Technical Assistance Request

1. Our Concept: Effective cleaning method for vacuum membrane distillation (VMD) modules

The Urban Solar-Thermal Desalination Building uses solar-thermal energy to provide heat for VMD processes and the BWC to create a natural vacuum within the permeate sides of the VMD modules. A schematic diagram of the multi-stage VMD desalination system based on the solar-thermal and barometric head principles is shown in Fig. 1. The system is structured in a vertical direction for following benefits: (1) reduced first cost due to the compact sized system and a small foot print requirement; (2) no limitation in installation as it can be built in anywhere in the city and able to supply water as a decentralized system; and (3) minimized- head loss and -dead storage, which is the volume at the lower than the level of the outlet pipe and typically exists in a horizontal plant.

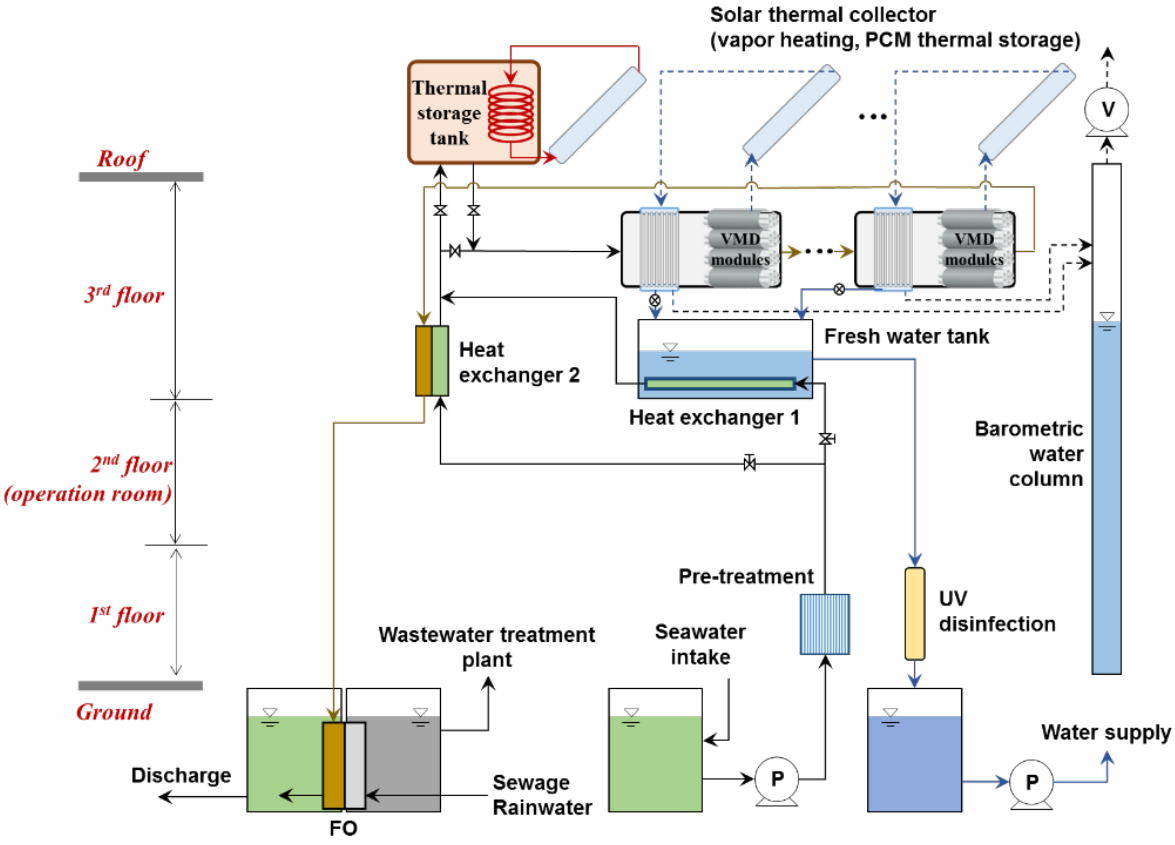

Figure 1. Concept of the Urban Solar-Thermal Desalination Building

2. Challenges: Fouling Control for VMD Modules

Fouling control is an important consideration in the design and operation stages of any water treatment process. For seawater reverse osmosis (SWRO) plants, cleaning-in-place (CIP) with chemicals is most widely used method to remove foulants and maintain the RO membrane performance. The chemicals of the CIP process can weaken the adhesion between the RO membrane and the foulants and help to remove foulants from the membrane. Therefore, an SWRO system requires an additional wastewater treatment system to treat cleaning chemicals

and the spent water after the chemical cleaning process. On the other hand, physical cleaning is used for a low-pressure membrane such as microfiltration (MF) or ultrafiltration (UF). In general, backwashing, air scrubbing, and flushing are applied as a physical cleaning process.

Most membranes including RO, MF, and UF for desalination and freshwater treatment are hydrophilic, and the cleaning processes are commercially developed around the world. Different from these membranes, a VMD modules use hydrophobic membranes and require vacuum pressure inside. Furthermore, membrane scaling is more severe and occurred when operating higher temperature. Therefore, the cleaning processes for the VMD modules should be a unique challenge for the next and final stages as suitable cleaning processes could secure reliable water production and competitive LCOW. When we can advance to the Design Contest, we will request technical assistance of the members of the American-Made Network to resolve this issue.