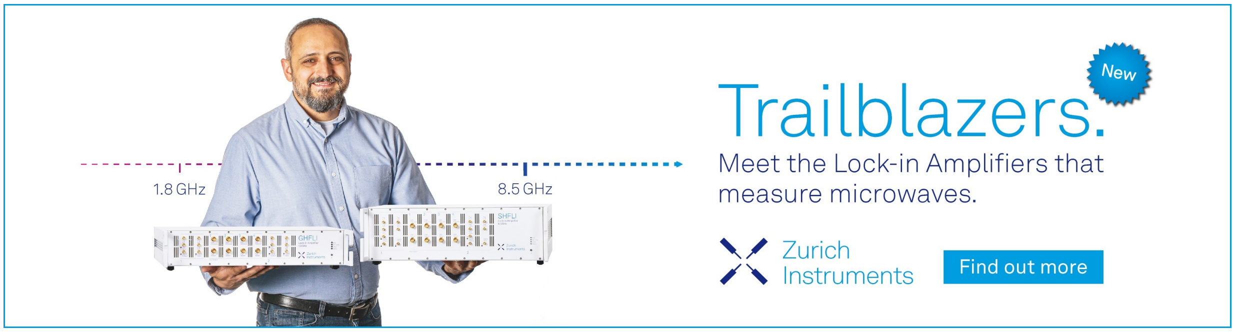
AIP Conference Proceedings

Degradation of methylene blue in TiO_2-Fe(VI) system with UV radiation

Cite as: AIP Conference Proceedings **2553**, 020003 (2022); https://doi.org/10.1063/5.0103697

Dian Windy Dwiasi, Anung Riapanitra and Eggy Izzi Saliya



AIP Publishing

Degradation of Methylene Blue in TiO_2-Fe(VI) System With UV Radiation

Dian Windy Dwiasi[a], Anung Riapanitra[b], and Eggy Izzi Saliya[c]

Department of Chemistry, Faculty of Mathematics and Natural Sciences,
Universitas Jenderal Soedirman, Jl. Dr. Suparno, Purwokerto, 53144, Indonesia

[a] Corresponding author: dian.dwiasi@unsoed.ac.id
[b] anung.riapanitra@unsoed.ac.id
[c] eggy_shalliya@yahoo.com

Abstract. Photocatalytic degradation is a combination of photochemical and catalytic processes in which light and a catalyst are needed to carry out chemical transformations. In this research, a photocatalytic degradation method has been developed using the TiO_2-Fe(VI) system with UV light activation. This method is one of the appropriate alternative methods for the treatment of azo dye waste because it is safe, economical, and environmentally friendly. The purpose of this study was to determine the effect of pH and contact time on the TiO_2-Fe(VI)-UV system on the photocatalytic degradation of methylene blue. The results showed that in the TiO_2-Fe(VI)-UV system, the percentage of methylene blue degradation reached 99.97% at pH 2.

Keywords: Photocatalytic, degradation, methylene blue, ferrate, UV radiation

INTRODUCTION

Methylene blue is the most commonly used dye for textile dyes. Although Methylene blue has a side effect that can irritate the digestive tract with symptoms of nausea, vomiting, and diarrhea. In addition, it can also cause methemoglobinemia, cyanosis, and convulsions when inhaled [1]. Currently, many azo dye removal methods have been used, including using coagulants, activated carbon, and biological processing, the coagulant method will cause new problems with the presence of large amounts of sludge so that further processing is needed to handle it [2]. The dye removal method using activated carbon will also produce sludge. The resulting sludge is then burned and produces harmful chlorine oxide compounds [3]. Another method is to use various types of bacteria, but the decomposition products are toxic and require further processing [4].

In this study, an efficient and effective photocatalytic degradation method was developed to overcome the problem of dye pollution. Photocatalytic degradation is a combination of photochemical and catalytic processes, therefore light and a catalyst are needed to carry out chemical transformations [5]. Generally, the catalyst used is a good semiconductor such as a TiO_2 catalyst. Photocatalytic degradation methods usually use a catalyst (TiO_2/UV-A) and ozonation, H2O2/UV-B. Heterogeneous photocatalytic oxidation using sunlight (TiO_2/H_2O_2, $Fe^{3+/}H_2O_2$) is also effectively used for the treatment of wastewater from various industries and contaminated water or air [6]. In this research, a ferrate oxidizing agent was used. Ferrat, Fe(VI) has received much attention for its uses in green organic synthesis, 'super-iron' batteries, and wastewater treatment [7, 8, 9]. Previous studies have shown that ferrate is very effective in degrading methyl orange dye with a 100% reduction percentage [10]. Photodegradation of methylene blue with UV light and Al_2O_3 catalyst is less effective because the percentage of degradation is only 30.22% [11]. The combination of ferrate with TiO_2 is a very promising photocatalytic degradation method, especially for the treatment of methylene blue dye waste. This method is one of the alternative methods of waste treatment that is safe, economical, and environmentally friendly.

Proceedings of the 16th Joint Conference on Chemistry (JCC 2021)
AIP Conf. Proc. 2553, 020003-1–020003-5; https://doi.org/10.1063/5.0103697
Published by AIP Publishing. 978-0-7354-4281-8/$30.00

MATERIAL AND METHOD

Material

TiO_2 (Merck), methylene blue (Sigma), KOH (Merck), NaOH (Merck), H_2SO_4 (Merck), $(NH_4)_2SO_4$ (Merck), $Fe(NO_3)_3$ (Merck), NaOCl (technical), KCl (Merck), KCl-HCl buffer (technical), acetate buffer (technical), phosphate buffer (technical), borax-HCl buffer (technical), Na_2HPO4-NaOH buffer (technical), brucine (technical), phenol (Merck), 95% ethanol (Merck), KNO_3 (Merck), NH_4Cl (Merck), sodium nitroprusside (Merck), trisodium citrate (Merck), and distilled water.

Instrumentation

pH-meter, magnetic stirrer, hot plate stirrer, glass wool, UV reactor, centrifuge (Quantum), vacuum desiccator, UV lamp, incandescent lamp, UV-Vis spectrophotometer Shimadzu 1800, and XRD (X-ray Diffraction) XD 700 Shimadzu.

Synthesis of Potassium Ferrate (K_2FeO_4) [10]

As much as 40 mL of 5.25% NaOCl solution was reacted with 12 g of KOH. The solution was stirred until all of the KOH dissolved completely, then added 1 mL of $Fe(NO_3)_3$ dropwise and stirred again until the solution turned purple. The solution was then stored in a dark room for ± 24 hours, thus forming a dark purple ferrate solution.

Characterization of Potassium Ferrate (K_2FeO_4)

The synthesized ferrate solution was filtered using glass wool over an Erlenmeyer containing 30 mL of KCl solution. Next, Erlenmeyer was covered with aluminum foil and left for ± 24 hours. The mixture was then centrifuged for 10 minutes at a speed of 2000 rpm. The precipitate is separated from the solution and then dried under an incandescent lamp and stored in a vacuum desiccator. The dried solids were characterized by XRD.

RESULT AND DISCUSSION

The potassium ferrate synthesis process begins by reacting KOH with a 5.25% NaOCl solution. NaOCl was used as an oxidizing agent. NaOCl can oxidize Fe(III) to Fe(VI) [12]. In this process, KOH is also used to make the solution alkaline. Ferrate in alkaline conditions has high stability compared to acidic conditions [13]. In this process, KOH is used to make a solution under alkaline conditions. Ferrate under alkaline conditions has high stability compared to acidic conditions [13]. This is because in alkaline conditions ferrate is formed, while in acidic conditions the more dominant species is $HFeO_4^-$. After the KOH dissolved, then a solution of $Fe(NO_3)_3.9H_2O$ was added dropwise. The addition of $Fe(NO_3)_3.9H_2O$ solution causes the solution to change from yellow to purple. This indicates that Fe_3^+ derived from $Fe(NO_3)_3.9H_2O$ has been oxidized by NaOCl to FeO_4^{2-}. The reaction for the formation of ferrate is as follows [14]:

$$\begin{array}{c} 2Fe^{3+} + 16OH^- \rightarrow 2FeO_4^{2-} + 3e^- + 8H_2O \\ 3OCl^- + 3H_2O + 3e^- \rightarrow 3Cl^- + 6OH^- \\ \hline 2Fe^{3+} + 10\ OH^- + 3OCl^- \rightarrow 2FeO_4^{2-} + 5H_2O + 3Cl^- \end{array}$$

Potassium ferrate was synthesized using the oxidation method, and the product was characterized using XRD. The diffractogram of synthesized potassium ferrate (K_2FeO_4) solid is shown in Fig 1.

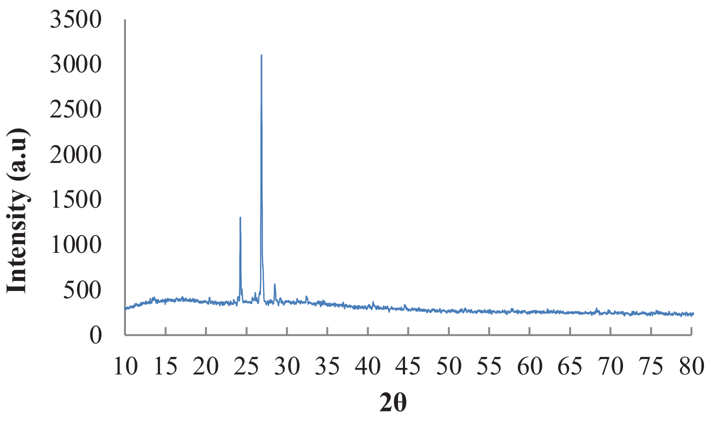


FIGURE 1. XRD pattern of synthesized potassium ferrate

Based on the diffractogram in Fig 1, three main peaks appear at 2θ 24.2377°, 26.8599°, and 27.0326°. The resulting diffractogram has the highest peak at 2θ = 27.0326° with lattice parameters (340). According to Li (2005) [13], potassium ferrate has 2θ at 30.1° with the main peak intensities of 75%, 90%, and 99% purity, respectively, namely 767, 912, and 1001. The diffractogram obtained in this study occurs slightly shift. The wet method in the synthesis of K2FeO4 produces solids that have high purity (99%) [13]. Based on the results of the study, it can be concluded that the resulting precipitate has high crystallinity. FeO42- has a tetrahedral structure in its crystalline form [15].

Photocatalytic Degradation of Methylene Blue

Effect of contact time

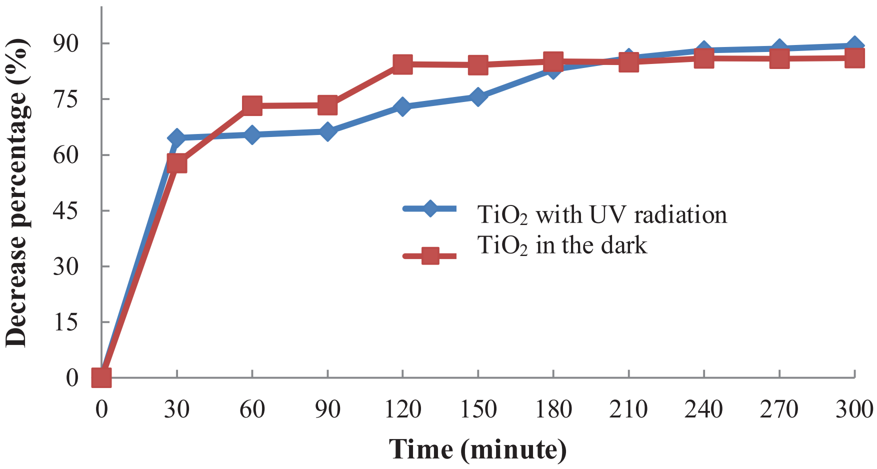


FIGURE 2. Effect of contact time

The maximum contact time is the time required for the photocatalyst to degrade methylene blue dye to obtain the largest percent reduction in methylene blue dye. Figure 2 shows the effect of contact time on the reduction of methylene blue dye levels using TiO_2 in two conditions (dark and UV radiation). The percentage decrease in methylene blue levels with UV radiation in the time range of 30 to 330 is 62.68%, 64.57%, 65.38%, 66.23%, 72.92%, 75.57%, 82.97% , 86.02%, 88.1%, 88.59%, and 89.41%. Meanwhile, the percentage decrease in the concentration of methylene blue solution in the darkroom was 56.83%, 57.78%, 73.18%, 73.35%, 84.32%, 84.18%, 85.07%, 84, 97%, 85.96%, 85.91%, and 86.08%. Based on these results, the largest decrease in methylene blue levels using Fe(VI) was obtained at a contact time of 330 minutes, namely 89.41% with UV lamp radiation and 86.08% in the darkroom. The presence of TiO_2 and a photon source from UV light will accelerate the reduction of ferrate.

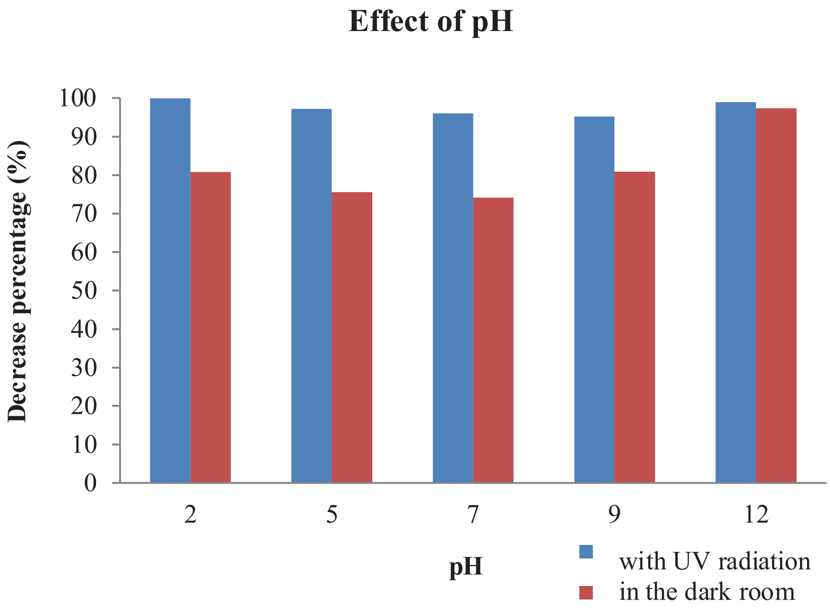


FIGURE 3. Effect of pH

Figure 3 shows the effect of pH variations on decreasing levels of methylene blue dye using the TiO2-Fe(VI) system. The decrease in methylene blue levels under UV radiation at pH 2 was 99.97%, pH 5 was 97.17%, pH 7 was 96.09%, pH 9 was 95.19%, and pH 12 was 98. 99%. The largest percentage decrease occurred in an acidic environment with pH 2. Meanwhile for the treatment carried out in a dark room the decrease in methylene blue levels at pH 2 was 80.85%, pH 5 was 75.63%, pH 7 was 74.18%, pH 9 is 80.87%, and pH 12 is 97.35%. The largest percentage decrease occurred in an alkaline environment with a pH of 12. The presence of TiO_2 and photons from UV light will accelerate the ferrate reduction process so that the combination of TiO2-Fe(VI) produces a significant decrease in methylene blue levels.

The largest percentage decrease in the concentration of methylene blue solution under the influence of UV light at pH 2 was 99.97%. Methylene blue at a low pH (acidic) should be more difficult to adsorb on the surface of TiO_2 because TiO_2 and methylene blue are both positively charged so that they repel. But based on the results of the study, due to the influence of photons from UV light, a large decrease at pH 2 can occur. Fe(VI) changes to Fe(III) because in an acidic environment the $H_3FeO_4^+$ species are more dominant. This large percentage decrease was due to a large number of •OH radicals. The formation of •OH radicals is influenced by the abundance of H+ ions in methylene blue which has been conditioned in acidic pH reacting with oxygen radicals (•O_2) which are formed from the interaction of TiO_2 electrons with oxygen in water (Peral, 1990). When degradation occurs in an alkaline environment, the positively charged methylene blue will be more easily adsorbed on the negative TiO_2 surface so that electrostatic interactions occur. That's why in the darkroom the largest percentage decrease occurred at pH 12. TiO_2 can be active at a certain pH, namely acid, while ferrate is more dominant at alkaline pH.

CONCLUSION

The degradation of methylene blue in the TiO_2-Fe(VI) system under UV lamp radiation reached a maximum at pH 2 and a contact time of 330 with a percentage decrease of 99.97%. Degradation of dyes using the TiO_2-Fe(VI)-UV system can be used as an alternative method for wastewater treatment.

REFERENCES

1. T.O. Zhang, A. Aoshima, H. Hidaka, J. Zhao, and N. Serpone, Journal of Photochemistry and Photobiology A: Chemistry, **140**, 163 – 172 (2002).
2. A. Tuty, “Pengembanan TiO_2 pada abu dasar batubara (bottom ash) dan uji aktivitasnya sebagai fotokatalis dalam degradasi zat warna metilen biru,” Thesis, Universitas Gadjah Mada, 2012.
3. M. Christina, dan S.R. Marjanto, Jurnal Forum Nuklir, **1**,31-44 (2007).
4. J. S. Chang, C. Chou, Y. C. Lin, J.Y. Ho, dan T.L. Hu, Wat. Res, **35**, 2841-2850 (2001).
5. E. Palupi, “Degradasi methylene blue dengan metode fotokatalis dan fotoelektrokatalis menggunakan film TiO_2”, Skripsi, FMIPA IPB, 2006.
6. M. Muruganandham, and M. Swaminathan, Dyes Pigments, **72**, 137–143 (2007).
7. L. Delaude, P. Laszlo, J. Org. Chem, **61**, 6360–6370 (1996)
8. V.K. Sharma, Environ. Res. **6**, 143–156 (2002).
9. S. Licht, V. Naschitz, and S. Ghosh, J. Phys. Chem. B. **106**, 5947–5955 (2002).
10. D.W. Dwiasi, “Studi Degradasi Zat Warna Azo Menggunakan Ferrat (FeO_4^{2-})”, Tesis, Universitas Gadjah Mada, 2008.
11. I. Ayu, Ida, N.P. Diantariani, dan Y.F. Nikmah, “Fotodegradasi Metilen Biru dengan Sinar UV dan Katalis Al_2O_3”, (Jurusan Kimia FMIPA Universitas Udayana, Bukit Jimbaran, 2011).
12. H.J. Lee, I. H. Oh, and D. C. Kim, , Theories and Applications of Chem. Eng, **12**, 2-10 (2004)
13. C. Li, X. Z. Li, and N. Graham, Chemosphore, **61**, 537-543 (2005).
14. D. W., Dwiasi, dan K. Mardiyah, J.Ilm. Kim. Mol. **3**, 1-52 (2010).
15. J.Q. Jiang, and B. Lloyd, Water Res. **36**, 1397–1408 (2002).

License to Publish Agreement

Journal: AIP Conference Proceedings
Manuscript ID #: AIPCP22-AR-JCC2021-00003
Article Title: Degradation of Methylene Blue in TiO2-Fe(VI) System With UV Radiation
Name: Dian Dwiasi
Author(s): Dian Dwiasi, Anung Riapanitra, and Eggy shaliya
Agreement Date: 17-Jun-2022 01:32 GMT

Copyright Ownership and Grant of Rights

For the purposes of this License, the "Work" consists of all content within the article itself and made available as part of the article, including but not limited to the abstract, tables, figures, graphs, images, and multimedia files, as well as any subsequent errata. The Work refers to the content contained in both the Accepted Manuscript (AM) and the Version of Record (VOR). "Supplementary Material" consists of material that is associated with the article but linked to or accessed separately (available electronically only), including but not limited to data sets and any additional files.

This Agreement is an Exclusive License to Publish not a Transfer of Copyright. Copyright to the Work remains with the Author(s) or, in the case of a Work Made for Hire, with the Author(s)' employer(s). AIP Publishing LLC shall own and have the right to register in its name the copyright to the journal issue or any other collective work in which the Work is included. Any rights granted under this License are contingent upon acceptance of the Work for publication by AIP Publishing. If for any reason and at its own discretion AIP Publishing decides not to publish the Work, this License is considered void.

Each Copyright Owner hereby grants to AIP Publishing LLC the following irrevocable rights for the full term of United States and foreign copyrights (including any extensions):

1. The exclusive right and license to publish, reproduce, distribute, transmit, display, store, translate, edit, adapt, and create derivative works from the Work (in whole or in part) throughout the world in all formats and media whether now known or later developed, and the nonexclusive right and license to do the same with the Supplementary Material.
2. The right for AIP Publishing to freely transfer and/or sublicense any or all of the exclusive rights listed in #1 above. Sublicensing includes the right to authorize requests for reuse of the Work by third parties.
3. The right for AIP Publishing to take whatever steps it considers necessary to protect and enforce, at its own expense, the exclusive rights granted herein against third parties.

Author Rights and Permitted Uses

Subject to the rights herein granted to AIP Publishing, each Copyright Owner retains ownership of copyright and all other proprietary rights such as patent rights in the Work.

Each Copyright Owner retains the following nonexclusive rights to use the Work, without obtaining permission from AIP Publishing, in keeping with professional publication ethics, and provided clear credit is given to its first publication in an AIP Publishing journal. Any reuse must include a full credit line acknowledging AIP Publishing's publication and a link to the VOR on AIP Publishing's site.

Each Copyright Owner may:

1. Reprint portions of the Work (excerpts, figures, tables) in future works created by the Author, in keeping with professional publication ethics.
2. Post the Accepted Manuscript (AM) to their personal web page or their employer's web page immediately after acceptance by AIP Publishing.
3. Deposit the AM in an institutional or funder-designated repository immediately after acceptance by AIP Publishing.

4. Use the AM for posting within scientific collaboration networks (SCNs). For a detailed description of our policy on posting to SCNs, please see our Web Posting Guidelines (https://publishing.aip.org/authors/web-posting-guidelines).
5. Reprint the Version of Record (VOR) in print collections written by the Author, or in the Author's thesis or dissertation. It is understood and agreed that the thesis or dissertation may be made available electronically on the university's site or in its repository and that copies may be offered for sale on demand.
6. Reproduce copies of the VOR for courses taught by the Author or offered at the institution where the Author is employed, provided no fee is charged for access to the Work.
7. Use the VOR for internal training and noncommercial business purposes by the Author's employer.
8. Use the VOR in oral presentations made by the Author, such as at conferences, meetings, seminars, etc., provided those receiving copies are informed that they may not further copy or distribute the Work.
9. Distribute the VOR to colleagues for noncommercial scholarly use, provided those receiving copies are informed that they may not further copy or distribute the Work.
10. Post the VOR to their personal web page or their employer's web page 12 months after publication by AIP Publishing.
11. Deposit the VOR in an institutional or funder-designated repository 12 months after publication by AIP Publishing.
12. Update a prior posting with the VOR on a noncommercial server such as arXiv, 12 months after publication by AIP Publishing.

Author Warranties

Each Copyright Owner may:

1. Reprint portions of the Work (excerpts, figures, tables) in future works created by the Author, in keeping with professional publication ethics.
2. Post the Accepted Manuscript (AM) to their personal web page or their employer's web page immediately after acceptance by AIP Publishing.
3. Deposit the AM in an institutional or funder-designated repository immediately after acceptance by AIP Publishing.
4. Use the AM for posting within scientific collaboration networks (SCNs). For a detailed description of our policy on posting to SCNs, please see our Web Posting Guidelines (https://publishing.aip.org/authors/web-posting-guidelines).
5. Reprint the Version of Record (VOR) in print collections written by the Author, or in the Author's thesis or dissertation. It is understood and agreed that the thesis or dissertation may be made available electronically on the university's site or in its repository and that copies may be offered for sale on demand.
6. Reproduce copies of the VOR for courses taught by the Author or offered at the institution where the Author is employed, provided no fee is charged for access to the Work.
7. Use the VOR for internal training and noncommercial business purposes by the Author's employer.
8. Use the VOR in oral presentations made by the Author, such as at conferences, meetings, seminars, etc., provided those receiving copies are informed that they may not further copy or distribute the Work.
9. Distribute the VOR to colleagues for noncommercial scholarly use, provided those receiving copies are informed that they may not further copy or distribute the Work.
10. Post the VOR to their personal web page or their employer's web page 12 months after publication by AIP Publishing.
11. Deposit the VOR in an institutional or funder-designated repository 12 months after publication by AIP Publishing.
12. Update a prior posting with the VOR on a noncommercial server such as arXiv, 12 months after publication by AIP Publishing.

Author Warranties

Each Author and Copyright Owner represents and warrants to AIP Publishing the following:

1. The Work is the original independent creation of each Author and does not infringe any copyright or violate any other right of any third party.
2. The Work has not been previously published and is not being considered for publication elsewhere in any form, except as a preprint on a noncommercial server such as arXiv, or in a thesis or dissertation.
3. Written permission has been obtained for any material used from other sources, and copies of the permission grants have been supplied to AIP Publishing to be included in the manuscript file.
4. All third-party material for which permission has been obtained has been properly credited within the manuscript.
5. In the event that an Author is subject to university open access policies or other institutional restrictions that conflict with any of the rights or provisions of this License, such Author has obtained the necessary waiver from his or her university or institution.

This License must be signed by the Author(s) and, in the case of a Work Made for Hire, also by the Copyright Owners. One Author/Copyright Owner may sign on behalf of all the contributors/owners only if they all have authorized the signing, approved of the License, and agreed to be bound by it. The signing Author and, in the case of a Work Made for Hire, the signing Copyright Owner warrants that he/she/it has full authority to enter into this License and to make the grants this License contains.

Click here for definitions of the License terms
Click here for definitions of the Government Institutions
Click here for the list of Federally Funded Research and Development Centers (FFRDCs)

Please select a Copyright License Type:

● **Regular (Exclusive license to publish)** - I represent and warrant that I am (i) the sole author; (ii) the authorized agent to sign on behalf of all of the authors; (iii) the authorized agent to sign on behalf of the commissioning person or organization: or (iv) the authorized agent to sign on behalf of my employer;
○ **U.S. Government (No copyright to be licensed)** - I represent and warrant that I am an employee of the U.S. Government and that this work was prepared as part of my official duties with the U.S. Government and therefore is not subject to copyright;
○ **U.S. Government-funded (Exclusive license to publish)** - I represent and warrant that this work was prepared in the scope of my employment at a laboratory that receives U.S. Government funding [see list of Federally Funded Research and Development Centers (FFRDCs)] and i) I am an authorized agent to sign on behalf of my employer; or ii) I am not authorized to sign on behalf of my employer but will supply a copy of the license to Publish Agreement form with an authorized signature (A PDF copy of the License to Publish Agreement may be obtained from the editorial staff.) Please note that if the Work was authored under a U.S. Government contract AIP Publishing acknowledges that the U.S. Government will retain for itself and others acting on Its behalf a paid-up nonexclusive irrevocable worldwide license In the Work to reproduce prepare derivative works from distribute copies to the public perform publicly and display publicly the Work by or on behalf of the Government;
○ **United Kingdom Crown Copyright (Crown retains copyright grants nonexclusive license)** - The work is subject to Crown Copyright. I am submitting a license agreement for AIP Publishing LLC's execution.
○ **Canadian Crown Copyright (Crown retains copyright grants nonexclusive license)** - The work is subject to Crown Copyright. I represent and warrant that I have received authorization to publish the work from the Crown Copyright and Licensing Section of Government of Canada Publishing. I am submitting a license agreement for AIP Publishing LLC's execution.
○ **Australian Crown Copyright (Crown retains copyright grants nonexclusive license)** - The work is subject to Crown Copyright. I represent and warrant that I have received authorization to publish the work from the Australian Commonwealth Department or other agency responsible for the work. I am submitting a license agreement for AIP Publishing LLC's execution.

EUROfusion Consortium: Authors whose work was carried out within the framework of the EUROfusion Consortium are now able to accept AIP Publishing’s standard license to publish and should select the “Regular” option above. Please refer to the joint announcement issued by AIP Publishing and EUROfusion.

Acting in the above capacity, you agree that in consideration of acceptance of the Work for publication, you do hereby grant to AIP Publishing LLC an exclusive license to publish the electronically attached/submitted work as specified in the AIP Publishing License to Publish Agreement above, which you have read.

Please check one of the checkboxes below:

● **I accept this form in accordance with the copyright type that I have chosen.**
○ **I am unable to accept this form and an alternate copyright license file has been uploaded.**

Please type your FULL First and Last Names (no initials) in the boxes below.

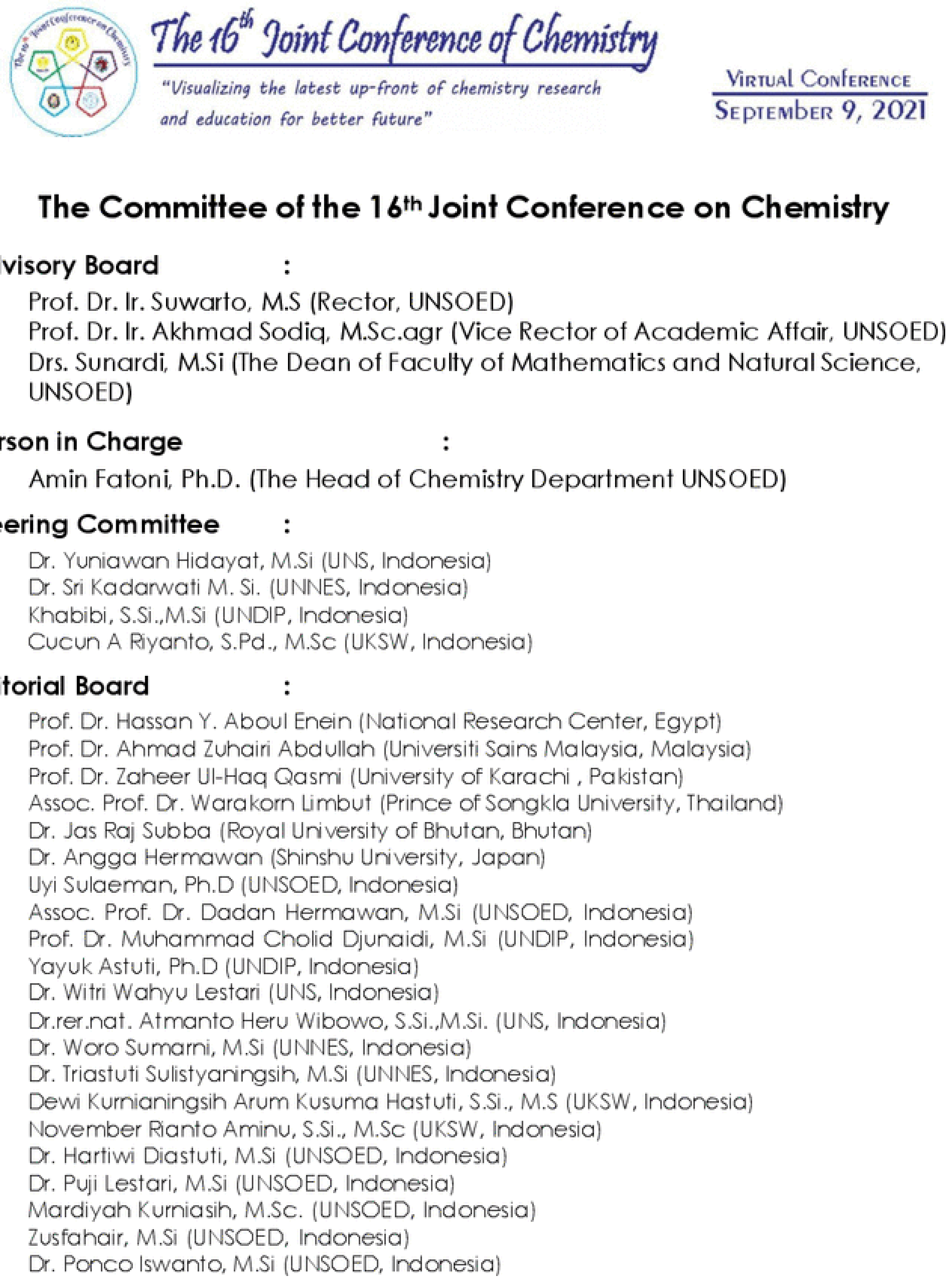
First Name: Dian   Last Name: Windy

You must accept this form or provide an appropriate alternate license form in order for the AIP Publishing LLC to publish your paper. Send requests for further information to the Office of Rights and Permissions, AIP Publishing LLC, Suite 110, 1305 Walt Whitman Road, Melville, NY 11747-4300, USA; Phone: 516-576-2268; Fax: 516-576-2450; Email: rights@aip.org.

Please review your selection and make any changes, if necessary, before submitting this form.

☑ I certify that the information provided in this form is accurate.

local_p_id: 1828923
time: 1655429739
ip address: 125.162.208.139



The 16th Joint Conference of Chemistry

"Visualizing the latest up-front of chemistry research and education for better future"

VIRTUAL CONFERENCE
SEPTEMBER 9, 2021

The Committee of the 16th Joint Conference on Chemistry

Advisory Board :

Prof. Dr. Ir. Suwarto, M.S (Rector, UNSOED)
Prof. Dr. Ir. Akhmad Sodiq, M.Sc.agr (Vice Rector of Academic Affair, UNSOED)
Drs. Sunardi, M.Si (The Dean of Faculty of Mathematics and Natural Science, UNSOED)

Person in Charge :

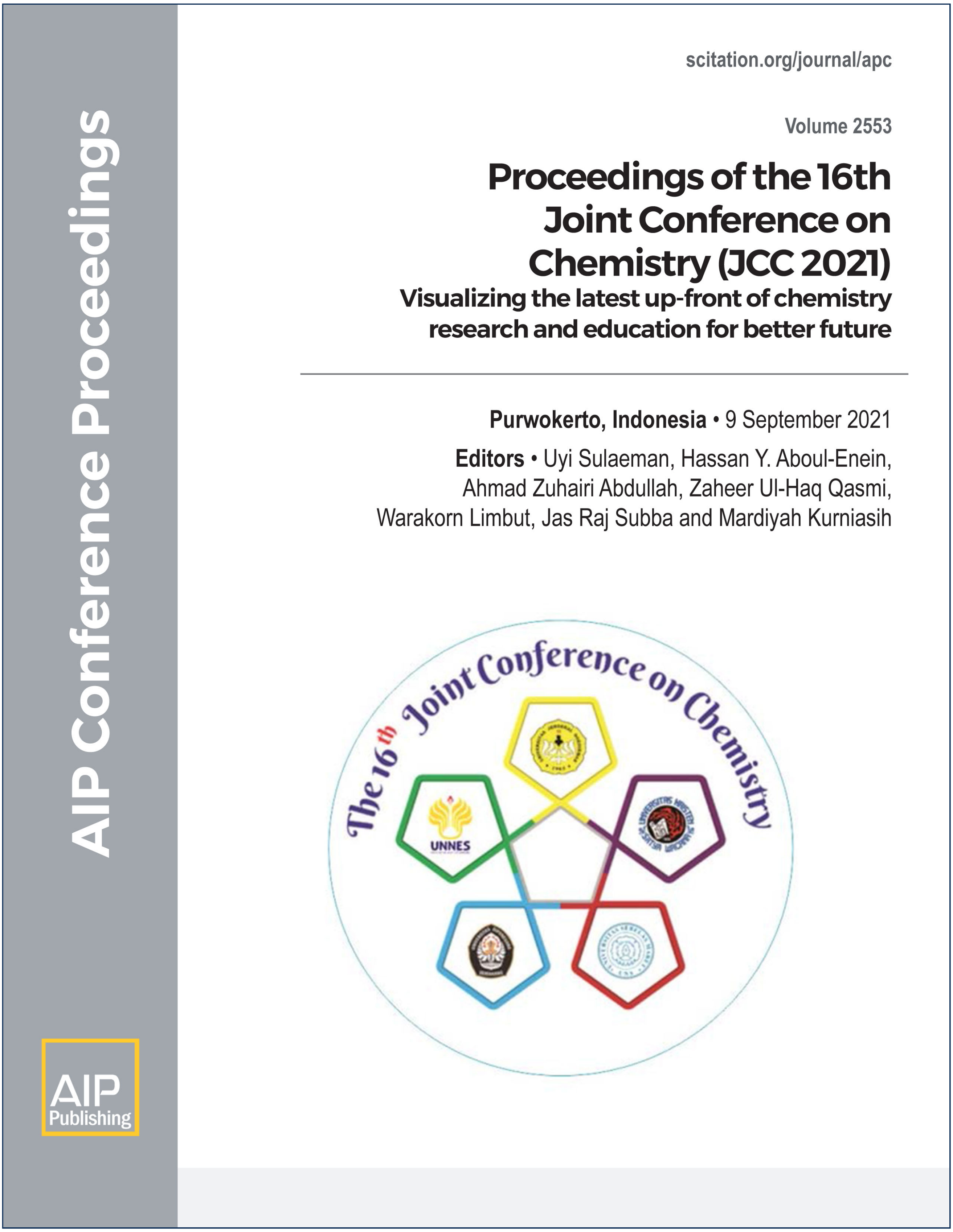
Amin Fatoni, Ph.D. (The Head of Chemistry Department UNSOED)

Steering Committee :

Dr. Yuniawan Hidayat, M.Si (UNS, Indonesia)
Dr. Sri Kadarwati M. Si. (UNNES, Indonesia)
Khabibi, S.Si.,M.Si (UNDIP, Indonesia)
Cucun A Riyanto, S.Pd., M.Sc (UKSW, Indonesia)

Editorial Board :

Prof. Dr. Hassan Y. Aboul Enein (National Research Center, Egypt)
Prof. Dr. Ahmad Zuhairi Abdullah (Universiti Sains Malaysia, Malaysia)
Prof. Dr. Zaheer Ul-Haq Qasmi (University of Karachi , Pakistan)
Assoc. Prof. Dr. Warakorn Limbut (Prince of Songkla University, Thailand)
Dr. Jas Raj Subba (Royal University of Bhutan, Bhutan)
Dr. Angga Hermawan (Shinshu University, Japan)
Uyi Sulaeman, Ph.D (UNSOED, Indonesia)
Assoc. Prof. Dr. Dadan Hermawan, M.Si (UNSOED, Indonesia)
Prof. Dr. Muhammad Cholid Djunaidi, M.Si (UNDIP, Indonesia)
Yayuk Astuti, Ph.D (UNDIP, Indonesia)
Dr. Witri Wahyu Lestari (UNS, Indonesia)
Dr.rer.nat. Atmanto Heru Wibowo, S.Si.,M.Si. (UNS, Indonesia)
Dr. Woro Sumarni, M.Si (UNNES, Indonesia)
Dr. Triastuti Sulistyaningsih, M.Si (UNNES, Indonesia)
Dewi Kurnianingsih Arum Kusuma Hastuti, S.Si., M.S (UKSW, Indonesia)
November Rianto Aminu, S.Si., M.Sc (UKSW, Indonesia)
Dr. Hartiwi Diastuti, M.Si (UNSOED, Indonesia)
Dr. Puji Lestari, M.Si (UNSOED, Indonesia)
Mardiyah Kurniasih, M.Sc. (UNSOED, Indonesia)
Zusfahair, M.Si (UNSOED, Indonesia)
Dr. Ponco Iswanto, M.Si (UNSOED, Indonesia)



AIP Conference Proceedings

scitation.org/journal/apc

Volume 2553

Proceedings of the 16th Joint Conference on Chemistry (JCC 2021)

Visualizing the latest up-front of chemistry research and education for better future

Purwokerto, Indonesia • 9 September 2021

Editors • Uyi Sulaeman, Hassan Y. Aboul-Enein,
Ahmad Zuhairi Abdullah, Zaheer Ul-Haq Qasmi,
Warakorn Limbut, Jas Raj Subba and Mardiyah Kurniasih

AIP Publishing

November 2022

PROCEEDINGS OF THE 16TH JOINT CONFERENCE ON CHEMISTRY (JCC 2021):
Visualizing the latest up-front of chemistry research and education for better future

Close

MENU SIGN IN/REGISTER

AIP Publishing Conference Proceedings

HOME BROWSE MORE

Table of Contents

PROCEEDINGS OF THE 16TH JOINT CONFERENCE ON CHEMISTRY (JCC 2021): Visualizing the latest up-front of chemistry research and education for better future

PREV NEXT

Conference date: 9 September 2021
Location: Purwokerto, Indonesia
ISBN: 978-0-7354-4281-8
Editors: Uyi Sulaeman, Hassan Y. Aboul-Enein, Ahman Zuhairi Abdullah, Zaheer Ul-Haq Qasmi, Warakorn Limbut, Jas Raj Subba and Mardiyah Kurniasih
Volume number: 2553
Published: Nov 22, 2022

DISPLAY : 20 50 100 all

PRELIMINARY

No Access . November 2022

Preface: The 16th Joint Conference on Chemistry 2021 (16th JCC)

BROWSE VOLUMES

AIP Conference Proceedings **2553**, 010001 (2022); https://doi.org/10.1063/12.0012151

No Access . November 2022

Committee: The 16th Joint Conference on Chemistry 2021 (16th JCC)

AIP Conference Proceedings **2553**, 010002 (2022); https://doi.org/10.1063/12.0015105

ARTICLES

No Access . November 2022

The adsorption capacity of clay cetyltrimethylammonium/magnetite against the metal ion Cr(VI)

Choiril Azmiyawati, Ahmad Al Mutashim Billah and Adi Darmawan

AIP Conference Proceedings **2553**, 020001 (2022); https://doi.org/10.1063/5.0103671

SHOW ABSTRACT

No Access . November 2022

BROWSE VOLUMES

Intermolecular interaction and molecular dynamics study of carboxymethyl Chitosan... Vitamin C molecular complex for understanding encapsulation and kinetics-controlled released mechanism

Cholifatul Jannah, Dwi Hudiyanti, Vivitri Dewi Prasasty and Parsaoran Siahaan

AIP Conference Proceedings **2553**, 020002 (2022); https://doi.org/10.1063/5.0103717

SHOW ABSTRACT ⋮

🔒 No Access . November 2022

Degradation of methylene blue in TiO_2-Fe(VI) system with UV radiation

Dian Windy Dwiasi, Anung Riapanitra and Eggy Izzi Saliya

AIP Conference Proceedings **2553**, 020003 (2022); https://doi.org/10.1063/5.0103697

SHOW ABSTRACT ⋮

🔒 No Access . November 2022

Encapsulation of hyptolide coated alginate, chitosan, and alginate-chitosan

Meiny Suzery, Bambang Cahyono, Widayat and Lina Apriliana

AIP Conference Proceedings **2553**, 020004 (2022); https://doi.org/10.1063/5.0106801

SHOW ABSTRACT ⋮

BROWSE VOLUMES

No Access . November 2022

Synthesis of chitosan for removal of methyl orange and malachite green dyes

Tien Setyaningtyas, Mardiyah Kurniasih, Afrizal Diaz Aztiza Nur Azizi, Kapti Riyani and Dwi Kartika

AIP Conference Proceedings **2553**, 020005 (2022); https://doi.org/10.1063/5.0103999

SHOW ABSTRACT

No Access . November 2022

The effect of formaldehyde addition on the distribution of trimethylamine oxide (TMAO) and trimethylamine (TMA) in marine and freshwater fish organs

Farida Ariyani, Umi Anissah, Hedi Indra Januar, Giri Rohmad Barokah and Ajeng Kurniasari Putri

AIP Conference Proceedings **2553**, 020006 (2022); https://doi.org/10.1063/5.0104100

SHOW ABSTRACT

No Access . November 2022

Synthesis of vanadium oxide material and its photocatalytic activity in the degradation of methylene blue

Anung Riapanitra, Tien Setyaningtyas, Kapti Riyani, Roy Andreas, Agni Lili Ariyanti and Uyi Sulaeman

BROWSE VOLUMES

AIP Conference Proceedings **2553**, 020007 (2022); https://doi.org/10.1063/5.0103707

SHOW ABSTRACT ⋮

No Access . November 2022

Ointmen the formulation of bachang mango (*Mangifera foetida* L.) leaves methanol extract and activity test against *Malassezia furfur*

Dian Riana Ningsih, Anung Riapanitra, Purwati, Zusfahair, Gangga Aji Tetuko and Alin Lutpiani

AIP Conference Proceedings **2553**, 020008 (2022); https://doi.org/10.1063/5.0103720

SHOW ABSTRACT ⋮

No Access . November 2022

Formulation and release profile for encapsulation of *Centella asiatica* (L.) urban extract in coconut liposomes

Khairul Anam, Silvia Handayani and Dwi Hudiyanti

AIP Conference Proceedings **2553**, 020009 (2022); https://doi.org/10.1063/5.0103925

SHOW ABSTRACT ⋮

No Access . November 2022

BROWSE VOLUMES

Recovery ion Cu(II) using precipitation method with NaOH for methylene blue degradation

Linda Suyati, Prasetyowati, Gunawan, Didik Setiyo Widodo, Khabibi and Yayuk Astuti

AIP Conference Proceedings **2553**, 020010 (2022); https://doi.org/10.1063/5.0104476

SHOW ABSTRACT ⋮

🔒 No Access . November 2022

Antimicrobial activity of N-methyl chitosan and correlation with their degree substitution

Mardiyah Kurniasih, Purwati, Intan Romadhani and Ratna Stia Dewi

AIP Conference Proceedings **2553**, 020011 (2022); https://doi.org/10.1063/5.0103998

SHOW ABSTRACT ⋮

🔒 No Access . November 2022

Non-invasive neonatal jaundice determination using smartphone camera

Mekar Dwi Anggraeni, Amin Fatoni and Eni Rahmawati

AIP Conference Proceedings **2553**, 020012 (2022); https://doi.org/10.1063/5.0103718

SHOW ABSTRACT ⋮

BROWSE VOLUMES

Synthesis of copolymer eugenol-trithiol-divinylbenzene via photoinitiated cross-linking reaction as antibacterial compound

Ngadiwiyana, Dihan Vigy Laksana, Damar Nurwahyu Bima, Ismiyarto, Purbowatiningrum Ria Sarjono and Nor Basid Adiwibawa Prasetya

AIP Conference Proceedings **2553**, 020013 (2022); https://doi.org/10.1063/5.0103667

SHOW ABSTRACT ⋮

No Access . November 2022

Potential of extracellular chitinase from *Bacillus subtilis* B 298 as antifungal against *Rhizoctonia solani*

Puji Lestari, Suyata Suyata and Ely Setiawan

AIP Conference Proceedings **2553**, 020014 (2022); https://doi.org/10.1063/5.0103775

SHOW ABSTRACT ⋮

No Access . November 2022

Analysis and identification of microbial activity of bioactive component fraction in red and green betels

Rifda Naufalin, Erminawati and Ahmad Hasyim

AIP Conference Proceedings **2553**, 020015 (2022); https://doi.org/10.1063/5.0103951

SHOW ABSTRACT ⋮

BROWSE VOLUMES

No Access . November 2022

Antioxidant soap formula based on nyamplung seed oil (*Calophyllum inopphyllum*) with bidara leaves (*Ziziphus mauritiana*) and ketapang fruit (*Terminalia catappa* L) additives

Senny Widyaningsih, Moch Chasani and Novia Ariska Pratiwi

AIP Conference Proceedings **2553**, 020016 (2022); https://doi.org/10.1063/5.0103812

SHOW ABSTRACT

No Access . November 2022

Formulation, characterization and sunscreen potential evaluation of lemongrass *(Cymbopogon citratus)* oil nanoemulsion

Undri Rastuti, Uyi Sulaeman, Senny Widyaningsih, Sity Khalidah Zia and Ryan Aditya Mahendra

AIP Conference Proceedings **2553**, 020017 (2022); https://doi.org/10.1063/5.0105009

SHOW ABSTRACT

No Access . November 2022

Synthesis and photocatalytic properties of Cr-doped SrTiO$_3$ with Ti deficiency for enhanced photocatalytic activity

Uyi Sulaeman, Resha Permana Putra, Kapti Riyani and Ahmad Zuhairi Abdullah

BROWSE VOLUMES

AIP Conference Proceedings **2553**, 020018 (2022); https://doi.org/10.1063/5.0104312

SHOW ABSTRACT

🔒 No Access . November 2022

Optimization of solid state fermentation of banana peel for removal of crystal violet dye from aqueous solution

Agustina L. N. Aminin, Ummy Ulvairoh, Nies Suci Mulyani and Gunawan

AIP Conference Proceedings **2553**, 020019 (2022); https://doi.org/10.1063/5.0103729

SHOW ABSTRACT

🔒 No Access . November 2022

A green chemistry approach using *Alternanthera brasiliana* extract for urea biosensor

Amin Fatoni, Greda Rido Gusti, Zusfahair, Mekar Dwi Anggraeni and Saluma Samanman

AIP Conference Proceedings **2553**, 020020 (2022); https://doi.org/10.1063/5.0103678

SHOW ABSTRACT

🔒 No Access . November 2022

The potency of ethanolic extracts of betel leaves as an antibiofilm against *methicillin-resistant* Staphylococcus

BROWSE VOLUMES

Ari Asnani, Prabadini Ruwielanisa, Hernayanti and Dwi Utami Anjarwati

AIP Conference Proceedings **2553**, 020021 (2022); https://doi.org/10.1063/5.0103681

SHOW ABSTRACT ⋮

No Access . November 2022

Eugenol-based molecularly imprinted membrane synthesis for glucose selective transport

Muhammad Cholid Djunaidi, Nesti Dwi Maharani, Pardoyo and Yanuardi Raharjo

AIP Conference Proceedings **2553**, 020022 (2022); https://doi.org/10.1063/5.0104444

SHOW ABSTRACT ⋮

No Access . November 2022

Analysis of students' conceptual understanding on the acid-base remedial program with multi-representation teaching material

Endang Susilaningsih, Sri Haryani and Nurkintan Aprilia

AIP Conference Proceedings **2553**, 020023 (2022); https://doi.org/10.1063/5.0103797

SHOW ABSTRACT ⋮

No Access . November 2022

BROWSE VOLUMES

The potential of wild spinach (*Amaranthus dubius* Mart) and cockscomb (*Celosia argentea* Var.*Cristata*) seed oil as a source of vegetable squalene

Hartati Soetjipto and November Rianto Aminu

AIP Conference Proceedings **2553**, 020024 (2022); https://doi.org/10.1063/5.0103738

SHOW ABSTRACT

No Access . November 2022

Brine shrimp lethality bioassay of *Zingiber zerumbet* and *Z. cassumunar* rhizomes extracts.

Hartiwi Diastuti, Purwati, Suwandri, Sri Indriani, Restu Pamukasari and Oto Dwi Wibowo

AIP Conference Proceedings **2553**, 020025 (2022); https://doi.org/10.1063/5.0103680

SHOW ABSTRACT

No Access . November 2022

Prediction of bilirubin concentration using neonatal forehead images

Mekar Dwi Anggraeni, Amin Fatoni and Eni Rahmawati

AIP Conference Proceedings **2553**, 020026 (2022); https://doi.org/10.1063/5.0103722

SHOW ABSTRACT

BROWSE VOLUMES

No Access . November 2022

Basis set validation of sodium dodecyl benzene sulfonate based on infrared spectrum using Ab initio method

Ponco Iswanto, Eva Vaulina Yulistia Delsy, Ely Setiawan and Fani Octaviani

AIP Conference Proceedings **2553**, 020027 (2022); https://doi.org/10.1063/5.0104470

SHOW ABSTRACT

No Access . November 2022

Formulation of handsanitizer made of methanolic leaf extract of bachang (*Mangifera foetida* L.) and bacterial activity test on *Escherichia coli*

Purwati, Zusfahair, Dian Riana Ningsih, Linda Cahyani and Alin Lutpiani

AIP Conference Proceedings **2553**, 020028 (2022); https://doi.org/10.1063/5.0103727

SHOW ABSTRACT

No Access . November 2022

Methylene blue removal using mesoporous silica and silica-alumina synthesized by gelatin template

Rahmad Nuryanto, Khabibi, Didik Setyo Widodo, Setiya Rahayu, Mochammad Rifandy Aldiansyah and Pipit Riyanti

AIP Conference Proceedings **2553**, 020029 (2022); https://doi.org/10.1063/5.0103683

SHOW ABSTRACT

BROWSE VOLUMES

No Access . November 2022

Synthesis of ZnO nanoparticles by polyol and co-precipitation method and the application for photoesterification of candlenut oil under UV-LED irradiation

Anisun Zakiyah, Riki Subagyo, Yuly Kusumawati and Hendro Juwono

AIP Conference Proceedings **2553**, 020030 (2022); https://doi.org/10.1063/5.0105816

SHOW ABSTRACT ⋮

No Access . November 2022

The effect of temperature on interaction and dynamical study of protease inhibitors as a SARS-CoV-2 potential drug

Ayu Octa Damayanti, Mukhammad Asy'ari, Vivitri Dewi Prasasty and Parsaoran Siahaan

AIP Conference Proceedings **2553**, 020031 (2022); https://doi.org/10.1063/5.0103742

SHOW ABSTRACT ⋮

No Access . November 2022

Synthesis and characterization of novel basketing of C-4-phenylocta-phenylhydrazide-calix[4]resorcinarene-PdNPs

Busroni Busroni, Ari Tri Wanodyo Handayani, Eka Deddy Irawan and Chairil Anwar

AIP Conference Proceedings **2553**, 020032 (2022); https://doi.org/10.1063/5.0111699

BROWSE VOLUMES

SHOW ABSTRACT

No Access . November 2022

Production and bioactive compounds identification of phytomedicine essential oil using low-cost instrument

Fajar Hardoyono, Kikin Windhani, Herman Sambodo and Hary Pudjianto

AIP Conference Proceedings **2553**, 020033 (2022); https://doi.org/10.1063/5.0103670

SHOW ABSTRACT

No Access . November 2022

Optimization of biodiesel production via esterification of sludge palm oil (SPO) over montmorillonite sulfonated carbon catalyst from glucose

Hasanudin, W. R. Asri, A. Mara, Suheryanto and Apriansyah

AIP Conference Proceedings **2553**, 020034 (2022); https://doi.org/10.1063/5.0103660

SHOW ABSTRACT

No Access . November 2022

The effect of direct current sources for electrolysis of laundry liquid waste surfactants using PbO_2/Pb electrodes with parallel circuit

Irmanto, Wisnu Permadi, Suyata and Santi Nur Handayani

BROWSE VOLUMES

AIP Conference Proceedings **2553**, 020035 (2022); https://doi.org/10.1063/5.0103716

SHOW ABSTRACT

No Access . November 2022

The effect of refining process on the quality of melon (*Cucumis melo* L.) seed oil

Sri Hartini, Stelly Revina Prabowo and Hartati Soetjipto

AIP Conference Proceedings **2553**, 020036 (2022); https://doi.org/10.1063/5.0103721

SHOW ABSTRACT

No Access . November 2022

Gingerol and shogaol content of *Zingiber officinale* Var. Rubrum and its potency as anti acnes based on *in silico* study

Setyanto Tri Wahyudi, Wulan Tri Wahyuni, Shadila Fira Asoka and Irmanida Batubara

AIP Conference Proceedings **2553**, 020037 (2022); https://doi.org/10.1063/5.0103689

SHOW ABSTRACT

No Access . November 2022

Green preparation of precipitated calcium carbonate from

BROWSE VOLUMES

BROWSE VOLUMES

The effect of hydrogen flow rate and temperature on hydrodeoxygenation of oleic acid over Ni/MOR catalysts

Khoirina Dwi Nugrahaningtyas, Yuniawan Hidayat, Rizki Lukitawati, Sofia Aulia Mukhsin and Aji Indo Sabiilagusti

AIP Conference Proceedings **2553**, 020041 (2022); https://doi.org/10.1063/5.0111684

SHOW ABSTRACT ⋮

No Access . November 2022

The effect of plasticizer on the development of chitosan-based bioplastic

Retno Ariadi Lusiana, Ahmad Suseno and Noer Laely Sa'adah

AIP Conference Proceedings **2553**, 020042 (2022); https://doi.org/10.1063/5.0103712

SHOW ABSTRACT ⋮

No Access . November 2022

Effect of calcination temperature on the morphology and photocatalytic activity of Bismuth oxide

Yayuk Astuti, Siti Nurhayati and Arnelli

AIP Conference Proceedings **2553**, 020043 (2022); https://doi.org/10.1063/5.0104124

SHOW ABSTRACT ⋮

BROWSE VOLUMES

No Access . November 2022

Immobilization and characterization of urease from *Phaseolus vulgaris* L using bentonite chitosan matrix

Zusfahair, Dian Riana Ningsih, Amin Fatoni, Dini Ika Lasniati Age and Mardiyah Kurniasih

AIP Conference Proceedings **2553**, 020044 (2022); https://doi.org/10.1063/5.0103676

SHOW ABSTRACT

No Access . November 2022

Effect of cetyltrimethylammonium bromide on hydrophobicity of silica thin layer and xerogel derived from sodium silicate and methyltrimethoxysilane

Riza Fithrotul Maghfiroh, Choiril Azmiyawati and Adi Darmawan

AIP Conference Proceedings **2553**, 020045 (2022); https://doi.org/10.1063/5.0104042

SHOW ABSTRACT

No Access . November 2022

Molecular docking approach for prediction of enantioseparation of miconazole using cyclodextrin derivatives as chiral selector

Dadan Hermawan, Ainaya Halwa Lathufa, Cacu, Ponco Iswanto, Uyi Sulaeman and Hassan Y. Aboul-Enein

AIP Conference Proceedings **2553**, 020046 (2022); https://doi.org/10.1063/5.0107144

BROWSE VOLUMES

SHOW ABSTRACT

No Access . November 2022

Synthesis of citric acid-crosslinked chitosan membrane with zeolite filler and its application as Cu(II) ion separation membrane

Khabibi, Nor Basid Adiwibawa Prasetya, Retno Ariadi Lusiana, Linda Suyati, Rahmad Nuryanto, Lailatul Rohmah and Ika Aprilia Khoirunnisa

AIP Conference Proceedings **2553**, 020047 (2022); https://doi.org/10.1063/5.0104558

SHOW ABSTRACT

No Access . November 2022

Activating cashew nut shell carbon (CNSC) produced by pyrolysis process using microwave and its application on the methylene blue adsorption

Mashuni, La Ode Ahmad, M. Jahiding, Fitri Handayani Hamid, Irmawati and Andi Muhammad Naufal Khaeri

AIP Conference Proceedings **2553**, 020048 (2022); https://doi.org/10.1063/5.0103713

SHOW ABSTRACT

1 2 >

Resources

BROWSE VOLUMES

AUTHOR

LIBRARIAN

ADVERTISER

General Information

ABOUT

CONTACT

HELP

PRIVACY POLICY

TERMS OF USE

FOLLOW AIP PUBLISHING:

Scitation

BROWSE VOLUMES