

## Development of Decentralized Simple Multiple-Effect Evaporator for Liquid Concentration and Distillation

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### Summary

Comparing with a vacuumed multiple-effect evaporator, it was found that there are two requirements to develop a multiple-effect evaporator with vapor diffusion between flat plates. One is to decrease the vapor diffusion distances to 5mm or less, and another is to decrease the amount of heat carried with condensate and concentrate flowing out of the evaporator. The present author proposed extending plates and wicks of the effects downstream from the heating area and insulating the bottom of the extended area of the first effect. As the condensate and concentrate flow down the extended area, more evaporation and condensation occur with decreasing their temperature, and the amount of total evaporation increases.

An evaporator with the extensions 0.32 times as long as the heating area was constructed, and experimentally explored in evaporating seawater. The evaporator had 5mm diffusion distances through humid air layers between flat plates and four evaporating wicks on the plates. An evaporator without such extensions was theoretically analyzed to find its performance under the same conditions as the experiments. The results of the experiments and theoretical analysis may be described as;

1. Mixing of concentrate and condensate did not occur in any effects with 5mm diffusion distances through humid air layers.
2. The extensions of the effects on insulation decreases temperature of concentrate and condensate, and decrease the amount of heat carried by them flowing out of the evaporator.
3. Comparing with the theoretical results for the evaporator without the extensions, the extensions increase the amounts of evaporation in all effects.
4. Comparing with the theoretical results for the evaporator without the extensions, the extensions increase the total amount of evaporation and the performance of coefficient by 10%.