Temperature control of reverse osmosis membrane

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One of the components for making dialysis fluid is pure water. A method to purify water from salts and other contaminants is reverse osmosis. This project has been about finding a solution that improves the purification of a device which uses reverse osmosis to purify water.

Dialysis is a life saving method that is used by a lot of people around the world. Baxter is a company that makes products and methods for dialysis treatment. In Periteonal Dialysis (PD) the abdomen is filled with a dialysis fluid that consists of pure water, electrolytes and salts. One of Baxters products is a water device which purifies water that is used in the making of dialysis fluid.

The water device is using a reverse osmosis membrane to purify water from contaminants. The reverse osmosis membrane used by Baxter has a temperature dependency that will affect the performance of the membrane. When the temperature of the water passing the membrane is decreased the salt rejection of the membrane is increased. This means that less salt passes through the membrane and the final product will contain less salt. Another benefit of lowering the temperature of the water is that the bacterial growth inside the water device is decreased.

The goal of the project was to find different solutions how to lower and control the temperature of the water passing the membrane. The different solutions would then be compared against each other to find the best solution. The final goal was to implement the solution on a real system and to test the performance.

There are several methods to cool down water but not all of them are suited for a device like this. Since the water device is a medical product the life time of the solution must be rather long. The space inside the device is also limited so the size of the solution could not be too big. The final solution for this project was a peltier cooler and can be seen in figure 1. The heart of a peltier cooler is several peltier modules. A peltier module is a solid state heat pump which means it has no moving parts. Since it has no moving parts the solution is rather robust. This Peltier cooler absorbs heat from one water flow and dissipate that heat with a second water flow. The water enters and exits the Peltier cooler at the red plugs seen in figure 1.

Figure 1: *Final solution (Peltier cooler)*

The final testings of the solution showed that the water could be decreased and the salt rejection was increased. The results didn't meet the level of the goals that was set in the beginning of the project but some important analysis could be made from the results. The major reason why the results didn't meet the goals was because of the low flow of the dissipating water. To use the full capacity of the Peltier cooler the system has to be modified or alternatively used in a system that's more suitable for the peltier cooler.