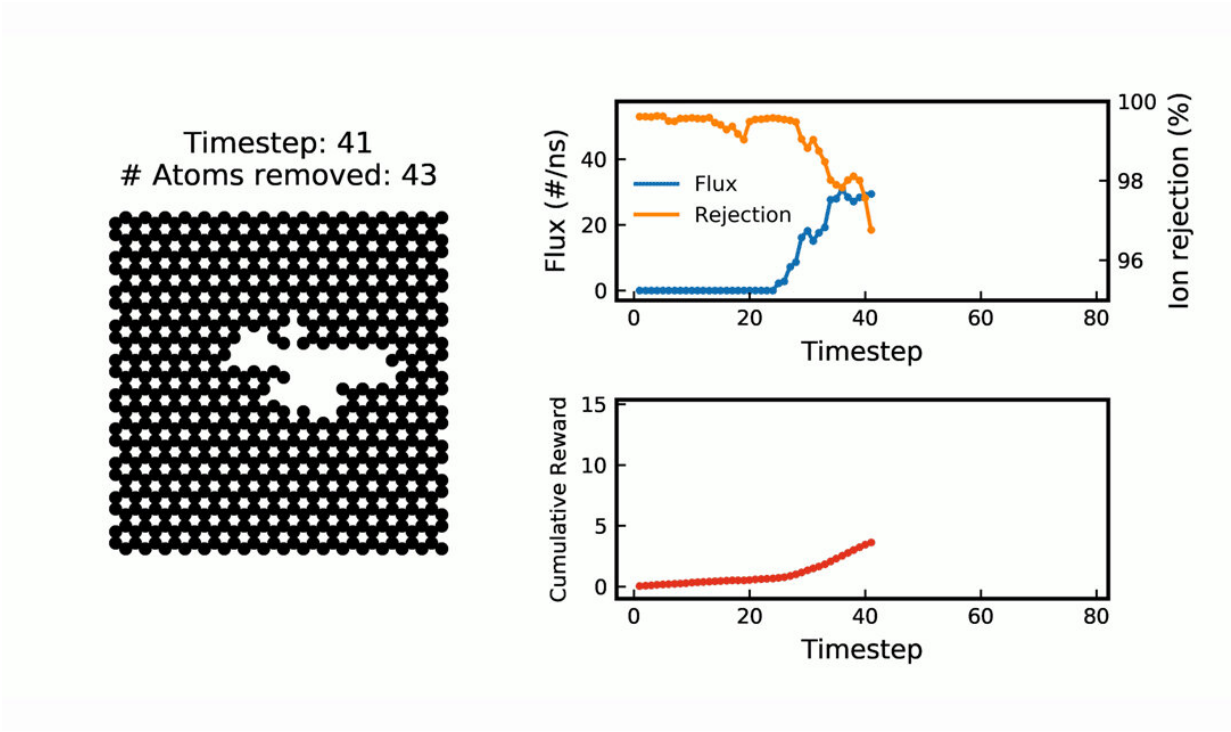
# Using AI to provide the world with drinking water

October 29 2021, by Kayla Valentine




Researchers explore new, efficient possibilities in water purification using AI agents in the desalination process. Credit: College of Engineering, Carnegie Mellon University

Providing fresh drinking water for our society is a challenge that has persisted through multiple efforts. Though water covers 71% of earth's surface, more than 2.5 billion people in the world lack access to fresh

water at least once a month. For Amir Barati Farimani and his team, combatting this problem meant refining the desalination process, the removal of salt or ions that are not favorable to the human body.

"The ions are so tiny, and if you want to remove them, you need to either boil, evaporate, and condense the water, or push it through membranes full of very tiny pores," explained Barati Farimani, an assistant professor of mechanical engineering at Carnegie Mellon University.

The current desalination and separation process is very energy and time inefficient. To combat this, Barati Farimani and his team have researched using artificial intelligence (AI) agents to design an improved method in a week that would likely take decades. "Ideally," he explained, "the best membrane should be one atom thick, such as graphene, a single-layer sheet."

However, the geometry of the nanopore has a significant effect on its performance, and it takes a long time to configure the most optimum nanoporous membrane. The AI agent would decide which atoms should be sequentially removed from this graphene membrane, creating the most efficient geometry of a pore for the desalination process.

"The most exciting thing that we found is that the geometry of the pores is fractal in its shape, showing that more perimeters are needed compared to the area of the pore in order to improve separation and desalination."

The team's research findings were published in the journal *npj 2D Materials and Applications*.

Their technology stands to heavily impact water desalination companies, separation technologies, and chemical engineering plants, among others.

Barati Farimani believes that the research will also be a gamechanger for nanotechnology, which is heavily involved in the process, "The current optimization takes a long time and is very expensive. The AI agent will give instructions on how to design the membrane for the best outcome, saving days of experimentation."

Eventually, this technology could be used for other important removal processes in water, such as removing other harmful particles like viruses and bacteria from water.

The fundamental artificial intelligence agent will allow its users to determine the best membranes for desalination and separation, expanding its use across multiple disciplines. The codes have been made accessible for everyone and can be found online.

**More information:** Wang, Y et al, Efficient water desalination with graphene nanopores obtained using artificial intelligence, *npj 2D Mater Appl* (2021). doi.org/10.1038/s41699-021-00246-9

Provided by Carnegie Mellon University Mechanical Engineering