

BAB V

KESIMPULAN DAN SARAN

5.1 Kesimpulan

Dari hasil penelitian dapat disimpulkan bahwa:

1. Pada proses biosorpsi pada *Chlorella sp.*, jenis zat warna berpengaruh terhadap persentase *removal* zat warna yang didapatkan.
2. Pada proses biosorpsi pada *Chlorella sp.*, pH berpengaruh terhadap persentase *removal* zat warna. Kondisi dengan persentase *removal* tertinggi dalam penelitian ini pada zat warna merah tertinggi dalam kondisi pH sebesar 7 dengan persentase *removal* sebesar 12,6%, pada zat warna biru tertinggi dalam kondisi pH sebesar 11 dengan persentase *removal* sebesar 31,5% dan pada zat warna kuning tertinggi dalam kondisi pH sebesar 7 dengan persentase *removal* sebesar 13,9%.

5.2. Saran

Saran yang dapat diberikan dari penelitian ini adalah:

1. Untuk penelitian selanjutnya dapat dilakukan dengan menggunakan konsentrasi mikroalga yang lebih banyak untuk menaikkan tingkat penyerapan zat warna.
2. Penggunaan nutrisi pada proses kultivasi mikroalga dibuat menjadi lebih banyak dalam proses kultivasi mikroalga sehingga mikroalga dapat bertumbuh dengan pesat.
3. Untuk penelitian selanjutnya, dalam perhitungan kepadatan sel bukan hanya mikroalga yang masih hidup saja yang dihitung namun dihitung pula mikroalga yang mati untuk memperluas pembahasan yang dilakukan.

DAFTAR PUSTAKA

- Acuner, E. & Dilek, F. B., 2004. Treatment of Tectilon Yellow 2G by *Chlorella vulgaris*. *Process Biochemistry* 39, pp. 623-631.
- Aksu, Z., 2005. *Process Biochemistry Vol. 40*, p. 997.
- Amoatey, P. & Bani, R., 2011. Wastewater Management. In: *Waste Water : Evaluation and Management* . s.l.:s.n., pp. 379-398.
- Artega, L. C., Zavaleta, M. P., Eustaquio, W. M. & Bobadilla, J. M., 2018. Removal of Aniline Blue Dye Using Live Microalgae *Chlorella vulgaris*. *Journal of energy & environment science*, pp. 6-12.
- Banat, I. M., Nigam, P., Singh, D. & Marchant, R., 1996. Microbial Decolorization of Textile Dye Containing Effluents. *Bioresource Technology*, III(58), pp. 217-227.
- Barsanti, L. & Gualtieri, P., 2006. *Algae : Anatomy , Biochemistry, and Biotechnology*. s.l.:Taylor and Francis.
- Behera, S. et al., 2012. UV-Visible Spectrophotometric Method Development and Validation Assay of Paracetamol Tablet Formulation. *Hournal of Analytical & Bioanalytical techniques*, pp. 1-6.
- Caner, N. et al., 2011. Biosorption of Reactive Yelloe 145 Dye by Dried *Penicillum Restrictum*. *separation Science and Technology* 46, pp. 2283-2290.
- Chojnacka, K., 2010. *Biosorption and Bioaccumulation in Practice*. s.l.:Mova Science Publisher.
- Christie, R. M., 2001. *Colour Chemistry*. United Kingdom: The Royal Society of Chemistry.
- Chu, W. L., See, Y. C. & Phang, S. M., 2009. Use of Immobilized *Chlorella vulgaris* for the Removal of Colour from Textile Dyes. *J. Apl Phycol*, pp. 641-648.
- Crini, C. et al., 2008. *Journal of Environmental Management Vol. 33*, p. 399.
- Dabrowski, A., 2001. Adsorption: From theory to Practice.. *Advances in Colloid and Interface Science* 93, pp. 135-224.

- Dajka, K., Takacs, E., Wojnarovits, L. & Guven, O., 2003. High-Energy Irradiation Treatment of Aqueous Solution of Reactive Black 5 Azo Dyes : Pulse radiolysis experiment. *Radiation Physics and Chemistry* 67, pp. 535-538.
- Dolphen, R., Sakkayawong, N., Thiravetyan, P. & Nakbanpote, W., 2007. Adsorption of Reactive Red 141 from Wastewater onto Modified Chitin. *Journal of Hazardous Materials*, Issue 145, pp. 250-255.
- Dotto, G. I., Esquerdo, V. M., Vieira, M. G. & Pinto, L. A., 2012. *Colloids and Surfaces B : Biointerfaces Vol.91*, p. 91.
- Dotto, G. I., Lima, E. C. & Pinto, L. A., 2012. *Bioresource Technology*. p. 123.
- Dotto, G. I. & Pinto, L. A., 2012. *Biochemical Engineering Journal Vol. 68*, p. 85.
- Dotto, G. L., Sharma, S. K. & Pinto, L. A. A., 2015. Biosorption of Organic Dyes: Research Opportunities and Challenge. In: S. K. Sharma, ed. *Green Chemistry for Dyes Removal from Waste Water*. Canada: Scrivener.
- Eren, Z. & Acar, F. N., 2006. *Desalination Vol.194*, p. 1.
- Forgacs, E., Cserhati, T. & Oros, G., 2004. Removal of synthetic dyes from wastewater : A review. *Environment International* 30, pp. 953-971.
- Ghaly, A., Ananthashankar, S., Alhattab, M. & Ramakrishnan, V., 2014. Characterization and treatment of textile effluents : a critical review. *J.Chem Eng Proc Technol*, pp. 1-18.
- Gregory , P., 1990. Classification of Dyes by Chemical Structure. In: D. R. Waring & G. Hallas, eds. *The Chemistry and Application of Dyes*. New York: A Division of Plenum.
- Isnansetyo, A. & Kurniastuty, 1995. *Teknik Kultur Phytoplankton, Zooplankton, Pakan Alam untuk Pembenihan Organism Laut*. Yogyakarta: Kanisius.
- Janczyk, P., 2005. Evaluation of Nutritional Value and Activity of Green Microalgae *Chlorella vulgaris* in Rats and Mice. *Journal -Nr*, p. 2971.
- Jinqi, L. & Houtian, L., 1991. Degradation of Azo Dyes by Algae. *Environmental Pollution* 74, pp. 273-278.

- Kale, R. D., Potdar, T. & Gorade, V., 2019. Treatment of CI. Reactive Blue 21 Effluent by Microcrystalline Cellulose Grafted with APTES: kinetics, isotherm and thermodynamic study. *Sustainable Environment Research*, VII(29), pp. 1-12.
- Kannan, N. & Sundaram, M. M., 25. *Dyes and Pigments Vol.51*, p. 2001.
- Karthikeyan, J., 1989. Removal of Colour from Industrial Effluents. *POLLUTION Management in Industries*, pp. 150-164.
- Khalaf, M. A., 2008. Biosorption of Reactive Dye from Textile Wastewater by non-viable Biomass of *Aspergillus niger* and *Spirogyra* sp.. *Bioresource Technology*, Issue 99, pp. 6631-6634.
- Khopkar, S. M., 2002. *Konsep Dasar Kimia Analitik*. Jakarta : Universitas Indonesia Press.
- Korucu, M. E. et al., 2015. Removal of Organic Dyes from Industrial Effluents: An Overview of Physical and Biotechnological Applications. In: *Green Chemistry for Dyes Removal from Wastewater*. Canada: Scrivener.
- Kumar, H. D. & Singh, H. N., 1979. *A Textbook on Algae*. London: Macmillan Tropical Biology Series.
- Kumar, S., Ahluwalia, A. S. & Charaya, M. U., 2019. Adsorption of Orange-G Dye by the Dried Powdered Biomass of *Chlorella vulgaris* Beijerinck. *Current Science Vol. 116*, pp. 604-611.
- Lavens, P. & Sorgeloos, P., 1996. Manual on the Production and use of live food for aquaculture. *FAO Fisheries Technical Paper*.
- Lin, S. H. & Lin, C. M., 1998. Methods of Decoloration of Textile Wastewater. *Dyes and Pigment 37*, pp. 335-356.
- Llyod, N. D., Canvin, D. T. & Culver, D. A., 1977. Photosynthesis and photorespiration in algae. *Plant physiol 59*, pp. 936-940.
- Lucio, D., Laurent, D. & Roger, G., 2008. Adsorption of Remazol Black B Dyes in Activated Cabon Felt. *Carbon Science and Technology*, pp. 66-71.

- Maurya, N. S., Mittal, A. K., Cornel, P. & Rother, E., 2005. Biosorption of Dyes Using Dead macro fungi: Effect of dye structure, ionic strength and pH. *Bioresource Technology* 97, pp. 512-521.
- Moshina, M. M., 2017. Culture of *Chlorella rllipsoidea* in Different Culture Media. *Int. K. Agril.Res. Innov & Tech* 7, pp. 51-57.
- Nakajima, Horikoshi, T. & Sakaguchi, T., 1991. Application Microbiology, Biotechnology. *Europian Journal* 12, pp. 76-83.
- Noercholis, A. & Wijaya, E. T., 2015. Image Processing pada Citra Mikroskopis Eritrosit dengan Hemocytometer untuk Menghitung Jumlah Eritrosit dalam 1 mm darah ikan. *Seminar Nasional " Inovasi dalam Desain dan Teknologi"*.
- Piccin, J. S., Vieira, M. G., Goncalves, J. O. & Pinto, L. A., 2009. *Journal of Food engineering Vol. 95*, p. 16.
- Prayitno, J., 2016. Pola Pertumbuhan dan Pemanenan Biomassa dalam Fotobioreaktor Mikroalga untuk Penangkapan Karbon. *Jurnal Teknologi Lingkungan Vol.17*, pp. 45-52.
- Raghavacharya, C., 1997. Colour Removal form Industrial Effluents : A comparative review of Available Technologies. *Chem Eng. World* 32, pp. 53-54.
- Ruthven, D. M., 1984. *Principles of Absorption and Adsorption Process*. New York: John Wiley & Sons.
- Sabat, S. et al., 2012. Biosorption : An Eco-Friendly Technique for the Removal of Heavy Metals.
- Sabnis, R. W., 2010. *Handbook of Biological Dyes and Stains Synthesis and Industrial Applications*. Canada: John Wiley & Sons .
- Safi, C. et al., 2014. Morphology, composition, production, processing, and applications of *Chlorella vulgaris*. *Renewable and Sustainable Energy Review*, Volume 35, pp. 265-278.
- Salleh, M. M., Mahmoud, D. K., Karim, W. W. & Idris, A., 2011. *Desalination Vol. 280*, p. 1.
- Singh, P. K. & Singh, R. L., 2017. Bio-removal of Azo Dyes. *International Journal of Applied Sciences and Biotechnology*, V(2), pp. 108-126.

- Sinly, E. P. & Johan, A. P., 2007. Bioremoval, Metode Alternatif untuk Menanggulangi Pencemaran Logam Berat.
- Slokar, Y. M. & Le Marechal, A. M., 1998. Methods of decoloration of textile wastewater. *Dyes and Pigments* 37, pp. 335-336.
- Volesky, B., 1999. Sorption for the Next Century. *International Biohydrometallurgy Symposium*, pp. 20-23.
- Wang, J. L. & Chen, C., 2008. Biosorbent for heavy metals removal and their future. *Biotechnology Advances* 27, pp. 195-226.
- Wassink, E. C., Kok, B. & Van Oorschot, P., 1964. The efficiency of light-energy conversion in *Chlorella* cultures as compared with higher plants. *Algal Culture : From Laboratory to Pilot Plant*, pp. 55-62.
- Won, S. W., Han, M. H. & Yun, Y. S., 2008. Different Binding Mechanisms in Biosorption of Reactive Dyes According to Their Reactivity. *Water Research*, Issue 42, pp. 4847-4855.
- Xiong, W., Li, X., Xiang, J. & Wu, Q., 2008. Highdensity fermentation of microalga *Chlorella protothecoides* in bioreactor for microbio-diesel production. *Appl. Microbiol Biotechnol* 78, pp. 29-36.
- Yadla, S. V., Sridevi, V. & Lakshmi, M. V., 2012. *Journal of Chemical, Biological, and Physical Science Vol.2*, p. 3759.
- Zamora, M. H. et al., 2015. Bioremoval of the azo dyes Congo red by the Microalga *Chlorella vulgaris*. *Environ Sci Pollut Res*.
- Zhang, Z., O'Hara, I., Kent, G. A. & Doherty, W. S., n.d. *Industrial Crops and Products Vol.42*.
- Zhang, Z., O'Hara, I. M., Kent, G. A. & Doherty, W. S., 2013. *Industrial Crops and Products Vol.42*, p. 41.
- Zumiriye, A. & Tezer, S., 2005. Biosorption of Reactive dyes on the Green Alga *Chlorella vulgaris*. *process Biochemistry* 40, pp. 1347-1361.

