation performance of an alkaline water electrolysis system, one of the technologies capable of producing green hydrogen, and developed a numerical analysis model that could predict the effect of pressure on the system's operational performance.
- Water electrolysis technology linked to renewable energy sources is attracting attention as a method to produce hydrogen, which is essential for building a future clean energy society, among which alkaline water electrolysis has advantages such as large size, low equipment cost, and sufficient operating life.



However, the cost of production, which is expensive compared to the existing hydrogen production process such as natural gas reforming, is an obstacle.

- To reduce the production cost, research on materials such as electrode and catalyst materials and system operation optimization studies are necessary. However, compared to material development, operation optimization studies are insufficient, and even that is focused on experiment-based research.
- The research team developed an alkaline electrolysis stack model based on numerical analysis to understand the change in the operating performance of the stack according to the operating variable, and they comprehensively analyzed the change in power consumption of BOP* devices that make up the hydrogen production facility in addition to the stack and derived operating conditions for hydrogen production efficiency.
 - * Balance of Plants (BOP): Devices that make up hydrogen production facilities in addition to the stack in which the electrolysis reaction of water takes place, refers to peripheral devices such as pumps, compressors, heat exchangers, gas-liquid separators, etc. that are necessary for operating environment control and post-treatment processes.
- The developed electrolytic stack model was verified using the data from the stack operation experiment conducted by the Korea Institute of Energy Research, and it has the advantage of being able to grasp the operation performance over a wide range, unlike experiment-based studies with limited performance conditions. Through this, the operating efficiency of the alkaline water electrolysis system greatly increases up to about 10 bar pressure due to the effect of the reduction in power consumption of the BOP device, but then it slowly decreases to 100 bar pressure and the effect of improving the purity of hydrogen generated by the pressure increase is effective after 20 bar, which.
- Professor Sanggyu Kang said, "The possibility of stable, high-efficiency green hydrogen production was identified using eco-friendly energy. Furthermore, we hope that it will contribute to revitalizing the hydrogen economy and promoting the hydrogen industry."



- This research, conducted by a master's student Dohyung Jang under the guidance of Professor Sanggyu Kang as part of the 'Alkaline Water Electrolysis Core Technology Development Research Group,' which was supported by the National Research Foundation of Korea's Hydrogen Energy Innovation Technology Development Project. The results were published online on February 7, 2021 in *Applied Energy*, a global academic journal in the field of chemical engineering.

