100% desalination! Amyloid for seawater desalination published in the international journal *Small*

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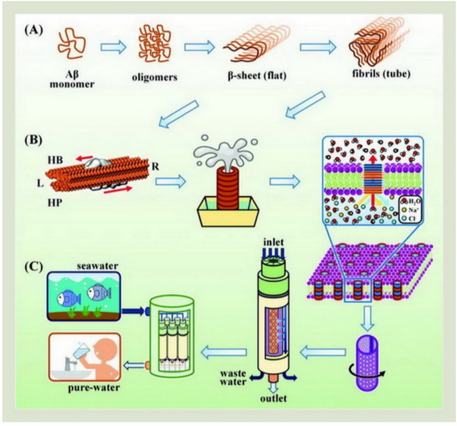
Being impacted by extreme weather, Taiwan has been facing a crisis of water shortage in recent years. Seawater desalination has become a new means of water creation. Professor Sheh-Yi Sheu of the Department of Life Sciences and Institute of Genome Sciences, National Yang Ming Chiao Tung University served as the principal investigator of a research paper published in the international academic journal *Small*. Scientists used amyloid that can cause Alzheimer's disease to block salt ions and transport water molecules, achieving the magical effect of 100% seawater desalination and developing a new method of seawater desalination.

Professor Sheu explained that amyloid is an insoluble fibrous protein that accumulates abnormally in body organs, causing a variety of severe diseases, the most famous of which is Alzheimer's disease. The medical field hopes to find a way to clear the accumulated amyloid in the brain, thereby treating Alzheimer's disease. However, scientists went in the opposite direction and developed a method of seawater desalination by using the properties of amyloid to block salt ions.

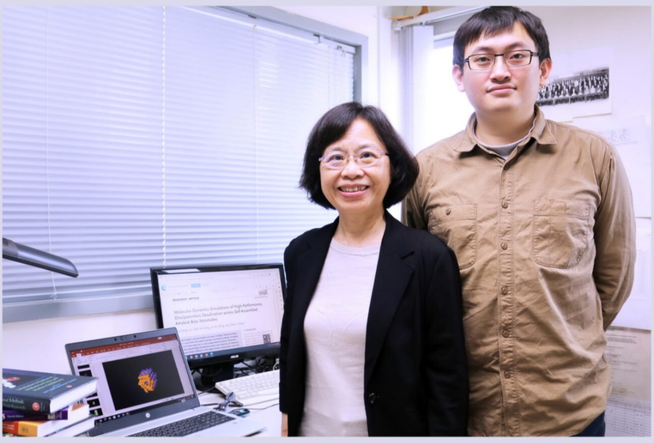
The seawater desalination method involves the use of a nanotube comprising three pieces of the amyloid protein and ingeniously utilizes the potential difference on the protein membrane surface to drive water molecules to move in a single direction, blocking the passage of salt ions (e.g., sodium ions and chlorine ions) and forming a molecular motor to achieve the effect of seawater desalination without any external energy supply.



Professor Sheu stated that reverse osmosis is currently the mainstream seawater desalination technology, which requires a motor to pressurize seawater to pass through the reverse osmosis membrane, thereby separating salt from seawater. Although the technology is feasible, it requires a large amount of electricity and equipment, rendering it difficult to achieve economies of scale. Using amyloid to filter seawater demonstrates a new direction for effective and energy-saving seawater desalination using biomimetic nanomaterials.

The research team theoretically estimated that a filtering membrane composed of a 10 ×10 cm^2 amyloid nanotube could produce 2.5 tons of fresh water per day, which is 200 times more than the amount of fresh water produced using the existing reverse osmosis method.

Professor Sheu stated that the sheet-like structure formed by amyloid can automatically guide water molecules. In addition, by changing one amino acid in the structure to a charged one and increasing the nanotube's hydrophilic potential, the efficiency of separating water molecules and salt ions can be enhanced. The experimental results allow the scientific field to understand the automatic transmission mechanism of biomimetic materials and an effective and energy-saving method of seawater desalination.



Professor Sheu pointed out that climate change has intensified the crisis of water resource shortage. This biomimetic nanomaterial not only demonstrates that the one-way diffusion of water molecules can occur on the nanoscale protein surface but also provides a new candidate material and research direction for future development of a seawater desalination mechanism that features high-yield, low-energy consumption, and low-carbon emission.

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