

Cryo-Desalination Project

2020: AIChE Projects – Prototype Showcase

Background

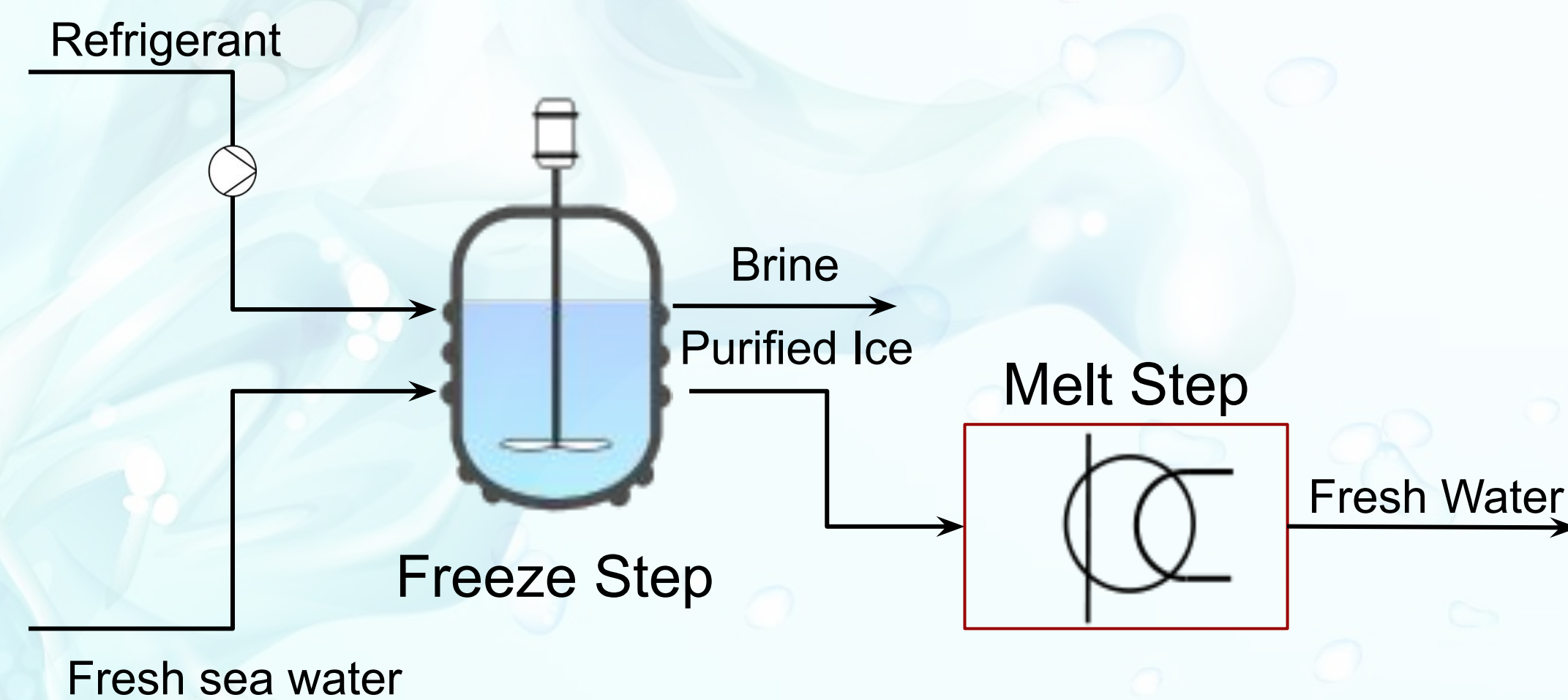
Nearly 71% of the world's surface is covered in water, but only 2.5% is actually potable. The goal of desalination is to create more usable fresh water.

One commonly pursued technique for desalination is reverse osmosis, which removes particulates with a prefilter. While it is often utilized due to being relatively energy efficient, cryodesalination has the potential to exceed it in efficiency.

Rather than using a membrane or prefilter, cryodesalination looks to remove salt from a solution simply by cooling it.

Project Mission

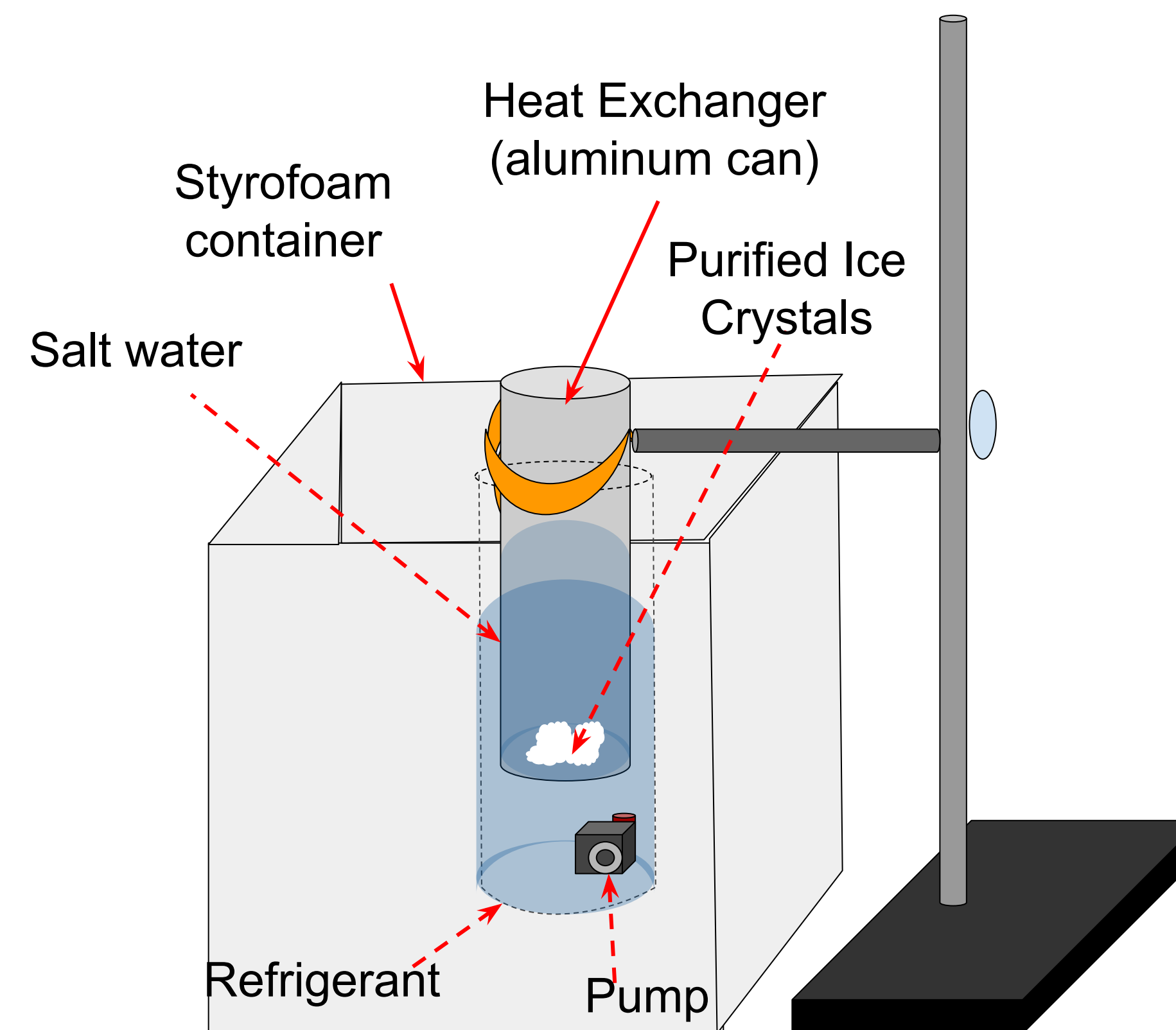
Engineer a small scale system for the **distillation of salt water** using a method that is cost and energy efficient.



Theory

Cryodesalination is about freezing saltwater to produce freshwater that is salt-free. Saltwater's freezing point is slightly lower than that of freshwater due to the salt dissolved in it. The idea is to cool the solution enough to freeze solely freshwater out, leaving the salt behind.

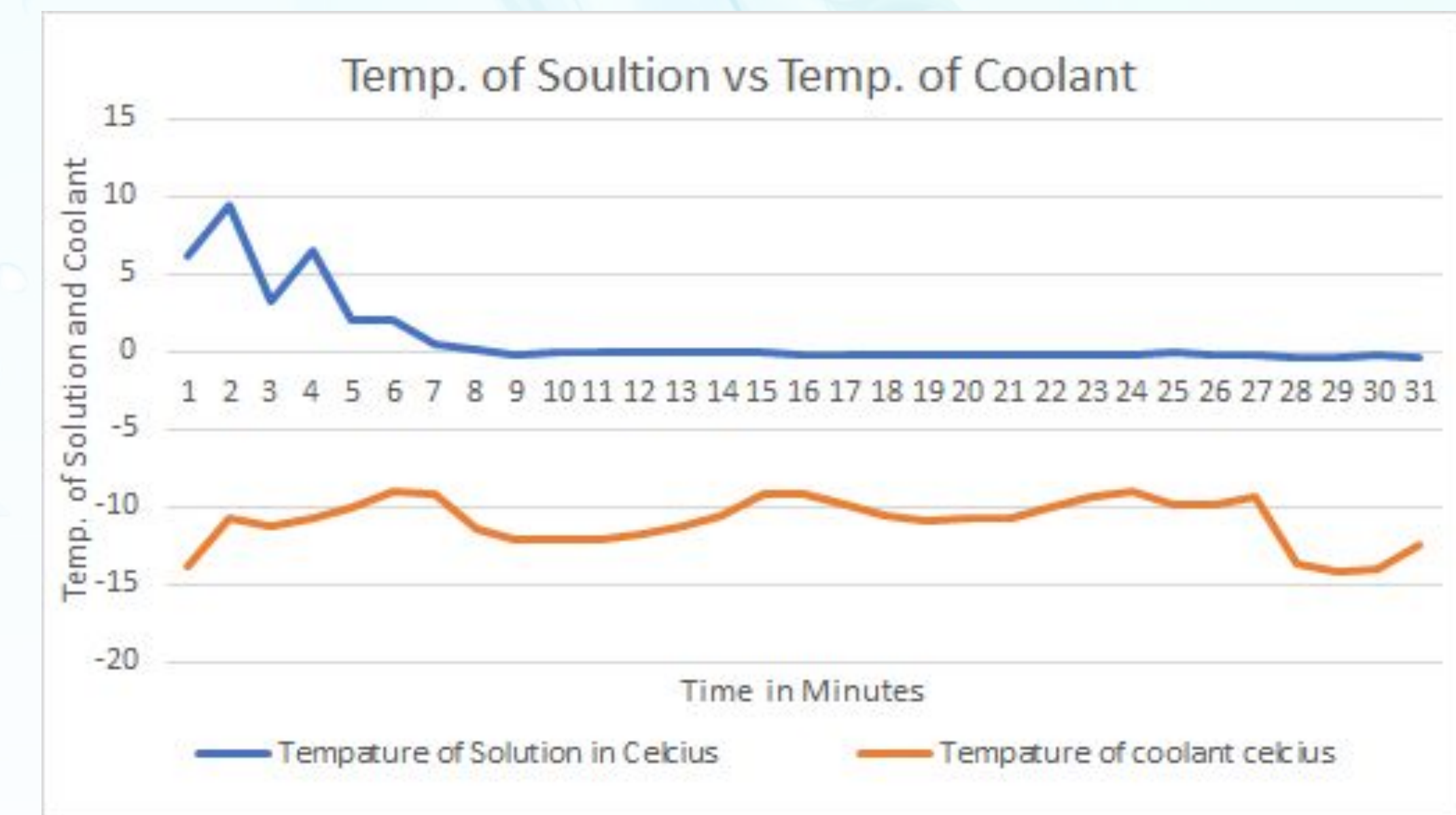
Our Current Design Model



Currently, our prototype consists of a styrofoam container that acts as an insulator to maintain the temperature of our coolant which is isopropyl alcohol and dry ice. The aluminum can acts as our heat exchanger between the saltwater solution and the container.

Current Prototype & Results

Current setup of our system with the isopropyl alcohol-dry ice bath and insulated aluminum vessel can be seen in **Figure 1**, and ice formation from the system can be seen in **Figure 2**.



We kept the temperature of coolant steady around -10 to -15 celsius, this help us maintain the temperature of solution to be at 0 celcius.

At the end of tests our results yielded :

Test	Ice PPM	Solution PPM
1	3430	6620
2	3000	6280
3	3700	4700

Path Forward

- Add a motor to automate the stirring process
- Utilize reverse osmosis and determine if useful
- Further increase the efficiency of our current design

Special Thank you to TESC and TGIF for sponsoring!

Project Lead: Cathy Lao, Harlan Maass

Members: Chelsie Ceballos, Arun Chumber, Errick-Michael Santos, Yumin Zhao, Harleen Mander, Kyle Bui