Development of multibore hollow fiber membranes for water deoxygenation

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Abstracts

The concentration of dissolved oxygen (DO) is critical to the quality of high-purity water required by semiconductor and pharmaceutical manufacturing processes, the injection liquid in oil/gas offshore industry for oil production as well as boiler water in power plants. Membrane contactor is an emerging technology for water degassing which easily reduces the DO level to below 10 ppb. Membrane contactors have a smaller footprint, they are simple to operate and maintain, they are modular and therefore to scale up easily, and their operating cost is much lower than that of conventional technologies such as vacuum tower or forced draft degasifier. With these advantages, however, membrane contactor is not replacing conventional technologies for oxygen removal. The main concern from industry is the limited throughput of the membrane contactor available in the market. As well, the membrane configuration, i.e., small in diameter and thin in wall thickness, is another issue for the cases where foulants are available. Robust and highly permeable degassing membranes are in need.

To obtain robust and more universal membrane contactor, we have developed multibore hollow fiber membranes. Specifically, 3-bore and 7-bore hydrophobic hollow fiber membranes have been prepared using poly(vinylidene fluoride). The multibore hollow fibers have been extensively characterized in terms of morphology, hydrophobicity, tensile strength, pore structure, and permeation properties. It is observed that the newly-developed hollow fibers are much more robust as compared to conventional single-bore hollow fibers. Experimental studies are carried out to explore how the membrane characteristics (e.g., membrane structure and fiber dimension) and operating conditions (e.g., temperature and flow rate) influence the efficiency of oxygen removal. Theoretical studies are also conducted to understand the factors dominating the mass transfer of the deoxygenation process. The experimental and theoretical studies are ongoing and the results will be presented in the conference.

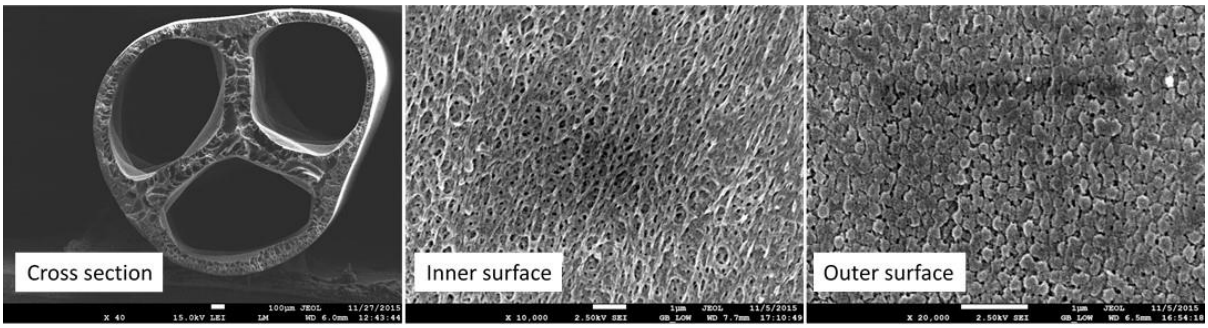


Figure 1. Morphology of 3-bore hollow fiber