ChemTech

International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.10 No.3, pp 76-79, 2017

Cellulose Actetate Membrane Using Water Hyacinth And Its Operation

Alia Damayanti, Rachmilda Pinnata Daia

Department of Environmental Engineering, Institut Teknologi Sepuluh Nopember (ITS), Surabaya,Indonesia.

Abstract : Sea water has the potential to be processed into clean water through desalination. The technology is currently being rapidly adopted for the desalination process through the membrane. The simple method to obtain a membrane is important. This study has used cellulose acetate from water hyacinth as raw material for the manufacture of membranes for desalination0.

Microbial cellulose from water hyacinth formed by 200 ml starter *Acetobacter xylinium* soaked in 4% NaOH for 24 hours and then washed with distilled water. The membrane is made by mixing clumps of cellulose acetate in dichloromethane solvent to form a dope and printed on glass plates. Cellulose acetate membranes is made and tested through dead-end operation with varying influent concentrations therefore 19.572 mg Cl^-/L, 8.388 mg Cl^-/L, and 5.992 mg Cl^-/L.

With a 200 mLstarter*Acetobacterxylinium*anda pressure of 1atm, the membrane rejection capability trend occurs follow orde 0 as the Cl^- concentration decrease inline with filtration time. The resulting membranes was ultrafiltration membranes with a pore size membrane produced between 19.43 nm to 58.28 nm.

Keywords : desalination, water hyacinth, membranes, celluloseacetate, ultrafiltration.

Introduction

The rate of water consumption in the world has doubled for every twenty years, exceeding twice the rate of human growth. Some have calculated that by 2025, demand for water will exceed supply by 56%. Lack of clean water may affect many things, which can reduce the level of life and reduce economic development. This shows that the world needs away to increase the supply of clean water. One source of potential as a source of cleanwater is seawater. Sea water canbe used as clean water by using desalination process[1].

Desalination is a separation process to reduce the amount of salt dissolved in seawater up toa certain level so that water can be used[2]. Several methods of filtration and purification has been researched and developed to obtain fresh water from seawater or waste water[3-5]. Today, desalination as an effort to increase the supply of clean wateris one of the urgent problems to get attention. That is becausethe growth of population, industry and irrigation should be offset by the availability of sufficient fresh water.

The technology is currently being rapidly adopted for the desalination process is through the membrane, but the price is relatively expensive commercial membranes[7-8]. This causes the need for technology in the country to create a membrane with a cheaper price from using cellulase acetate[9-10]. In this study the use of cellulose acetate from water hyacinth as raw material for the manufacture of membrane for desalination process.

Based on the above, water hyacinth with a big number will be used as raw material for the manufacture of cellulose acetate membrane for desalination. The membrane has high economic value and also high benefit to the community. In this study,membrane characterization tests has done with a variety of feedback, namely: 19.572mgCl^-/L, 8.388mgCl^-/L, and5.992mgCl^-/L. This is to determine the effect of feed concentration on the ability ofthe membrane desalination.

Material and Methods

Materials

Ingredients: water hyacinth, $(NH_4)_2SO_4$, starter *Acetobacter xylinium*, NaOH, CH_3COOH, glacial acetic acid, sulfuric acid, distilled water, 2-propanol, dichloromethane. Equipment: blender, magnetic stirrer, shaker, filter paper, stir bar, Dead-End reactor. Cl^- is examined using spetrophotometry[11].

Preparation ofMicrobialCelluloseWater Hyacinth

Hyacinth that have been washed, cut into small pieces and then blended, filtered to take a liquid concentrates. The concentrate is heated to a temperature of 100°C to a boil, then add sugar to 10% and $(NH_4)_2SO_4$ 2.5% was stirred and cooled and adjust pH=4. Add *Acetobacter xylinium* into the mixture. In this study used a nine-day incubation period, so that the resulting gelnatahasa thickness from 3 to 8mm and the slipperry surface.

In the early stages of the preparation of cellulose acetate membranes, performed by filtering out the clumps of yellowish white hydrolysis reaction results using filter paper and washing repeatedly using distilled water and ethanol which aims to reduce the smell of acid and acid content. Followed by the vacuum pump and mixing with dichloromethane to obtain dope solution.

In the printing process membrane, used in the form of polyester support layer. Cellulose acetate membrane with polyester support layer has a tensile strength and carrying capacity of the membrane[12].

Results and Discussion

Of the membrane that has been formed through the process of characterization test Dead-End and SEM. Characterization of membrane aimed to determine the ability of the membrane in the process of desalination by Cl^- examination[12], membrane structure, and the pore size of the membrane.

The ability of membranes in desalination process

The ability of the membrane desalination process depends on the ability of the membrane to the particle to reject Cl^-. Rejection efficiency is defined as the fraction of the retained solute concentration membrane. Efficiency is used as a parameter for calculating the value of membrane permselectivity. The varying concentrations of Cl^- 19.572 mg/ l8.388 mg Cl^-/L, and 5.992 mg Cl^-/L where the filtered through the filter tool in the form of Dead-End reactor. At each 10 minutes, the resulting permeate rejeksinya measured values (%) with applied pressure is 1 atm. Seen in Figure 1, the difference value of rejection every 10 minutes, where the rejection rate increases exponentially with time.

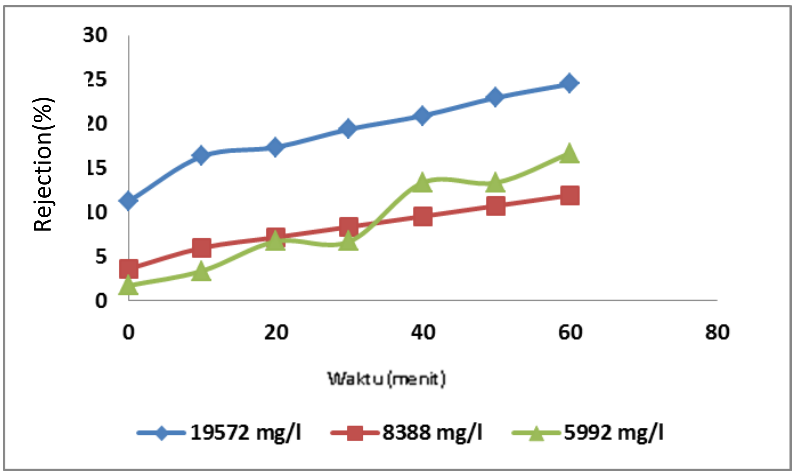
Change the value of such rejection may occur due to the process of fouling (pore blockage) membrane that can withstand the solute particles in the feed. The longer the time, the more particles are retained on the membrane which can cause blockage of the membrane pores. Membrane rejection values calculated by the equation:

$$R = (1 - C_p) / CJ) \times 100\% \quad (1)$$

Remarks:
R= coefficient of rejection
Cp= concentration of particles in the permeate

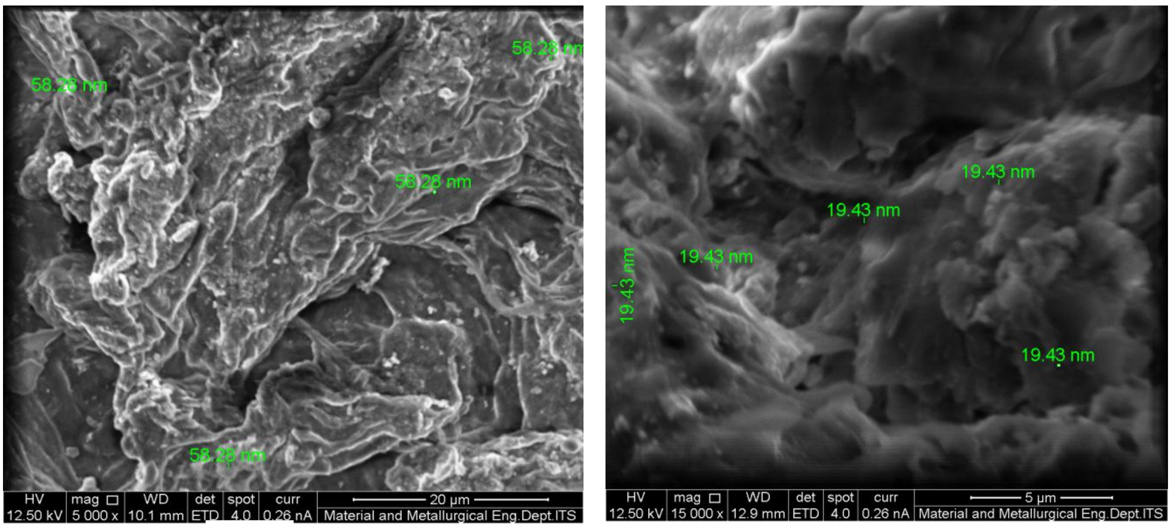
CJ = particle concentration in the feed

The concentration which used during the characterization tests is the membrane reactor dead-end affect the ability of the membrane to filter dissolved particles contained in the feed. The higher the concentration of the feed, the content of dissolved particles in the feed the more so the more soluble particles that can beretainedbythe membrane surface. In Figure1 we can seethat over time the operation of the membrane, the membrane rejection rate will increase has ode one in trend.Visible differences were significant rejection values be tween feed concentration of19.572mgCl^-/L witha feed concentration of 8.388mgCl^-/L and 5.992mgCl^-/L. With a200mLstarter*Acetobacter xylinium* and a pressure of 1atm, the membrane rejection capability trend occurs follow orde 1 can be seen in Figure 1. Efforts should be made to produce cellulose acetate membrane rejection rate is good is to increase the operating time of the membrane. In addition to the operating time of the membrane, the concentration of cellulose acetate added (increasing the number of starter *Acetobacterxylinium*) orby mixing the polymer material known to minimize the pores of the membrane[12]. The membrane rejection capability trend occurs follow orde 0 as the Cl^- concentration decrease inline with filtration time.



Time (minute)

Figure 1.The relationship between the value of the membrane rejection with increasing feed concentration time



(a) (b)

Figure 2.SEM photos Cellulose Acetate Membrane Surface:
(a) Magnification 5000times,
(b) magnification of15000times

Membrane Morphological

Morphological analysis membrane was used in order to see the size of the pores of the membrane. The measurement of the membrane pores used SEM technique can be seen in Figure 2. The size of the pores were identified through SEM imagesranged from19.43nm to58.28nm. From theresults of the dataof thissize, thenthemembraneis include an ultrafiltration membrane. The measured result is the same according to membrane sizeasde fined by Ghaffour et al.[13].

Conclusions

From the analysis and discussion of this study concluded that thefeed concentration significant influence on the ability of the cellulose acetate membrane desalination processes(rejection particle Cl). Test with a characterization of the membrane ata feed concentration of19 572mg Cl/L has the best ability in the desalination process, namely the rejection rate reaches 25% has orde one.

Acknowledgment

The author would like to thank to Ministry High Education Indonesia for funding this study by Fund of Research for New Doctor.

References

1. M'nif, A., Bouguecha, S., Hamrouni, B., Dhahbi, M. 2007. Coupling of Membrane Processes for Brackish Water Desalination. Desalination, 203:331-336.
2. Akili, D. K., Kutubkhanah, I. K., J-M, Wie. 2008. Advances in Seawater Desalinatiom Technologies. Desalination, 221:47-69.
3. Damayanti, A., Ujang, Z., Salim, MR, Ollsonn G., Sulaiman, AZ. 2010. Respirometric analysis of activated sludge models from palm oil mill effluent. Bioresource Technology. 101(1).
4. Damayanti A., Hidayanti W., Masduqi A., Soedjono ES, Mangkoedihardjo S. 2013[a]. The Use of Shells as membrane Material for Sea Water Desalination. International Journal of Academic Research 5 (6).
5. Damayanti A., Dewi S.C. , Ahmad, Z. 2013[b]. The use of coconut choir as a raw material for the fabrication of seawater membrane desalination.International Journal of Academic Research Part A 5 (5), 221-225.
6. Damayanti, A., Ujang, Z. Salim, M. R., Ollson, G. 2011[a]. The Effect of Mixed Liquor Suspended Solids (MLSS) on Biofouling in a Hybrid Membrane Bioreactor for the Treatment of High Concentration Organic Wastewater. Water Science and Technology, 63(8).
7. Damayanti, A., Z. Ujang, MR Salim, 2011[b]. The influenced of PAC, zeolite, and Moringa oleifera as biofouling reducer (BFR) on hybrid membrane bioreactor of palm oil mill effluent (POME). Bioresource Technology, 102(6).
8. Wenten, I. G. 1995. Teknologi Membran Industrial. Institut Teknologi Bandung. Bandung.
9. Lindu, M., Puspitasari, T., Ismi, E., 2010. Sintesis dan Karakterisasi selulosa Asetat Dari *Nata de Coco* Sebagai Bahan Baku Membran Ultrafiltrasi. Jurnal Sains Materi Indonesia, 12:17-23.
10. Pratomo, H. 2007. Pembuatan Dan Karakterisasi Membran Komposit Polisulfon Selulosa Asetat Untuk Proses Ultrafiltrasi. Jurnal Pendidikan Matematika dan Sains, Edisi 3 Tahun VIII.
11. (11).APHA, AWWA, AWF. 2012. Standard Methods for the Examination of Water adn Wastewater 22nd edition. New York.
12. Pasla, F., R. 2006. Pencirian membran Selulosa Asetat Berbahan Dasar Selulosa Bakteri dari Limbah Nanas. PKM-GT Fakultas Matematika dan Ilmu Pengetahuan Alam. IPB, Bogor.
13. Ghaffour, N, Naceur, M.W., Drovido, N, Mahmoudi, H. 2009. The use of ultrafiltration membrane in the treatment of refinery wastewater. Desalination and Water Treatment. 5:159-166.

*****