

## Novel ceramic hollow fibre membranes contactor derived from kaolin and zirconia for ammonia removal and recovery from synthetic ammonia

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### ABSTRACT

The adverse effects of ammonia found in wastewater streams lead to the development of advanced water treatment technology, i.e. membrane contactor (MC). In this study, single layer hollow fibre membrane (SLZK) and dual layer hollow fibre membrane (DLZK) were prepared from zirconia and kaolin and modified into hydrophobic membrane through simple grafting process via fluoroalkylsilane (FAS) agent. The properties of membranes such as morphology, surface roughness, mechanical strength, wettability and liquid entry pressure were analysed through scanning electron microscopy (SEM), atomic force microscopy (AFM), 3-point bending strength, contact angle and LEPw setup. Finally, the performance of the membranes was also investigated towards ammonia removal via membrane contactor system. Our findings showed that hydrophobicity properties significantly improved for both SLZK and DLZK membranes after grafting modification process as indicated by the increase of contact angle value from 5° and 1° to 132.7° and ~180.0° respectively. Based on the morphological analysis, the surface of DLZK showed more porous structure as compared to the SLZK. In addition, DLZK also displayed the highest mechanical strength and contact angle reading of 125 MPa and ~180° respectively. This suggests that the DLZK showed an excellent membrane contactor performance with highest value of mass transfer coefficient ( $3.77 \times 10^{-5} \text{ ms}^{-1}$ ) and almost complete removal of ammonia

removal (91%). Overall, these results implied that dual layer ceramic membrane developed from kaolin and zirconia could provide the basis for the development of alternative ceramic membrane with excellent properties for membrane contactor system.

#### **KEYWORDS**

Single layer hollow fibre membrane; Dual layer hollow fibre membrane; Hydrophobic membrane; Ammonia; Membrane contactor

#### **ACKNOWLEDGEMENT**

The authors gratefully acknowledge financial support from the Ministry of Higher Education Malaysia under the Fundamental Research Grant Scheme (Project Number: R.J130000.7809.5F161) and Higher Institution Centre of Excellence Scheme (Project Number: R.J090301.7809.4J430), and Universiti Teknologi Malaysia under the Collaborative Research Grant (Project number: Q.J130000.2409.08G29) and Matching Grant (Project number: Q.J130000.3009.03M15). The authors would also like to thank Research Management Centre, Universiti Teknologi Malaysia for the technical support.