

DAFTAR PUSTAKA

- [1] K. Wijaya, E. Sugiharto, I. Fatimah, S. Sudiono dan D. Kurniaysih, "Utilisasi TiO₂-Zeolit dan Sinar UV Untuk Fotodegradasi Zat Warna Congo Red", *TEKNOIN*, Vol. 11, No. 3:199-209. 2006.
- [2] J. Theerhagiri, S. Chandrasekaran, S. Sunitha, V. Elakkiya, P. Nithayadharseni, R.A. Senthil, T. Maialagan, H.S. Kim, "Recent Developments Of Metal Oxide Based Heterostructures For Photocatalytic Applications Towards Environmental Remediation". *Journal Solid State Chem*, No. 267:35-52. 2018.
- [3] A. Ramadhani, "Kapasitansi Adsorpsi Metilen Biru Oleh Lempung Cengar Teraktivasi Asam Sulfat", *JOM FMIPA*, No. 2:232-238. 2015.
- [4] X. Lang, J. Zhao, dan Chen. "Visible Light Induced Photoredox Catalysis Of Dye Sensitized Titanium Dioxide: Selective Aerobic Oxidation Of Organic Sulfides", *Angew. Chem. Int. Ed*, No. 55:4697-4700. 2016.
- [5] N. Sedaghati, A.H. Yangjeh, M. Pirhashemi dan S. Vadivel, "Boosted Visible Light Photocatalytic Performance Of TiO_{2-x} Decorated by BiOI and AgBr Nanoparticles". *Journal Photochem, Photobiol*, No. 384:122066. 2019.
- [6] P. Wang, T. Zhou, R. Wang, dan T.T. Lim, "Carbon Sensitized And Nitrogen Doped TiO₂ For Photocatalytic Degradation Of Sulfanilamide Under Visible Light Irradiation Water Res", No. 45:5015-5026. 2011.
- [7] H. Huang, Y. Song, N. Li, D. Chen, Q. Xu, H. Li, J. He, dan J. Lu, "One Step In Situ Preparation Of N-Doped TiO₂ @C Derived From Ti₃C₂ Mxene For Enhanced Visible Light Driven Photodegradation", *Appl. Catal. B*. No. 251:154-161. 2019.
- [8] T. Khalyavka, M. Bondarenko, N. Shcherban, I. Petrik dan A. Melnyk, "Effect Of The C and S Additives On Structural, Optical And Photocatalytic Properties Of TiO₂ Appl Nanosci". No. 9:695-702. 2019.
- [9] W. Ren, A. Zhihui, J. Falong, Z. Lizhi, F. Xiaoxing, dan Z. Zhigang, "low Temperature Preparation and Visible light Photocatalytic Activity Of

- Mesoporous Carbon-doped Crystalline TiO₂”, *Appl. Catal. B: Environ.*, No. 69:138-144. 2007.
- [10] A. Zaleska. “Doped-TiO₂, Recent patents on Engineering”, No. 2:157-164 2008.
- [11] H. Azis, A. Admin, Safni., Syukri., dan N.T Olly. *Pengantar Fotokimia*, Edisi I, Padang: Sukabina Press 2009.
- [12] Rahmayeni., S. Yeni, dan Zulhadjri. “Fotokatalis Komposit Magnetik TiO₂-MnFe₂O₄”. *Prosiding Semirata FMIPA Universitas Lampung* 2013.
- [13] Q. Yang, Y. Liaou, dan L. Mao, “Kinetics of Photocatalytic degradation of Gaseous Organic Compounds On Modified TiO₂/AC Composite Photocatalyst”, *Chin. J. Chem. Eng*, Vol. 20 No. 3:572-576. 2012.
- [14] W. Zhou, Z. Peng, and L. Weian, “Anatase TiO₂ Nanospindle Activated Carbon (AC) Composite Photocatalyst With Enhanced Activity In Removal of Organic Contaminant”. *Journal International Photoenergy*, 1-7 2012.
- [15] R.F. Azhar, M. Wildan, B.Y. Syifa, F.S. Ucu, dan Widayati. Carbon, Rofaneutron. Files. Wordpress.Com/2010/09/carbon.docx. Diunduh pada 2 Agustus 2013.
- [16] Misbakhuddin, “Pengaruh Ketebalan Karbon Aktif Sebagai Media Filter Terhadap Penurunan Air Sumur Artetis”, *Eksplanasi*, Vol. 5 No. 2:1-11 2010.
- [17] W. Andayani, dan S. Agustin, “Karakterisasi Katalis TiO₂ dan TiO₂/Karbon Aktif Yang Diimobilisasi Pada Pelat Titanium dan Uji Aktifitasnya Sebagai Fotokatalis”, *Jurnal Kimia Indonesia*, Vol. 1 No. 2:54-58 2006.
- [18] I. Fatimah, “Pengaruh Konsentrasi Agen Pemilar Terhadap Karakter Fisikokimiawi dan Fotoaktivitas ZrO₂-Montmorillonit Pada Degradasi Fotokatalitik Limbah Cair Industri Tekstil”, Vol. 3 No. 2:42-50. 2006.
- [19] Savitri, “Pembuatan Katalis Asam (Ni/T-Al₂O₃) dan Katalis Basa (Mg/T-Al₂O₃) Untuk Aplikasi Pembuatan Biodiesel Dari Bahan Baku Minyak Jelantah”, *Jurnal Kimia Valensi*, Vol. 2 No.1:1-10. 2016.

- [20] Naimah, “Keramik Sebagai Media Fotokatalis TiO_2 -Karbon Aktif Serta Aplikasinya Pada Kesehatan Lingkungan”. *Kimia Kemasan*. Vol.37 No.2:123-132. 2015.
- [21] C. McCullagh, P.K.J. Robetson, M. Adams, P.M. Pollrd, dan A. Mohammed, “Decelopment of A Slurry Continous Flow Reactor For Photocatalytic Treatment of Industrial Waste Water”, *Journal of Photochemistry and Photobiology A: Chemistry*, No. 211:42-46. 2010.
- [22] S. Banarjee, J. Gopal, P. Muraleedharan, A. Tyagi, dan R. Baldev, “Physics and Chemistry of Photocatalytic Titanium Dioxide: Visualization of Bactericidal Activity Using Atomic Force Microscopy”. *Journal of Currents Science*, Vol. 90No. 10:1378-1383. 2006.
- [23] K.M.Joshi dan V.S.Shirivasta, “Removal of Hazardious Textile Dyes From Aqueous Solution by Using Commercial Activated Carbon With TiO_2 and ZnO as Photocatalyst. *International Journal Of Chem Tech Research*, No. 2:427-435. 2010.
- [24] A.P.L.Batista, H.W.Carvalho, G.H.P.Luz, P.F.Q.Martins, M.Goncalves dan L.C.A.O.Oliveira, “Preparation of CuO/SiO_2 and Photocatalytic Activity by Degradation of Methylene Blue”. *Environmental Chemistry Letter*, No. 8:63-67. 2010.
- [25] E. Agus, P. Wibowo, K. Sekaran, Pati, K, G., dan Tengah, J. “Karakterisasi dan Aplikasinya TiO_2 -N Photocatalyst: Study On The Synthesis Sol-gel Method”. *Prosiding Seminar Nasional Kimia*, 3-4. 2015.
- [26] J. Wang, C. Fan, Z. Ren, X. Fu, G. Qian, dan Z. Wang, “N-doped TiO_2/C Nanocomposites And N-doped TiO_2 Syhthesised at Different Thermal Treatment Temperatures With The Same Hydrothermal Precursor, *Dalton Transaction*”, Vol. 43 No. 36:13783-13791. 2014.
- [27] A. Pandey. A.B. Samaddar, “Dye Sensitized Photo Volataic Devices: An Answer To The Daunting Challenge of Future Energy Crisis”. 497-502. 2006.

- [28] M. Gratzel, "Review: Dye-sensitized Solar Cells". *Journal of Photochemistry and Photobiology. Photochemistry Reviews*, No. 4:145-153. 2003.
- [29] C. Longo, dan M.A. Paoli, "Dye-Sensitized Solar Cells: A Successful Combination of Materials". Vol. 14 No. 6:889-901. 2003.
- [30] A. Kolmakov, dan M. Moskovits, "Chemical Sensing and Catalysis by One Dimension Metal-Oxide Nanostructures". No.34:151-80. 2004.
- [31] Timuda, E. Gerald, Maddu, Akhiruddin, Irmansyah, dan Widiyantrieko, B. "Sintesis Partikel Nanocrystalline TiO₂ Untuk Aplikasi Sel Surya Menggunakan Metode Sonokimia". 104-109. 2010.
- [32] V. Ekasari, dan G. Yudoyono, "Fabrikasi DSCC Dengan Dye Ekstrak Jahe Merah (*Zingiber Officinale* Linn Var.*Rubrum*) Variasi Larutan TiO₂ Nanopartikel Berfase Anatase Dengan Teknik Pelapisan Spin Coating". *Jurnal Sains dan Seni ITS*, Vol. 2 No. 1:15-20. 2013.
- [33] J. Gunlazuardi, "Fotokatalisis Pada Permukaan TiO₂: Aspek Fundamental dan Aplikasinya". *Seminar Nasional Kimia Fisika II*. Jurusan Kimia FMIPA, Universitas Indonesia, 2001.
- [34] R.T. Tjahjanto, dan J. Gunlazuardi, "Preparasi Lapisan Tipis Sebagai Fotokatalis: Keterkaitan Antara Ketebalan dan Aktivitas Fotokatalisis". *Jurnal Penelitian Universitas Indonesia*, Vol. 5 No. 2:81-91. 2001.
- [35] M.A. Barakat, G. Hayes, dan S.I. Shah, "Effect of Cobalt Doping on The Phase Transformation of TiO₂ Nanoparticles". *Journal of Nanoscience and Nanotechnology*. No 10:1-7. 2005.
- [36] G.T. Austin, *Industri Proses Kimia*, Erlangga, Jakarta, 1996.
- [37] A.L. Prabowo, "Pembuatan Karbon Aktif Dari Tongkol Jagung Serta Aplikasinya untuk Adsorpsi Cu, Pb, dan Amonia", 2009.
- [38] M. Smilja, Dragan, Uskokovic, A. Stankovic, Z. Lopicic, S. Lazarevic, dan M. Stojanovic, "Application of raw peach shell particles for removal of methylene blue". *Journal of Environmental Chemical Engineering*, No. 2:716-724. 2015.

- [39] F. Hanum, R. Gultom dan M. Simanjuntak, “Adsorpsi zat warna metilen biru dengan karbon aktif dari kulit durian menggunakan KOH dan NaOH sebagai aktivator”. *Jurnal Teknik Kimia USU*, Vol. 6 No. 1 2017.
- [40] N. Shahram dan N. Farzin., “Comparative procedure of photodegradation of methylene blue using N doped activated carbon loaded with hollow 3D flower like ZnS in two synergic phases of adsorption and Catalytic”. *Journal of Photochemistry and Photobiology A: Chemistry*, No. 18:301-527. 2018.
- [41] G. Widihati. Idaayu dan P.N. Diantariani, “Fotodegradasi metilen biru dengan sinar uv dan katalis Al_2O_3 ”. *Jurnal Kimia*, Vol. 5 No. 1:31-42. 2011.
- [42] F.Motahari, Mozdianfard dan Faezah, “NiO Nanostructural:Synthesis, Characterization and Photocatalyst Application in Die Pollution Waswater Treatment”. Article RSC Advances. 2014.
- [43] X. Zhu,Q. Li, Y. Fang, X. Liu, I. Xiao, X. Ai, H.Yang dan Y.Cao, Graphene Modified TiO_2 Microspheres Synthesized by a Facile Spray Drying Route for Enhanced Sodium-ion Storage, Part. Syst. Charact No. 33:545-552. 2016.
- [44] G.N. Brown, J.W.Birks dan Koval, Development and Characterization of Titanium-dioxid Based Semiconductors Photoelectrochemical Detector, Analysis Chemistry. Vol. 64 No.4:427-434. 1992.
- [45] A.B. Pambudi, R. Kurniawati, A. Iryani dan D. Hartanto, Effect of Calcination Temperature Synthesis of Carbon Doped TiO_2 Without External Carbon Source, Aip Conference Proceedings 2018.
- [46] N. Suganthi, S. Thangavel dan K. Kannan, Hibiscus Subdariffa leaf Extract Mediated 2-D fern-like ZnO/TiO_2 H ierarchical Nanoleaf for Photocatalytic Degradation, FlatChem No. 24:1-9. 2020.
- [47] B. Ulum, S. Ilyas, A.N. Fahri, I. Mutmainna, M.A. Anugrah, N. Yudasari, E.B. Demmalino dan D. Tahir, Composite Carbon-lignin/ Zinc Oxide Nanocrystalline Ball-like Hexagonal Mediated from *Jatropha Curcas* L leaf as Photocatalyst for

- Industrial dye Degradation, *Journal of Inorganic and Organometallic Polymers and Materials* Vo. 30, No. 12:4905-4916. 2020.
- [48] S. Bagheri, K. Shameli, S.B.A. Hamid, Synthesis and Characterization of Anatase Titanium dioxide Nanoparticles Using egg white Solution via Sol-gel Method, *Journal of Chemistry* 2013 848205. 2013.
- [49] M.A. Rauf dan S.S. Ashraf, Fundamentals Principles and Application of Heterogeneous Photocatalytic Degradation of Dyes in Solution, *Journal Chemical Engineering*, No. 151:10-18. 2019.
- [50] M.F.R. Samsudin, S. Sufian, R. Bashiri, N.M. Mohamed, L.T.Siang dan R.M. Ramli, Optimization of Photodegradation of Methylene Blue over Modified TiO₂/BiVO₄ Photocatalyst: Effects of Total TiO₂ Loading and Different Type of Co-Catalyst. No 5:2170-21717. 2018.
- [51] H.Yu, Y. Zhao, C. Zhao, L. Shang, Y. Peng, Y. Cao, L.Z. Wu, C.H. Tung dan T. Zhang, Carbon Quantum Dots/TiO₂ Composites for Efficient Photocatalytic Hydrogen Evolution, *Journal Material Chem*, 3259-3678. 2014.
- [52] Y. Yang, P. Gao, Y. Wang, L. Sha, X. Ren, J. Zhang, Y. Chen, T. Wu, P. Yang, X. Li, A Direct Charge Transfer From Interface To Surface for the Highly Efficient Spatial Separation of Electrons and Hole: the Construction of Ti-C Bonded Interfaces in TiO₂-C Composites as A Touchstone for Photocatalytic Water Splitting, No 33:29-36. 2007.
- [53] L. Munguti dan F. Dejene, Influence of Annealing Temperature on Structural, Optical and Photocatalytic Properties of ZnO-TiO₂ Composite for Application in Dye Removal in Water, *Nano-Structures & Nano-Objects*, 24 100594. 2020.
- [54] S.M.T.H. Moghaddas, B. Elahi dan V. Javanbakht, Biosynthesis of Pure Zinc Oxide Nanoparticles using quince seed Mucilage for Photocatalytic dye Degradation. *Journal of Alloys and Compounds* No. 821:1-9. 2020.
- [55] A. Elshaghi dan H. Moradi, Optical and Photocatalytic of the Fe-doped TiO₂ Nanoparticles loaded on the Activated Carbon. *Journal Advanced Powder Technology* No. 7:1-7. 2018.

- [56] N. Selvi, S. Sankar dan K. Dinakaran, Effect of Shell ZnO on the Structure and Optical Property of TiO₂ core@shell Hybrid Nanoparticles. *J. Mater. Sci: Mater. Electron.* No. 26:2271- 2277. 2015.
- [57] F. Xu, J. Chen, S. Kalytchuk, L. Chu, Y. Shao, D. Khong, K.H. Chu, H. Patrick, L. Duduk dan W.Y. Teoh, Supported Gold Clustes as Effective and Reusable Photocatalyst for the Abatement of Endocrine Disrupting Chemicals Under Visible Light. *Journal of Catalysis.* 1-12. 2017.

LAMPIRAN**Lampiran 1. Gambar bahan penelitian**

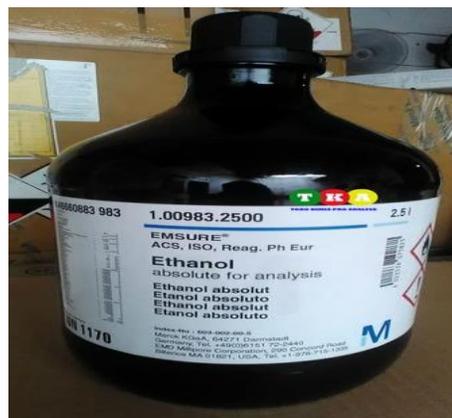
Metilen Biru



Titanium Dioksida



Karbon Aktif



Etanol

Lampiran 2. Analisis Data

Tabel 1. Analisis data XRD untuk ukuran kristal TiO₂/Karbon Aktif

1:1TiO₂/KarbonAktif					
2θ (°)	θ (°)	θ (rad)	FWHM (°)	FWHM (rad)	D (nm)
22,11	11,055	0,19	0,4	0,01	12,54
32,42	16,21	0,28	0,29	0,01	8,553
38,42	19,21	0,33	0,46	0,01	7,217
42,78	21,39	0,37	0,41	0,01	6,482
53,78	26,89	0,46	0,44	0,01	5,156
Rata-rata					7,98

1,5:0,5TiO₂/KarbonAktif					
2θ (°)	θ (°)	θ (rad)	FWHM (°)	FWHM (rad)	D (nm)
25,81	12,905	0,22	0,61	0,01	10,74
27,29	13,645	0,23	0,3	0,01	10,16
33,18	16,59	0,28	0,42	0,01	8,357
43,24	21,62	0,37	0,25	0,01	6,413
52,26	26,13	0,45	0,28	0,01	5,306
Rata-rata					36,7

0,5:1,5 TiO₂/KarbonAktif					
2θ (°)	θ (°)	θ (rad)	FWHM (°)	FWHM (rad)	D (nm)
25,22	12,61	0,22	0,42	0,01	10,99
26,56	13,28	0,23	0,26	0,01	10,44
32,57	16,285	0,28	0,34	0,01	8,516
42,9	21,45	0,37	0,37	0,01	6,464
53,81	26,905	0,46	0,39	0,01	5,154
Rata-rata					37,4

Tabel 2. Analisis data UV-Vis untuk persentase degradasi metilen biru

Sampel	C₀	C_t			%D = [(C₀C_t)/C₀]-100		
		15 min	30 min	45 min	15 min	30 min	45 min
1:1 TiO ₂ /Karbon Aktif	1,18	0,32	0,17	0,06	72,88	85,59	94,91
1,5:0,5 TiO ₂ /Karbon Aktif	1,18	0,11	0,08	0,07	90,67	93,22	94,06
0,5:1,5 TiO ₂ /Karbon Aktif	1,18	0,5	0,27	0,13	57,62	77,11	88,98

