

BAB V

KESIMPULAN DAN SARAN

V.1 Kesimpulan

Berdasarkan hasil penelitian dan pembahasan, maka dapat disimpulkan:

1. Penurunan persentase konsentrasi Cu(II) yang paling tinggi terdapat pada larutan Cu(II) dengan konsentrasi awal 8.000 ppn pH = 6 yakni sebesar 13,84% Sedangkan penurunan persentase konsentrasi Cu(II) yang paling rendah terdapat pada larutan Cu(II) dengan konsentrasi awal 12.000 ppn pH = 5 yakni sebesar 4,39%
2. Konstanta kinetika adsorpsi (k) pada larutan Cu(II) pH = 4 dengan konsentrasi awal 8.000 ppm , 10.0000 ppm, dan 12.000 ppm adalah 0,0328; 0,0333; dan 0,0349. Larutan Cu(II) pH = 5 dengan konsentrasi awal larutan Cu(II) 8.000 ppm , 10.0000 ppm, dan 12.000 ppm memiliki konstanta kinetika adsorpsi (k) sebesar 0,0186 , 0,0172 , dan 0,0118. Sedangkan pada larutan Cu(II) pH = 6 dengan konsentrasi awal larutan 8.000 ppm , 10.0000 ppm, dan 12.000 ppm memiliki konstanta kinetika adsorpsi (k) sebesar 0,0294 , 0,0161 , 0,0135.

V.2 Saran

Dari penelitian ini saran yang dapat diberikan peneliti yaitu perlu adanya penelitian lebih lanjut mengenai kemampuan *Pseudomonas putida* dalam bentuk *dry cells* sebagai biosorben dalam proses biosorpsi logam Cu(II).

DAFTAR PUSTAKA

- [1] N. I. Said, "METODA PENGHILANGAN LOGAM BERAT (As, Cd, Cr, Ag, Cu,Pb, Ni dan Zn) DI DALAM AIR LIMBAH INDUSTRI," *Pusat Teknologi Lingkungan, BPPT.*, 2010.
- [2] A. P. Daud Satria Putra, "ANALISIS PENCEMARAN LIMBAH CAIR KELAPA SAWIT BERDASARKAN KANDUNGAN LOGAM, KONDUKTIVITAS, TDS, DAN TSS," *Jurnal Fisika Unand*, 2014.
- [3] B. Volesky dan Z. Holan, "Biosorption of Heavy Metals," *Department of Chemical Engineering, McGill University, 3480 University Street, Montreal, Canada H3A 2A7.*, p. 237, 1995.
- [4] R. Dewi, "Penentuan Kondisi Optimum pada Pembentukan Kompleks Fe(III)-Fenantrolin dengan Spektrofotometri UV-Vis," 2014.
- [5] H. Palar, *Pencemaran dan Toksikologi Logam Berat*, Jakarta: PT. Rineka Cipta, 2004.
- [6] R. T. P. M. Siti Marwati, "PEMANFAATAN ION LOGAM BERAT TEMBAGA(II), KROMIUM(III), TIMBAL(II), DAN SENG(II) DALAM LIMBAH INDUSTRI ELECTROPLATING DALAM PELAPISAN LOGAM BESI," *Prosiding Seminar Nasional Penelitian, Pendidikan dan Penerapan MIPA, Fakultas MIPA, Universitas Negeri Yogyakarta*, 2009.
- [7] G. GM., "Interactions of Fungi with Toxic Metals," *Phytologist*, vol. 124, pp. 25-60, 1993.
- [8] B. C. Martins, "A Sorption and Desorption of Pb²⁺ ions by dead *Sargassum* sp. Biomass," *Biochemical Engineering Journal*, vol. 27. no 3, pp. 310-314, 2006.
- [9] S. A. S. J. P. J. Bareng Monika, "Biosorption of Heavy Metals from Wastewater by Using Microalgae," *International Journal of Chemical and Physical Sciences*, 2014.
- [10] 27 Januari 2017. [Online]. Available: <https://id.m.wikipedia.org/wiki/sisteina>. [Diakses 4 Desember 2018].
- [11] H. Z. VoleskyB, "biosorption of heavy metals," *Biotechnol Prog* 11, p. 235, 1995.

- [12] a. Z. H. B. Volesky, "Biosorption of Heavy Metals," *Department of Chemical Engineering, McGill University, 3480 University Street, Montreal, Canada H3A 2A7*,, p. 237, 1995.
- [13] D. Cotoras, P. Viedma dan J. Pimentel, "Biosorption of metal ions by attached bacterial cells in a packed-bed bioreactor.," *In Biohydrometallurgical Technologies*, pp. 103-110, 1993.
- [14] Y. K. Sag, "The Selective Biosorption of Chromuim (VI) and Copper ion (II) ion from binary metal mixtures by *R. arrhizus*," *Process Biochem*, 1996.
- [15] M. S. Espinosa-Urgel, "Genetic Analysis of Functions Involved in Adhesion of *Pseudomonas Putida*," *Journal of Bacteriology*, vol. 182, pp. 2363-2369, May 2002.
- [16] A. Marcus, "Versatile soil-dwelling microbe is mapped," January 2003.
- [17] H. Kowalski, "German Research Consortium Sequences Genome of Versatile Soil Microbe," Desember 2002.
- [18] C. F. Hardwood, "Flagellation of *Pseudomonas Putida* and Analysis of its motile behavior," *Journal of Bachterology*, vol. 171, pp. 4063-4066, July 1989.
- [19] H. M. Pardo R, "Biosorption of Cadmium, copper, lead, and zinc by inactive biomass of *Pseudomonas Putida*," *Anal Bioanal Chem*, vol. 376, pp. 26-32, 2003.
- [20] "AGROTEKNO LAB," 2012. [Online]. Available: <http://www.agrotekno-lab.com/2015/06/pseudomonas-putida.html>. [Diakses 5 Desember 2018].
- [21] Y. P. W. Q. L. J. Y. S. ., W. X. W. Y. X. C. Xin Cai Chen, "Biosorption of copper(II) and zinc(II) from aqueous solution by *Pseudomonas putida* CZ1," *Colloids and Surfaces B: Biointerfaces*, 2005.
- [22] S. F. I. K. K. H. M. Hany Hussei, "Biosorption of heavy metals from waste water using *Pseudomonas* sp.," *Electronic Journal of Biotechnology*, 2004.
- [23] E. O. M. S. A. Bulu, "Adsorption of Malachite Green Onto Bentonite : Equibrilium and Kinetics Studies and Process Design, Microporous and Mesoporous Materials," *Elsevier* , 2008.
- [24] H. S. S. R. Betty, "Studi Kinetika Adsorpsi Logam Cu²⁺ dengan Menggunakan Adsorben Zeolit Alami Teraktifasi".

- [25] K. Y.-S. Y. Vijaraghavan, "Bacterial Biosorbent and Biosorption," *ScienceDirect*, pp. 266-291, 2008.
- [26] M. H. ., E. B. Rafael Pardo, "Biosorption of cadmium, copper, lead and zinc by inactive biomass of *Pseudomonas Putida*," *Anal Bioanal Chem (2003)*, 2003.
- [27] J. Lab, "Its Elemental- The Periodic Table of Elements," 29 April 2009. [Online]. Available: <http://id.m.wikipedia.org..> [Diakses 30 November 2018].
- [28] R. Kementerian Lingkungan Hidup, "PERATURAN MENTERI LINGKUNGAN HIDUP REPUBLIK INDONESIA TENTANG BAKU MUTU AIR LIMBAH," 2014.
- [29] K. Foo dan B. Hammed, "Insight Into Modeling of Adsorption Isotherm System," *Elsevier: Chemical engineering Journal*, 2009.
- [30] e. O. M. S. A. Bulut., Adsorption of Molachite Green Onto Bentonite: Equilibrium and Kinethics Studies and Process Design, vol. 115, Elsevier, 2008, pp. 234-256.