

A step towards green desalination: Industrial desalination powered by carbon nanotube membrane technology

Juan L. Fajardo Diaz, Postdoctoral Researcher, Shinshu University

Vision

- **What will the technologies realize?** The incorporation of carbon nanotubes to the formulation of polyamide desalination membranes provides anti-biofouling characteristics with high rejection rates and high permeation that will increase the lifetime of industrial vessels and can yield lower energy consumption and lower operating costs according to green desalination..

Issue to solve

- **What are the problems?** Fouling is one of the more significant problems on reverse osmosis desalination modules, a problem that is considerably reduced with this technology.
- **Who has those problems?** Fouling is commonly observed in the seawater desalination industry focused on the production of freshwater. But this fouling problem can be part of those industries looking for the recovery of water from wastewater, recovery of minerals from brine, or production of energy by saline water, and more.

Technology features

- From laboratory membrane to industrial-scale module production at Shinshu University.
- RO industrial vessel built by carbon nanotubes-polyamide membrane with high rejection rates (99.87%).
- Anti-biofouling characteristics.
- Competitive performance compared with technologies focused on seawater desalination.

Possible implementation

- **In which industry can this technology be employed?** These CNT-PA membranes and modules are intended to be used in the production of desalination vessels for industrial-scale seawater desalination facilities. However, the “know-how” allows us to modify the formulation and adapt it to other carbon-based materials (graphene oxide, cellulose nanofibers) nanocomposites and test its potential for other water sources, such as wastewater, brackish water, groundwater. Additional industrial applications associated with membrane technology could be energy production by saline water, filtration of proteins or ions, and the production of HPW or UPW.
- **Who are the target users?** Firstly, companies and governments looking for sustainability and greener desalination technology to get fresh water from seawater. But any company interested in reverse osmosis nanocomposite membrane technology for freshwater production, ion filtrations and related can contact us.
- **What sort of partnership are you seeking?** Solid strategies between the university and companies/government to develop, test, and produce these carbon nanocomposites to reduce costs on seawater desalination. Also, companies looking for alternatives to treat industrial wastewater, produce energy from brine or saline water, are welcome.
- **How large will the market be?** The desalination market was valued at US\$14.5 billion in 2021 and it is expected to grow to US\$35.5 billion by 2031 [1]. Furthermore, there is an increased tendency for companies that use ultrapure water or high purity water to treat the wastewater and reuse it. The HPW and UPW represent ~25-30% of the desalination market.
- [1] Water desalination market report, 2021-2031, Visiongain.