

초청강연

Fabrication of Hollow Fiber Membranes for Gas Separation: Historical Development and Technology Challenges Ahead

Tai-Shung Chung*

Department of Chemical and Environmental Engineering, National University of Singapore, 10 Kent Ridge Crescent, Singapore 119260

Polymeric hollow fiber membranes are market driving high-performance products. In many cases, polymeric hollow fiber membranes were produced prior to the fundamental understanding of detailed fabrication mechanisms. Even today, most membrane scientists admit that they understand hollow fiber forming mechanism qualitatively, but not quantitatively. New hollow fiber membranes were prepared or invented mainly based on our experience, empirical data, limited qualitative and scientific understanding, and luck. Therefore, polymeric membranes have emerged as one of the fastest growing research areas in these days.

In this presentation, we will review technology breakthroughs for gas separation membranes in the last two decades and the challenges awaiting us. A critical examination on the fundamentals of asymmetric and composite hollow fiber spinning and membrane formation will be carried out. We will start the basic principle of dope preparation and principle of phase inversion process. We will analyze the limitations of using Flory-Huggins theory for hollow fiber formation. Various technologies to develop ultra-thin skin-layer hollow fiber membranes will be reviewed and compared in terms of their uniqueness, impact, and the remaining uncertainties in these technologies. The effect of shear stress and shear experience within a spinneret during hollow fiber spinning on membrane morphology and gas separation performance will be analyzed and the problem of aging and plasticization will be discussed. Following which, we may discuss a few important and challenging topics that need more attention as well as answers from membrane scientists and engineers.

*E-mail: chencts@nus.edu.sg