

ABSTRACT

PREPARATIONS OF COMPOSITE CERAMIC MEMBRANE TO BE APPLIED IN SEA WATER DESALINATION

Heri Setiawan^{1,2}, Raisa Khairani¹, Rino Rakhmata Mukti³, Hermawan K. Dipojono^{4,5} and Bambang Sunendar Purwasasmita^{1,5}

¹Laboratory of Advanced Material Processing, Department of Engineering Physics, Faculty of Industrial Technology, Institut Teknologi Bandung, Jl. Ganesha 10, Bandung 40132, Indonesia.

²Bandung State Polytechnic for Manufacturing, Jl. Kanayakan No. 21, Bandung 40135, Indonesia

³Department of Chemistry, Faculty of Mathematics and Natural Sciences, Institut Teknologi Bandung, Bandung 40132, Indonesia

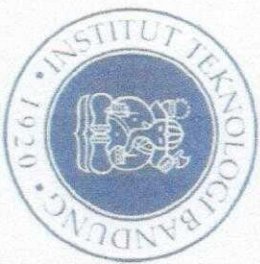
⁴Laboratory of Computational Material Design, Department of Engineering Physics, Faculty of Industrial Technology, Institut Teknologi Bandung, Jl. Ganesha 10, Bandung 40132, Indonesia

⁵Research Center for Nanosciences and Nanotechnology, Bandung Institute of Technology, Bandung 40132, Indonesia.

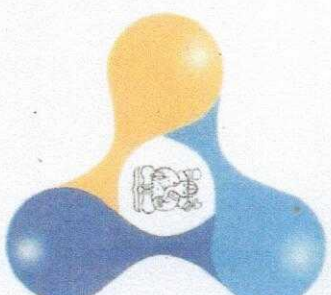
*E-mail: heris@polman-bandung.ac.id.

Membrane-based desalination technology is one of solution to provide clean water supplies. This technology can resolve the shortage from ground and surface water supplies, to meet the needs of growing human population. Ceramic materials gamma alumina ($\gamma\text{-Al}_2\text{O}_3$) and zeolites are known to have mechanical strength, thermal and chemical stability better than organic materials, as well as having the characteristics of high surface area and molecular sieve, which potentially to be use as desalination membrane. In this work $\gamma\text{-Al}_2\text{O}_3$ and zeolite nanoparticles were synthesized and then were coated on the surface of the porous geopolymer support to be used as desalination membranes. The $\gamma\text{-Al}_2\text{O}_3$ was synthesized using polyethyleneglycol (PEG) 6000 as template ($\gamma\text{-Al}_2\text{O}_3\text{+PEG}$) through aging in ultrasonic bath for 4 hours in form of white powder. resulting morphology particles was rod with diameter about 10-20 nm and 40-70 nm in length, surface area reached to 326.26 m²/g, total pore volume of 0.10 cm³/g and average pore diameter about 2.10 nm. Zeolite nanoparticles were obtained with composition 6Na₂O: 0,55Al₂O₃: SiO₂: 150H₂O in the form of white powder with particle size varied in the range of 100-400 nm, surface area reached to 97.32 m²/g, total pore volume of 0.80 cm³/g and average pore diameter of 11.19 nm. The support was made of geopolymer materials (natural zeolites, silica sand, and activated carbon with metakaoline as binder) and has porous structure, with dimensions size ± 5 cm in diameter and $\pm 0,8$ cm in thickness. The membranes were prepared by three kinds of coatings, the $\gamma\text{-Al}_2\text{O}_3$ coating (Al membrane), zeolite coating (Z membrane), and a of $\gamma\text{-Al}_2\text{O}_3$ and zeolite (Al+Z membrane). The performance of membranes was evaluated by measuring the rejection and flux values of saline water NaCl 1% (w/v) that was passed through the membrane. Zeolite membrane (Z membrane) demonstrated the highest salt rejection, amounted to 87.88%, whereas the membrane consist of $\gamma\text{-Al}_2\text{O}_3$ and zeolite (Al+Z membrane) resulted in rejection of 68%. The $\gamma\text{-Al}_2\text{O}_3$ membrane (Al membrane) resulted in the lowest rejection, reached to 57.14%. The highest flux was obtained by the Al membrane, reached to 3.43x10³ L/m²h on the 54.29% rejection value; whereas the Z membrane resulted in 3.28x10³ L/m²h and 87.88% on flux and rejection values, and the Al+Z membrane showed the lowest flux of 2.91x10³ L/m²h at 62% rejection value. It can be concluded that the synthesized $\gamma\text{-Al}_2\text{O}_3$ and zeolite is an alternative ceramic materials to be used as desalination membrane.

Keywords: Ceramic membranes, Gamma alumina, Zeolite, Desalination



SERTIFIKAT



diberikan kepada

Heri Setiawan

atas partisipasinya sebagai

Pemakalah
dalam

Symposium Nanotechnology 2016

yang diselenggarakan di Grand Inna Kuta, Bali

28 - 29 Oktober 2016

Ketua Panitia

Kepala Pusat Penelitian Nanosains
Nanoteknologi - ITB

Dr. Triati Dewi Kencana Wungu

Prof. Ir. Hermawan K. Dipojono, MSFE., Ph.D