

### Modeling of multi-stage multi-component membrane gas separation

Michael John Binns, 하성용<sup>1</sup>, 민광준<sup>2</sup>, 김진국\*  
한양대학교; <sup>1</sup>에어레인; <sup>2</sup>GS건설  
(jinkukkim@hanyang.ac.kr\*)

Membranes have been used for many years to perform various gas separations. Compared with alternative separation processes they are relatively easy to install and take up less space since they can be tightly packed in bundles. They can achieve high purity and separation efficiency but may require very high pressures or large membrane surface areas. In this study models are developed to simulate the multi-component separation of gases using hollow fibre membranes. The simulated membranes are operated in counter-current flow pattern and are solved dynamically and at steady state. These models are connected to form a multi-stage membrane superstructure which allows higher purities and involves recycling and 2 or 3 membranes. The resulting superstructure can be solved iteratively using 1-stage membrane models or simultaneously using a combined multi-stage membrane model. Optimisation of the superstructure gives the optimal membrane area(s) and pressures which minimise the cost of the separation.

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