



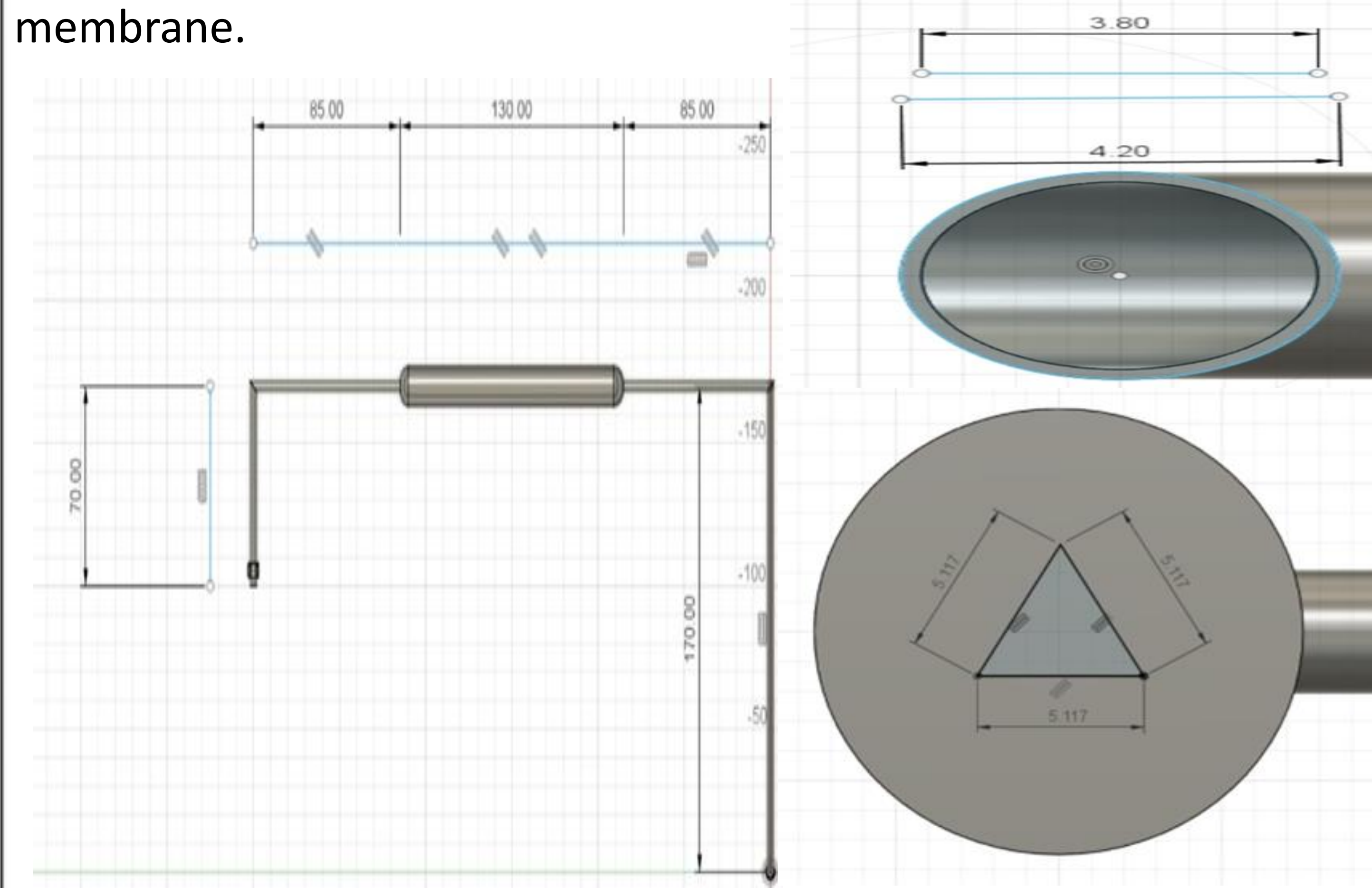
# RO fouling mitigation by frequency disturbance modifying geometry with the aid of DCS

## Abstract

This project is a continuation of prior work, which involved operating reverse osmosis system with the aid of YOKOGAWA distributed control system (DCS). A new approach of membrane cyclic cleaning has been added to what has already been done by changing the pipe geometry to partially triangle between the inlet valve and the membrane and driving cleaning pulses to occur at different locations with different frequency ranges.

## Design and Implementation

Pipes are usually circular in form, and the tubes used in the RO system were initially round. The form or geometry of the pipe, on the other hand, might impact the flow of the fluid, changing the pressure and perhaps generating turbulence. In This project a partial triangular tube is equipped between the feed valve and the membrane.



## Conclusion

The findings revealed that adding the partial triangle pipe to the system improved the prior work done by the previous students that they worked on the actual laboratory RO by boosting turbulence and pressure across the membrane. The greatest results were obtained by making cycles on the valve at the membrane's input and simultaneously applying cyclic pulses to reject valve while using triangle pipe.

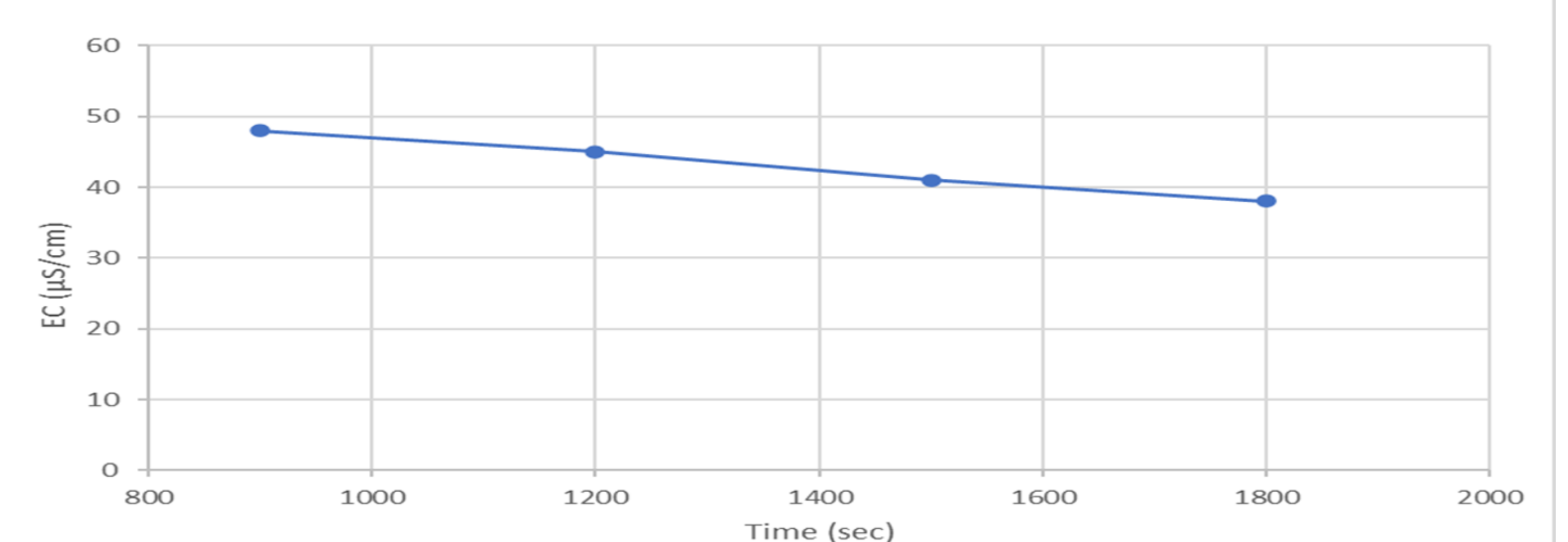
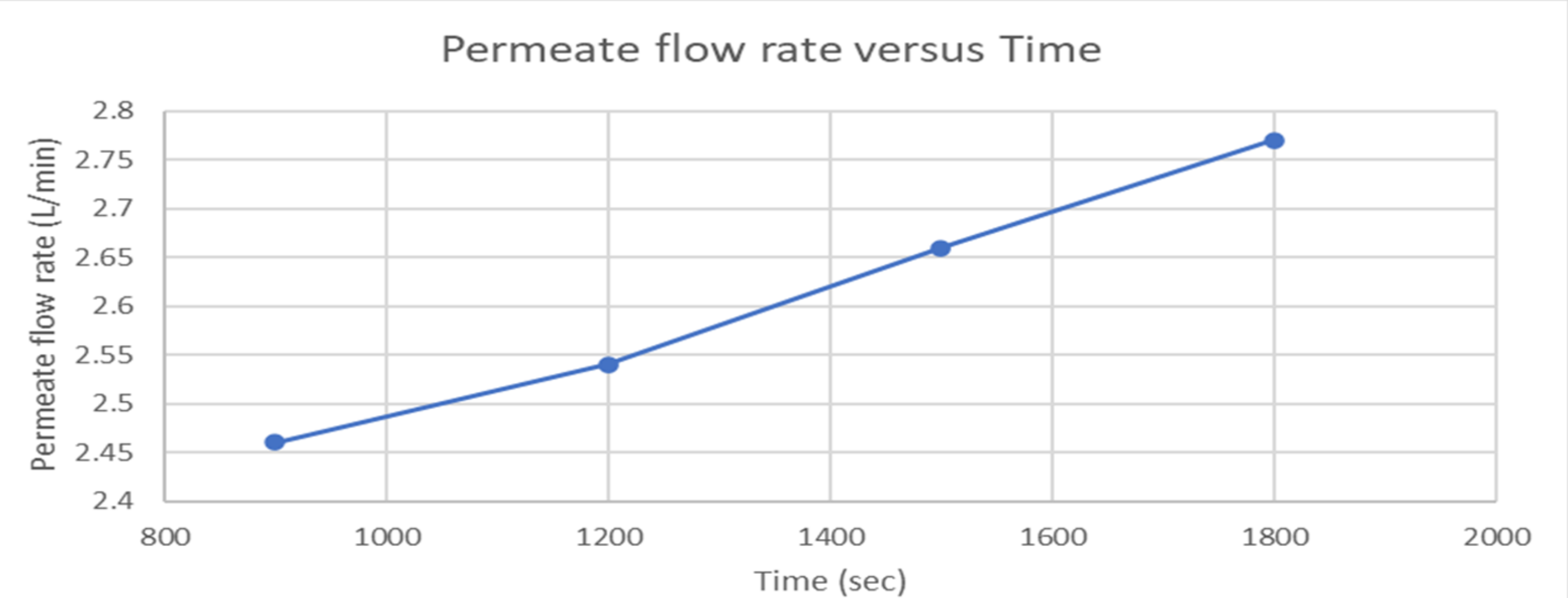
## Objective and Motivation

Earth surface contains 70% water and 97.5% of it is seawater which is not for human consumption, on the other hand, the 2.5% that represents fresh water sources are consumed much faster. Moreover, the population is increasing rapidly and at the same time temperature is increasing too. As it is mentioned in the introduction everything in this world relies on water, therefore, the global water demand is increasing. One of the solutions to desalinate water using RO technology to overcome the global needs and at the same time to reduce the consumption of water and energy for future generation.

The goal of this project is to computerize the fouling cleaning process by using DCS, furthermore, improving the clean cycle by changing the pipe geometry to triangle between the inlet valve and the membrane and driving cleaning pulses to occur at different locations with different frequency ranges, as well as to investigate the effect on membrane performance by measuring electrical conductivity and the permeate flow rate.

## Results

The best outcome from this experiment is applying the cyclic on both reject and inlet valves, that gave us a great results in flowrate and conductivity.



Student Name:  
1- Sayed Mustafa Mohammed  
2- Ali Isa Ali Taher  
3- Hussain Adel Ahmed

Student ID:  
1- 20171001  
2- 20166211  
3- 20164234

Adviser Name:  
1- Dr. Mostefa Ghassoul