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Investigating the effect of pressure and concentration on permeability of methylene blue through a geopolymeric membrane based on phosphorus slag

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The effluent from textile factories carries various types of hazardous chemicals through a few stages of manufacturing processes and also known to contain highly coloured species[1]. Not only colours, the break down products are toxic and harmful to human and living organisms, raising attention to the world on the importance of removing the dyes from the wastewater. Recently, membrane separation techniques which used polymeric and inorganic materials have also been introduced for dye removal[2]. In this article, 3 pre-prepared membranes p1, p2 and p3 were tested to test the permeability and removal of methylene blue effluent. Each of the membranes were compacted with distilled water for 25 minutes before starting the effluent test. In the next step, the membranes were tested at 3 pressures of 1, 2, and 3 bar and concentrations of 20, 30, and 40 ppm for 30 minutes. All 3 membranes are based on phosphorus slag and compounds of mullite and microsilica with sodium hydroxide and sodium silicate alkaline activators. The results showed that all 3 membranes have a rejection rate of over 85% in all 3 tested pressures and concentrations. By comparing the results in order to obtain the best result, taking into account the optimal permeability of the membrane, p2 is the selected membrane with a separation rate of 97% and a permeability of $69\times 10^{-7}\ m^3/m^2 s$ at 3 bar pressures and 20 ppm concentrations. According to the results obtained from the BET analysis, the selected membrane has a pore size of 12.42 nm and a porosity of 20.84%. In the spectrum of the sample analyzed by FT-IR, there is a broad and strong main absorption band that appeared in the range of 979 cm^{-1}, which is related to the asymmetric stretching vibrations of Si-O(Al) in the tetrahedron SiO4 and asymmetric stretching of Al [3]

Keywords: Membrane, phosphorus slag, mullite, geopolymerization

References

[1] N. Zaghbani, A. Hafiane, and M. Dhahbi, “Separation of methylene blue from aqueous solution by micellar enhanced ultrafiltration,” *Sep. Purif. Technol.*, vol. 55, no. 1, pp. 117–124, 2007, doi: 10.1016/j.seppur.2006.11.008.

[2] Richard W. Baker, “Membrnae Technology,” *Encycl. Polym. Sci. Technol.*, vol. 3, pp. 121–153, 2010, [Online]. Available: http://www.sciencedirect.com/science/article/pii/B9781856176323000070

[3] M. Elzeadani, D. V. Bompa, and A. Y. Elghazouli, “One part alkali activated materials: A state-of-the-art review,” *J. Build. Eng.*, vol. 57, no. April, p. 104871, 2022, doi: 10.1016/j.jobe.2022.104871.