

In-Home Water Desalination in Urban India

Using Electrodialysis to Improve Recovery

Sahil R. Shah, Prof Amos G. Winter V

Massachusetts Institute of Technology
in collaboration with Tata Chemicals Ltd

TATA CENTER
TECHNOLOGY + DESIGN

Massachusetts
Institute of
Technology

RO Products are Wasteful

Reverse osmosis (RO) systems are widely used to desalinate groundwater in Indian households.

- 60% of this groundwater is brackish, with 500 to 3000 ppm TDS.
- Existing products recover only 25 to 40% of feed supply.
- This inefficiency further stresses scarce groundwater resources.

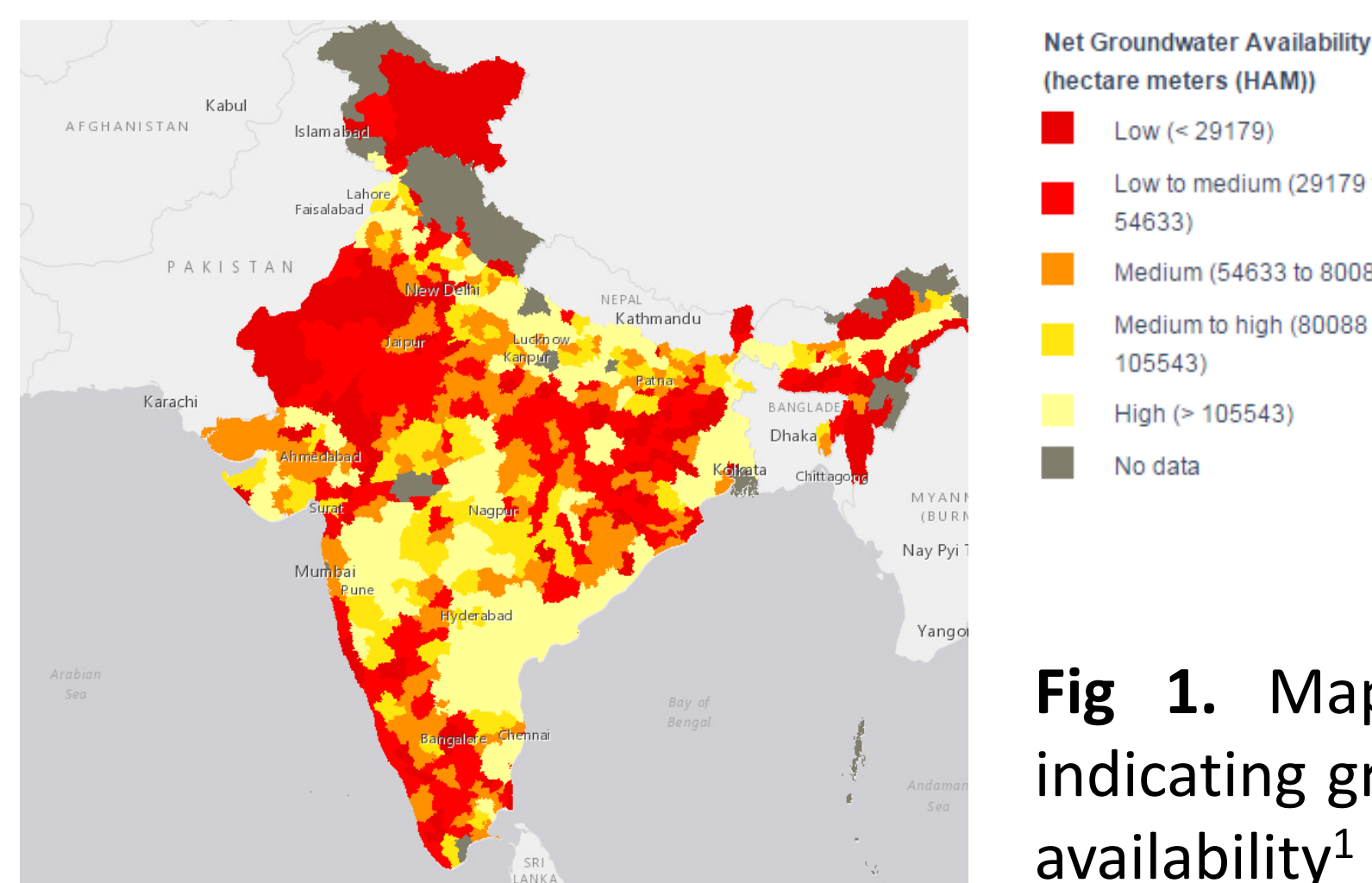
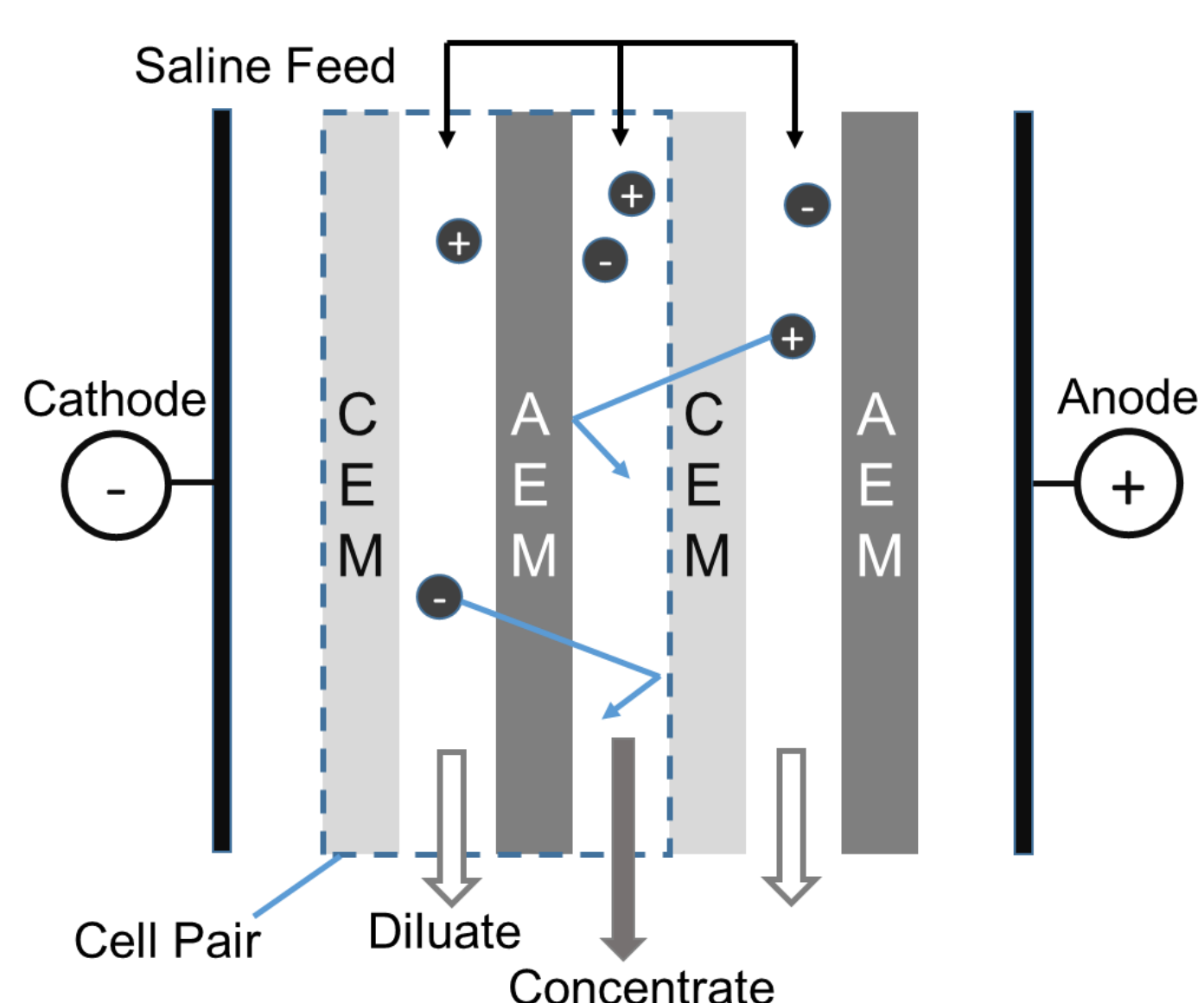


Fig 1. Map of India indicating groundwater availability¹

ED – A More Efficient Alternative

Electrodialysis (ED) can provide the same TDS reduction at higher recovery and lower energy consumption.

Fig 2. A voltage potential is applied across a series of alternating cation (CEM) and anion (AEM) exchange membranes to separate the feed into concentrate and diluate streams



- ED can recover 80 to 90% of feed.²
- Energy consumption is 30 to 75% less for ED compared to RO.²

Acknowledgments

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Demonstrating the Feasibility of Using ED

A concept ED system provided 80% recovery, desalinating water from 3000 ppm to 350 ppm TDS at a rate of 12 L/hr.

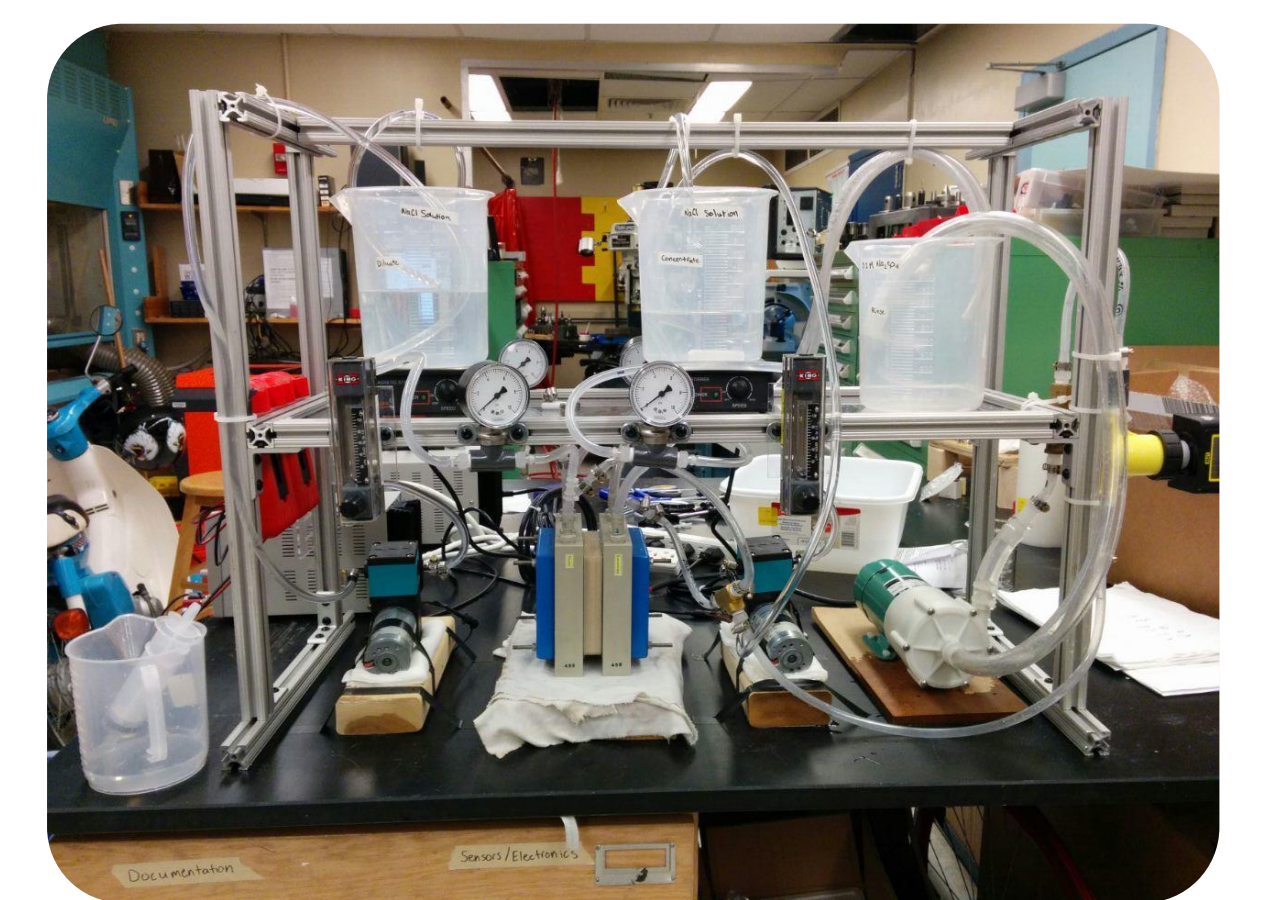
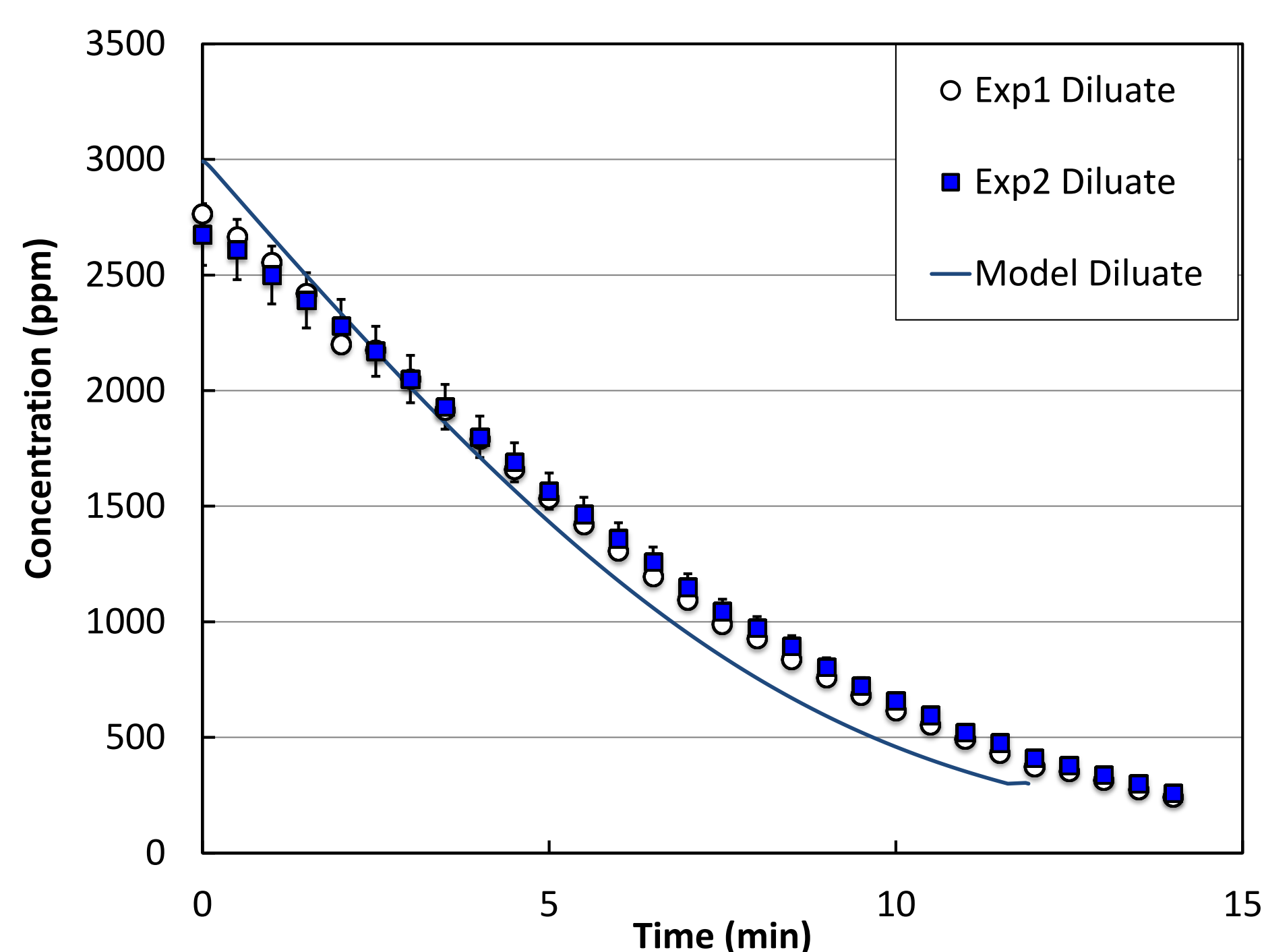
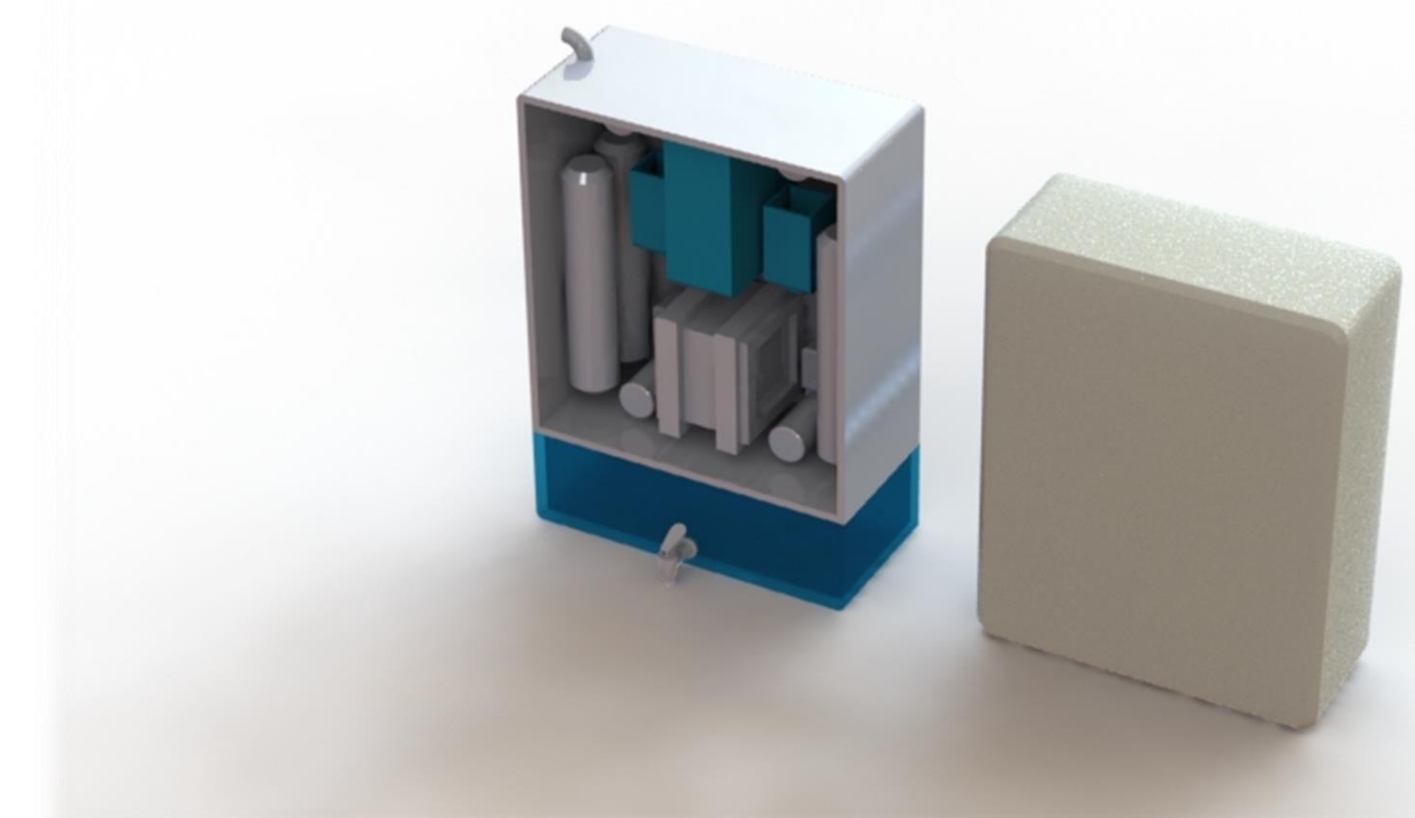


Fig 3. Plot comparing experimental diluate concentration over time to model prediction for the test set-up shown above

- A batch architecture was employed to allow the use of a small ED stack. The feed is recirculated through the stack until the desired salinity is achieved.
- With the small stack, the system can be packaged similarly to existing RO products.

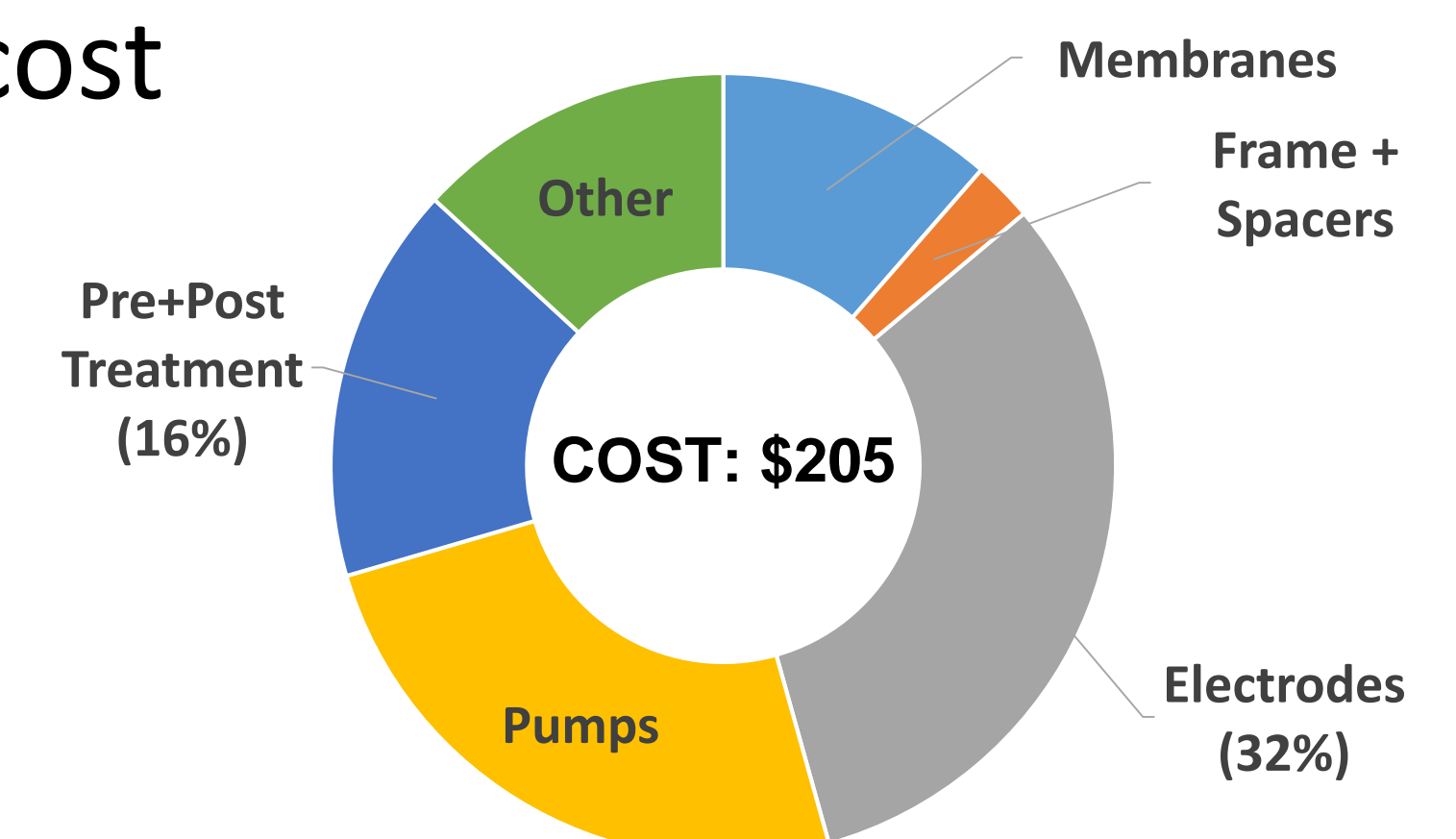
Fig 4. Visual size comparison of concept ED product (left) to Tata Swach Ultima Silver RO unit (right)



Next Steps - Developing a Competitive Product

- Exploring the user needs through interviews and surveys
- Optimizing the stack size for maximizing production rate, power consumption, and cost

Fig 5. Chart showing the total manufacturing cost and the breakdown into the components of the concept ED product



- Designing, constructing, and testing a prototype

References

- [1] Central Ground Water Board, 2010, Ground Water Quality in Shallow Aquifers of India.
- [2] Wright, N. C., and Winter V., A. G., 2014, "Justification for community-scale photovoltaic-powered electrodialysis desalination systems for inland rural villages in India."