

## **Fractional-Submerged Membrane distillation crystallizer for resource recovery from desalination plant brine**

\*Youngkwon Choi<sup>1)</sup>, Joowan Lim<sup>2)</sup>, Linitho Suu<sup>3)</sup>, June-Seok Choi<sup>4)</sup>

<sup>1),2),3),4)</sup> *Department of Environmental Engineering, Korea Institute of Civil Engineering and Building Technology(KICT), 283, Goyang-Dearo, Ilsanseo-Gu, Goyang-Si, Gyeonggi-Do, 10223, Republic of Korea*

\* [youngkwon813@kict.re.kr](mailto:youngkwon813@kict.re.kr)

### **ABSTRACT**

Generation of large amount of brine from desalination process is the emerging problem in seawater desalination plant. However, conventional treatment technologies to treat and disposal brine have some limitation such as negative potential on ecosystem and low economic benefit etc. In other to overcome the limitation in brine treatment, in this study, the feasibility of fractional-submerged membrane distillation crystallizer (F-SMDC) with CO<sub>2</sub> injection was investigated for improvement of water recovery ratio and resource recovery from seawater desalination brine. Membrane distillation (MD) and crystallizer (cooling crystallization technique was used in this study) are integrated in a single reactor of F-SMDC process. Hollow fiber MD membrane is installed at top side of reactor, and crystallization phenomenon is induced at bottom side of reactor by temperature control. Top and bottom side are separated by partition. The concentrated feed solution by MD generates the high concentration lay around membrane boundary layer, and then it move to the bottom side by difference of density. The downward stream of concentrated feed solution makes the concentration gradient (CG) phenomenon in reactor (concentration maintenance at top side, continuous increase of concentration at bottom side). CG phenomenon in reactor provides the favorable condition for each process. As a result, higher volume concentration factor and crystal (Na<sub>2</sub>SO<sub>4</sub> and Li<sub>2</sub>CO<sub>3</sub> in this study) were obtained.

---

<sup>1)</sup> Senior researcher

<sup>2)</sup> Post-doctoral researcher

<sup>3)</sup> Student

<sup>4)</sup> Professor

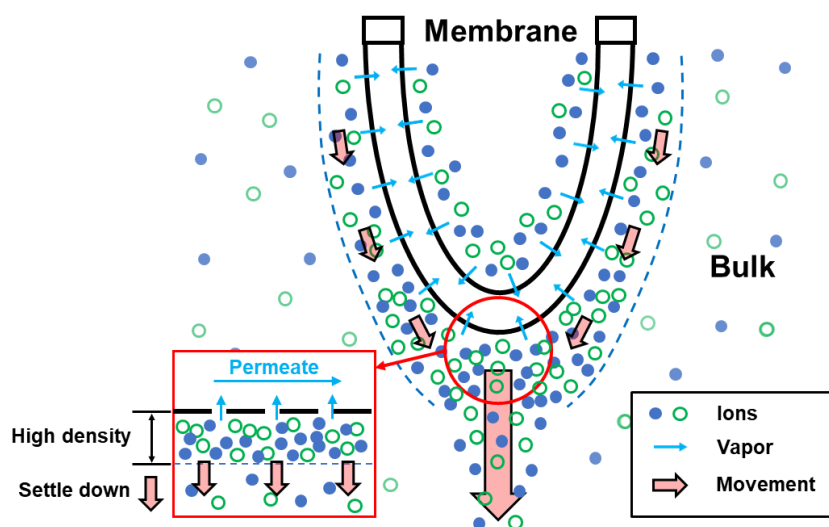


Fig. 1 Gravitation of concentrated feed solution downwards enabling formation of CG/TG in reactor of F-SMDC.

## ACKNOWLEDGEMENT

Research for this paper was carried out under the KICT Research Program (project no. 20240441-001) funded by the Ministry of Science and ICT.

## REFERENCES

- Choi, Y., Naidu, G., Jeong, S., Lee, S., Vigneswaran, S., 2018b. Fractional-submerged membrane distillation crystallizer (F-SMDC) for treatment of high salinity solution. *Desalination* 440, 59-67.
- Choi, Y., Naidu, G., Lee, S., Vigneswaran, S., 2019a. Effect of inorganic and organic compounds on the performance of fractional-submerged membrane distillation-crystallizer. *J. Membr. Sci.* 582, 9-19.
- Choi, Y., Naidu, G., Nghiem, L., Lee, S., Vigneswaran, S., 2019b. Membrane distillation crystallization for brine mining and zero liquid discharge: opportunities, challenges, and recent progress. *Environ. Sci. Water Res. Technol.*
- Macedonio, F., Drioli, E., 2010. Hydrophobic membranes for salts recovery from desalination plants. *Desalin. Water Treat.* 18, 224-234.