



All-Liquid Thermal Desalination and Brine Concentration using Thermodiffusion

Prof. Juan Felipe Torres

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Hosted by the Lienhard Research Group

For over two millennia, distillation has been used for water purification, but its high energy demands led to the rise of reverse osmosis (RO). While more energy-efficient, RO faces challenges like membrane fouling, high costs, and unsuitability for off-grid use. As a result, desalination meets only about 1% of global freshwater needs, yet in RO-dependent regions, it consumes a major share of water utilities' energy.

Dr Torres has developed thermodiffusive desalination (TDD), the first thermal desalination method operating entirely in the liquid phase, eliminating energy-intensive phase changes. By enhancing thermodiffusion with a multichannel Burgers cascade, TDD achieves faster desalination with high recovery rates. Operating below 100°C and leveraging low-grade thermal energy, it offers a scalable, cost-effective, and sustainable solution for water purification and brine management.

Biography: Dr. Torres began his career in 2014 as a Research Scientist at Toshiba Corporation after completing a double-degree PhD at École Centrale de Lyon, France, and Tohoku University, Japan. A few years later, he joined the Australian National University (ANU) as an academic. Now an Associate Professor at ANU, he leads a research group specializing in applied heat and mass transfer, developing innovative solutions for environmental, energy, and aerospace technologies. Dr. Torres holds a world record in high-temperature solar thermal energy conversion and pioneered the first all-liquid thermal desalination method—the focus of this talk.

Relevant articles:

(1) <https://doi.org/10.1038/s41467-024-47313-5>

(2) <https://doi.org/10.13140/RG.2.2.15900.91524> (in press)

(3) <https://doi.org/10.13140/RG.2.2.35518.70728> (preprint under review)