REALISTING OF CHEMISTRY PONFERENCES Vol 5 (2020)

14th Joint Conference on Chemistry held by Universitas Sebelas Maret

September 10th – 11th, 2019 Surakarta, INDONESIA



CONTENTS

Cover	i
Contents	ii
Preface	iii
Welcome speech	iv
Organizing committee	ix
List of article in AIP Conferences Proceedings	xi
List of article in Alchemy	xxi
List of article in Proceeding of Chemistry Conferences	xxii

PREFACE

Welcome to Surakarta (Solo) - Indonesia

Assalamualaikum wr wb.

Allahamdulillah to the almighty ALLAH SWT, thank you very much for this opportunity to hold the international conference of JCC 14 on 10-11 September 2019, by Chemistry Department, Faculty of Math and Natural Science, Universitas Sebelas Maret. This JCC conference is as annually program of the consortium of five chemistry departments in the region of Middle Java (Universitas Sebelas Maret, Universitas Diponegoro, Universitas Jenderal Sudirman, Universitas Negeri Semarang, Universitas Kristen Satya Wacana) and a guest member from Malaysia (Universitas Malaysia Sabah).

On the behalf of organizing committee of JCC 2019, I appreciate to all participants to meet in this scientific conference on chemistry 2019, 14th JCC. It was my pleasure to facilitate the ideas in development of chemistry and education chemistry within the region of middle Java also worldwide. I expect that our conference gives good impact to the chemist society not only in the region but in the world through the scientific ideas or publications outcoming from this conference. Some outstanding papers that have been presented in the venue of conference were and will be published in some different journals such as Evergreen, Open Chemistry, Indonesian Journal of Chemistry and also in AIP publishing that are indexed by Scopus.

I would like to thank to Scientific Committee for the publishing articles of the proceeding of the 14th JCC conference in PCC proceeding.

Waalaikumsalam wr. wb.

Surakarta, 6 June 2020

Dr. rer.nat. Atmanto Heru Wibowo, Chairman of JCC 2019

Welcome Speech from Head of Chemistry Department

Universitas Sebelas Maret

We are very pleased to introduce The 14th Joint Chemistry Conference held by Chemistry Dept. of Sebelas Maret University on behalf of the Chemistry Consortium in Central Java, Indonesia. In this year, we have guests consortium from University Malaysia Sabah (UMS), I hope that the joining of UMS can increase the quality of this conference and can be continued for the upcoming JCC.

The 14th Joint Chemistry Conference was held on the Solo Paragon Hotel and Residences (Paragon Hotel) in Solo during 10 -11th of September 2019. Solo as "The Spirit of Java," a Javanese culture and heritage center, batik capital, and tourist-friendly city. Theme this conference is "Strengthening the Foundation of Sustainable Development: Research, Practice and Education". The conference will emphasize the multidisciplinary chemical issue and impact of today's sustainable chemistry which covering the following topics: Electrochemistry, Polymer Chemistry, Materials Chemistry, Nanomaterials, Medicinal Chemistry, Pharmaceutical Chemistry, Green Chemistry, Computational Chemistry, Natural Products Chemistry, Surface Chemistry and Interfaces, and Educational Chemistry.

We hope that this conference can initiate UNS cooperation with various parties to contribute our science for the benefit of society. Finally, we hope this seminar can take place smoothly and successfully, and its results can be implemented and bring benefit to the wider community.

Dr. Abu Masykur, M.Si. Head of Chemistry Department, Universitas Sebelas Maret (UNS)

Welcome Speech from Head of Chemistry Department Universitas Jenderal Soedirman

Assalamualaykum warohmatullohi wabarokatuh,

Praises to Alloh SWT who give blessing to allow us to organize the 14th Joint Conference on Chemistry 2019.

I would like to greatly appreciate to the Keynote Speakers, Invited Speaker and all participant who delight to joint this international conference in chemistry. I also would like to deepest appreciation to the organizing committee of 14th Joint Conference on Chemistry who well organize this event. The great collaboration between Diponegoro University, Semarang State University, Jenderal Soedirman University, Sebelas Maret University and Satya Wacana University continuously improve this yearly scientific event in chemistry. Hopefully in the future, the collaboration would be improved in other fields such as research collaboration and lecture exchange.

In the end, I hope this event provide a scientific discussion, professional networking, research collaboration, education, and dissemination of scientific research, innovation and industrial products in order to solve the problem in Chemistry in the future life.

Amin Fatoni, Ph.D. Head of Chemistry Department, Universitas Jenderal Soedirman (UNSOED)

Welcome Speech from Head of Chemistry Department Universitas Kristen Satya Wacana Indonesia

Distinguished guest, ladies and gentlemen,

Welcome to The14th Joint Conference on Chemistry (The 14th JCC). This Year, The 14thJCC is conducted by Department of Chemistry, Universitas Sebelas Maret, Indonesia. The 14th JCC take theme "Strengthening the Foundation of Sustainable Development: Research, Practice and Education".

Chemistry Department, Faculty of Science and Mathematics of Universitas Kristen Satya Wacana (UKSW) Indonesia has been motivated to joint in Chemistry Department Central Java Indonesia Consortium to strengthen networking and collaboration in the advancement of the mastery of science and technology and the applications, to the benefits of all human kinds. Chemistry Department UKSW Indonesia works focus on applied chemistry in food, natural resources and environment research development. Working with several industries, Chemistry Department UKSW diffuses innovation through product development in health and functional food.

We truly expect that this conference can advance networking and collaboration through chemistry and related field innovation for sustainable development. We hope you will enjoy a pleasant and valuable conference at The 14th JCC.

Dr. Yohanes Martono, M.Sc. Head of Chemistry Department, Faculty of Science and Mathematics Universitas Kristen Satya Wacana Indonesia (UKSW)

Welcome Speech from Head of Chemistry Department Universitas Diponegoro

Warm greetings!!!

On behalf of the Chemistry Department Diponegoro University, I am pleased to welcome all the delegates and their guests to Surakarta, Jawa Tengah, for the 14th Joint Conference on Chemistry that will take place from September 10-11, 2019. This annual conference dedicated to the science and practice of chemistry, and it will give participants a stage to uncover novel opportunities, discuss ideas, meet fresh contacts, reacquaint with colleagues, and grow their understanding. We believe that the event, as in earlier years, will offer a medium for lively discussion among participants.

Research and innovation is the pillars of chemistry. That calls upon us to strengthen our basic research energy and our communal networks to become a global leader in chemistry. I cannot help but be astounded by the breadth and depth of the topics addressed in the program for this conference. It is an agenda that well embody the crucial roles that chemists play. By coming to this meeting, you confirm your capacity to take up and implement this knowledge as well as to transfer it so as to have impact.

To all partakers I acknowledge each of you for joining our conference and conveying your knowledge to our gathering. I also would like to thank fellow associates of the consortium who have devotedly partaken this occasion every year. Lastly, my uppermost appreciation and gratefulness goes to the entire Organizing and Scientific Program committees, for the enormous amounts of time and energy they have dedicated to guarantee that this conference is a success.

Thank you and enjoy the conference! Semarang, September 2019

Dr. Dwi Hudiyanti, MSc. Head of Chemistry Department, Universitas Diponegoro (UNDIP)

Welcome Speech from Head of Chemistry Department

Universitas Negeri Semarang

The 14th Joint Conference on Chemistry (JCC) 2019 was successfully took place on the 10th -11th October 2019 at Solo, Indonesia. The JCC2019 was organized by Universitas Negeri Sebelas Maret (UNS) in collaboration with Universitas Negeri Semarang (UNNES), Universitas Jenderal Soedirman (UNSOED), Universitas Diponegoro (UNDIP) and Universitas Kristen Satya Wacana (UKSW). The JCC2019 aims to provide a platform for discussing the issues, challenges, opportunities and findings of chemistry and related field research.

The responses to the call-for-papers had been overwhelming. We would like to express our gratitude and appreciation for all of the reviewers who helped us maintain the high quality of manuscripts. We would also like to extend our thanks to the members of the organizing team for their hard work.

It is a great privilege for us to present the proceedings of the JCC2019 to the authors and delegates of the event. We hope that you will find it useful, exciting and inspiring.

Let us wish that all the participants of JCC2019 will have a beneficial, wonderful and fruitful time at the conference.

Cepi Kurniawan, PhD Chemistry Department Universitas Negeri Semarang (UNNES)

ORGANIZING COMMITTEE OF 14th JOINT CONFERENCE ON CHEMISTRY (JCC) 2019

Advisory Board:

Prof. Dr. Jamal Wiwoho, S.H., M.Hum (Rector of Sebelas Maret University, Indonesia) Prof. Dr. Ir. Ahmad Yunus, M.S (Sebelas Maret University)

Drs. Harjana, M.Si., M.Sc., Ph.D (Dean of Faculty of Mathematics & Natural Sciences, Sebelas Maret University, Indonesia)

Prof. Dr. Evamarie. Hey-Hawkins (Leipzig University, Germany) Prof. Hirofumi Tanaka (Kyushu Institute of Technology, Japan) Prof. Santiago Gomez-Ruiz (Rey Juan Carlos University, Spain) Assoc. Prof. Javier Cepeda Ruiz (University of the Basque Country, Spain) Prof. Zaher Judeh, Ph.D (Nanyang Technology University, Singapore)

Assoc. Prof. Dr. Younki Lee (Gyeongsang National University, Republic of Korea) Prof.Dr. How Siew Eng (Universiti Malaysia Sabah)

Assoc. Prof. Dr. Pranoto, M.Sc (Sebelas Maret University) Dr. Abu Masykur, M.Si (Sebelas Maret University)

Prof. Dra. Neng Sri Suharty, M.S., Ph.D (Sebelas Maret University)

Prof. Drs. Sentot Budi Rahardjo, Ph.D (Sebelas Maret University) Dr. Triana Kusumaningsih, M.Si (Sebelas Maret University)

Scientific Committee: Publication and proceeding:

Dr. Fitria Rahmawati, S.Si., M.Si. (Sebelas Maret University) Dr. Khoirina Dwi Nugrahaningtyas, M.Si (Sebelas Maret University) Teguh Endah saraswati, M.Eng, PhD (Sebelas Maret University) Dr. Mohd Sani Sarjadi (Universiti Malaysia Sabah) Nor Basid Adiwibawa P., S.Si, M.Sc, Ph.D (Diponegoro University) Dr. Santi Nur Handayani, M.Si (Jenderal Soedirman University) Dra. Hartati Soetjipto, M.Sc (Kristen Satya Wacana University) M. Alauhdin, Ph.D (Semarang State University)

Organizing committee:

General Chair

Dr.rer.nat. Atmanto Heru Wibowo, M.Si. (Sebelas Maret University)

Co-chairman

Dr. Dian Maruto Widjanarko, M.Si. (Sebelas Maret University) Dr. Dwi Hudiyanti, M.Sc (Diponegoro University) Dr. Suwandri, S.Si., M.Si (Jenderal Soedirman University) Dr. Nanik Wijayati, M.Si (Semarang State University) Dr. Yohanes Martono, S.Si., M.Sc (Kristen Satya Wacana University)

Secretary

Dr.rer.nat. Maulidan Firdaus, M.Sc. (Sebelas Maret University) Prof. Venty Suryani, M.Phil., Ph.D (Sebelas Maret University) Dr.rer.nat. Witri Wahyu Lestari, M.Sc. (Sebelas Maret University)

Treasury

Dr. Desi Suci Handayani, M.Si. (Sebelas Maret University) Dr. Soerya Dewi Marliana, M.Si. (Sebelas Maret University)

Secretariat, registration, equipments

Candra Purnawan, MSc (Sebelas Maret University) Dr. Sri Hastuti, M.Si. (Sebelas Maret University)

Publication, documentation

Anang Kuncoro Rachmad Setiawan, S.Si. Apt (Sebelas Maret University) Fachrul Faizalti Ricki Arfian (Sebelas Maret University)

Technical program

Dr. Eddy Heraldy, M.Si (Sebelas Maret University) Dr. Sayekti Wahyuningsih, M.Si (Sebelas Maret University) Dra. Tri Martini, M.Si (Sebelas Maret University)

Web and Information System

Dr.rer.nat. Fajar Rahman W, M.Si. (Sebelas Maret University) Edi Pramono, M.Si (Sebelas Maret University)

Cultural event, Sponsorship, and City Tour

Dr. Yuniawan Hidayat, M.Si. (Sebelas Maret University) Dr. I.F. Nurcahyo, M.Si. (Sebelas Maret University)

Logistic

Nanik Subekti, A.Md (Sebelas Maret University) Tri Daryanti, S.Sos (Sebelas Maret University) Ninik Hartati, A.Md (Sebelas Maret University)

List of published articles in AIP Conferences Proceeding Vol 2237 (2020) Published Online: 02 June 2020 (https://aip.scitation.org/toc/apc/2237/1?windowStart=50&size=50)

Kinetic study of methylene blue photocatalytic decolorization using zinc oxide under UV-LED irradiation

Riki Subagyo, Yuly Kusumawati and Wahyu Bambang Widayatno AIP Conference Proceedings **2237**, 020001 (2020); https://doi.org/10.1063/5.0005263

Fenton reaction involvement on methyl orange biodegradation by brown-rot fungus *Gloeophyllum* trabeum

Adi Setyo Purnomo, Nur Elis Agustina Andyani, Refdinal Nawfa and Surya Rosa Putra AIP Conference Proceedings **2237**, 020002 (2020); https://doi.org/10.1063/5.0005230

Metal phase and electron density of transition metal/HZSM-5

Khoirina Dwi Nugrahaningtyas, Marita Maharani Putri and Teguh Endah Saraswati AIP Conference Proceedings **2237**, 020003 (2020); https://doi.org/10.1063/5.0005561

Renewable energy from sediment microbial fuel cell technology from Kendari Bay swamp sediments

Ahmad Zaeni, Prima Endang Susilowati, Alwahab and La Ode Ahmad AIP Conference Proceedings **2237**, 020004 (2020); https://doi.org/10.1063/5.0011271

Synthesis and characterization of unsymmetrically branched alkyl chains carbazole-based polymer

Mohd Sani Sarjadi, Shu Er Tan, Xin Lin Wong, Farah Hannan Anuar, Md. Shaheen Sarkar and Md. Lutfor Rahman

AIP Conference Proceedings 2237, 020005 (2020); https://doi.org/10.1063/5.0005389

Synthesis of magnetite@SILICA-CTA in a *cetyl trimethyl ammonium bromide* (CTAB) concentration variations for fenol adsorption

Choiril Azmiyawati, F. A. Yamin, A. Darmawan and L. Suyati AIP Conference Proceedings **2237**, 020006 (2020); https://doi.org/10.1063/5.0005717

Study of Rhodamine B adsorption onto activated carbon from spent coffee grounds Teguh Wirawan, Soerja Koesnarpadi and Nanang Tri Widodo AIP Conference Proceedings **2237**, 020007 (2020); https://doi.org/10.1063/5.0005610

Photodegradation of phenol in batik wastewater with copper (II) oxide under visible light illumination

Tien Setyaningtyas, Kapti Riyani and Cherly Firdharini AIP Conference Proceedings **2237**, 020008 (2020); https://doi.org/10.1063/5.0005354

Curing characteristics and mechanical properties of wasted crumb rubber-styrene butadiene rubber binary blends using bio based softener

Rahmaniar, Aprillena Tornadez Bondan and Tri Susanto AIP Conference Proceedings **2237**, 020009 (2020); https://doi.org/10.1063/5.0005226

Activation of carbon from rice husk using chemical activating agents and physical treatments as sodium lauryl sulfate adsorbent

Arnelli, Laila N. Mastuti, Aulia D. Arini and Yayuk Astuti AIP Conference Proceedings **2237**, 020010 (2020); https://doi.org/10.1063/5.0008302

Imprinted zeolite modified carbon paste electrode as a selective potentiometric sensor for blood glucose

Miratul Khasanah, Alfa Akustia Widati, Usreg Sri Handajani, Masfah Raudlotus Shofiyyah, Sabrina Aulia Rakhma and Herwin Predianto

AIP Conference Proceedings 2237, 020011 (2020); https://doi.org/10.1063/5.0005231

Optimization of supersaturated solution from *stevia rebaudiana* water extract lead to crystal nucleation

Yohanes Martono, Yohanes Difto Adiwibowo and November Rianto Aminu AIP Conference Proceedings **2237**, 020012 (2020); https://doi.org/10.1063/5.0005667

Determination of glucose content with a concentration within the physiological range by FT-NIR spectroscopy in a trans-reflectance mode

Ferdy S. Rondonuwu and Andreas Setiawan AIP Conference Proceedings **2237**, 020013 (2020); https://doi.org/10.1063/5.0008552

Effect of acidic level (pH) of red dragon fruit (Hylocereus costaricencis) peels extract on DSSC efficiency

P. Faqih, F. Nurosyid and T. Kusumaningsih AIP Conference Proceedings **2237**, 020014 (2020); https://doi.org/10.1063/5.0005686

Larvicidal potential of Lantana camara as bio larvicidal for Aedes aegypti 3rd instar larvae

November Rianto Aminu, Ribka Dewi Kristiana, Sri Hartini and Hartati Soetjipto AIP Conference Proceedings **2237**, 020015 (2020); https://doi.org/10.1063/5.0005207

Adsorption of cibacet yellow and cibacet red from aqueous solution onto activated carbon from annatto peels (*Bixa orellana* L.)

C. A. Riyanto, Y. S. Widodo, M. S. Ampri, E. Prabalaras, A. Sudibya, Y. A. Putra, I. G. K. A. Kameswara and F. T. W. Hananto AIP Conference Proceedings **2237**, 020016 (2020); https://doi.org/10.1063/5.0005372

Effect of working electrode thickness using binahong leaves (Anredera cordifolia) dye to the efficiency of dye-sensitized solar cell (DSSC)

B. Y. Muryani, F. Nurosyid and Kusumandari

AIP Conference Proceedings 2237, 020017 (2020); https://doi.org/10.1063/5.0005688

A novel synthesis of 1,1'-(2,4,6-trihydroxy-1,3-phenylene)bis(ethan-1-one) (DAPG) using CuSO₄.5H₂O as a green catalyst

Carissa Hertiningtyas, Triana Kusumaningsih and Maulidan Firdaus AIP Conference Proceedings **2237**, 020018 (2020); https://doi.org/10.1063/5.0005344

$RGO\text{-}NiCo_2S_4$ composite as a counter electrode for solid-state DSSC system with CuI as an electrolyte

Qonita Awliya Hanif, Sayekti Wahyuningsih and Ari Handono Ramelan AIP Conference Proceedings **2237**, 020019 (2020); https://doi.org/10.1063/5.0009131

Biodiesel production using palm fatty acid distillate and rice husk silica supported NiSO₄ as catalyst

Noor Hindryawati, Nanang Tri Widodo, Moh. Syaiful Arief, Irfan Ashari Hiyahara and Gaanty Pragas Maniam

AIP Conference Proceedings **2237**, 020020 (2020); https://doi.org/10.1063/5.0005557

Esterification of oxidized ricinoleic acid with various alcohols to produce emulsifier and antimicrobial compounds

Atika Nabilah, Sri Handayani, Siswati Setiasih, Dyah Utami Cahyaning Rahayu and Sumi Hudiyono AIP Conference Proceedings **2237**, 020021 (2020); https://doi.org/10.1063/5.0005809

Nanoparticles Fe₃O₄ modified chitosan and its antibacterial applications

Soerja Koesnarpadi, Winni Astuti and Ika Yekti Lianasari AIP Conference Proceedings **2237**, 020022 (2020); https://doi.org/10.1063/5.0005693

Synthesis of hydroxylated azomethine compounds and the antioxidant activity

Nova Rifqi Rahmawati, Ngadiwiyana, Nor Basid Adiwibawa Prasetya, Purbowatingrum Ria Sarjono, Yosie Andriani, Desy Fitrya Syamsumir and Ismiyarto AIP Conference Proceedings **2237**, 020023 (2020); https://doi.org/10.1063/5.0005806

Synthesis of salicylic acid modified magnetite nanoparticles and its application in wastewater treatment

Thutug Rahardiant Primadi, Fauziatul Fajaroh, Syaiful Bahri, Nazriati, Aman Santoso, Endang Ciptawati and Adrian Nur

AIP Conference Proceedings 2237, 020024 (2020); https://doi.org/10.1063/5.0005360

Modification of synthetic carpet using chitosan-titania nanocomposite for anti-bacterial and antiodor purposes

Mohamad Iman Sulaeman, M. Ibadurrohman and Slamet AIP Conference Proceedings **2237**, 020025 (2020); https://doi.org/10.1063/5.0005257

Development of nanofluid biodegradable detergent from palm kernel oil and TiO_2

Reysa Anggraini Vestiana Putri, Muhammad Ibadurrohman and Slamet AIP Conference Proceedings **2237**, 020026 (2020); https://doi.org/10.1063/5.0005258

Preparation of activated carbon from *Calophyllum inophyllum* seed using different activating agents: Comparison study

Nur Izzati Machrita, Kartika A. Madurani, Suprapto, M. Luki Kurniawan, Yulianto Adi Nugroho and Fredy Kurniawan

AIP Conference Proceedings 2237, 020027 (2020); https://doi.org/10.1063/5.0005659

Synthesis and characterization of tetrasulfapyridine-copper(II) sulfate trihydrate

Sentot Budi Rahardjo, Husna Syaima, Yuniar Dwi Andrieza, Witri Wahyu Lestari and Abu Masykur AIP Conference Proceedings **2237**, 020028 (2020); https://doi.org/10.1063/5.0005340

Preparation of starch-graft-acrylic acid/bentonite composite gel

Kaeksi Sekar Arum, Enggar Candra Prastiti, Prida Novarita Trisanti and Sumarno AIP Conference Proceedings **2237**, 020029 (2020); https://doi.org/10.1063/5.0006169

Identification of natural product compounds as NS5 RDRP inhibitor for dengue virus serotype 1-4 through in silico analysis

Hersal Hermana Putra, Mutiara Saragih, Yulianti and Usman Sumo Friend Tambunan AIP Conference Proceedings **2237**, 020030 (2020); https://doi.org/10.1063/5.0005236

Flexible molecular docking simulation of peptide compounds as inhibitor of GluI host protein for dengue fever therapy

Filia Stephanie, Ahmad Husein Alkaff and Usman Sumo Friend Tambunan AIP Conference Proceedings **2237**, 020031 (2020); https://doi.org/10.1063/5.0005237

The synthesis of surfactant by alcoholysis between glyceryl trilaurate and n-amyl alcohol Daniel

AIP Conference Proceedings 2237, 020032 (2020); https://doi.org/10.1063/5.0005692

Study on the ion-exchange properties of the activated carbon black nanoparticles of ACBNPs20_17 code using sodium hydroxide solution

Pratama Jujur Wibawa, Muhammad Nur, Muhammad Asy'ari, Hadi Nur, Mohd. Arif Agam and Hashim Saim

AIP Conference Proceedings 2237, 020033 (2020); https://doi.org/10.1063/5.0005234

The effect of zeolite addition and freeze-drying method on alginat beads for controlled release fertilizer

Adhitasari Suratman, Nurul Pramita, Pradiya Nadya Agasta, Dwi Ratih Purwaningsih, Agus Kuncaka, Eko Sri Kunarti and Atmanto Heru Wibowo

AIP Conference Proceedings **2237**, 020034 (2020); https://doi.org/10.1063/5.0005798

Chemical composition and antioxidant activities of citronella essential oil Cymbopogon nardus (L.) rendle fractions

Undri Rastuti, Hartiwi Diastuti, Moch. Chasani, Purwati and Rafly Hidayatullah AIP Conference Proceedings 2237, 020035 (2020); https://doi.org/10.1063/5.0005685

Initial study on the synthesis of 1-(4'-isopropilbenzil)-1,10-phenanthrolinium bromide from cuminyl alcohol, a potent antimalarial

Maulidan Firdaus, Soerya Dewi Marliyana and Muhammad Fajar Razak AIP Conference Proceedings 2237, 020036 (2020); https://doi.org/10.1063/5.0005341

Freundlich adsorption isotherm in the perspective of chemical kinetics (II): rate law approach

Patiha, Maulidan Firdaus, Fitria Rahmawati, Sayekti Wahyuningsih and Triana Kusumaningsih AIP Conference Proceedings 2237, 020037 (2020); https://doi.org/10.1063/5.0005342

Synthesis and spectra study of Cu (II), Fe (II), Zn (II)-5,15-diphenyl porphyrin

Atmanto Heru Wibowo, Metin Yuliati, Abu Masykur, Suyitno, Desi Suci Handayani, Dian Maruto Widjonarko, Maulidan Firdaus, Ari Yustisia and Takuji Ogawa AIP Conference Proceedings 2237, 020038 (2020); https://doi.org/10.1063/5.0005553

Forward osmosis membrane to produce water energy drink from seawater

Saiful, Aida Afriyanti, Marlina, Muliadi Ramli and Abu Masykur AIP Conference Proceedings 2237, 020039 (2020); https://doi.org/10.1063/5.0005201

Reusability study of fenton catalyst@bacterial celluloses for removal of methylene blue as synthetic dves model

Husaini Ardy, Fakhri Arsyi Hawari, Ade Wahyu Y. P. Parmita, Untung Triadi, Azhar Isti Hanifah and Arie Wibowo

AIP Conference Proceedings 2237, 020040 (2020); https://doi.org/10.1063/5.0005229

Effect of phosphate ion on sorption of Nd(III) ion from aqueous solution using ion imprinted polymers

Muhammad Ali Zulfikar, Sri Wahyuni, Muhammad Yudhistira Azis, Muhammad Bachri Amran, Handajaya Rusli and Henry Setiyanto

AIP Conference Proceedings 2237, 020041 (2020); https://doi.org/10.1063/5.0005598

Aging resistance and functional group analysis of natural rubber/oil palm empty fruit bunch charcoal composites

Hari Adi Prasetya, Popy Marlina and Rochmi Widjajanti AIP Conference Proceedings 2237, 020042 (2020); https://doi.org/10.1063/5.0005338

Determination of the optimum composition to produce minimum particle size of β -carotene microencapsulated in acid hydrolyzed starch-chitosan/TPP (tripolyphosphate) matrices using Taguchi method

Agnes Dyah Novitasari Lestari, Mudasir, Dwi Siswanta and Ronny Martien AIP Conference Proceedings **2237**, 020043 (2020); https://doi.org/10.1063/5.0005249

The effect of coconut shell activated charcoal on vulcanizaton and morphology behaviour in natural rubber starch modified

Popy Marlina, Hari Adi Prasetya, Bambang Sugiyono and Rochmi Widjajanti AIP Conference Proceedings **2237**, 020044 (2020); https://doi.org/10.1063/5.0005337

Synthesis and characterization of chitosan based super absorbent polymer modified with acrylic acid and acrylonitrile for Pb (II) metal ions removal from water

F. Widhi Mahatmanti, Harjono and Izzatun Niswah Assa'idah AIP Conference Proceedings **2237**, 020045 (2020); https://doi.org/10.1063/5.0005748

Hybrid PVA/alginate for extended delivery of antibiotic

Michael, Julietta Lady and Eko Adi Prasetyanto AIP Conference Proceedings **2237**, 020046 (2020); https://doi.org/10.1063/5.0005241

Synthesis of N'-(3-trimethoxysilylpropyl)diethylentriamine modified silica (SiO_{2(RHA)}-TMPDT) for adsorption of gold(III)

Sri Hastuti, S. Wahyuningsih, T. Martini, E. N. Fajariani and I. K. Candraningrum AIP Conference Proceedings **2237**, 020047 (2020); https://doi.org/10.1063/5.0008267

Methyl red dye-sensitized zinc oxide as photocatalyst for phenol degradation under visible light

Wynona A. Nimpoeno, Hendrik O. Lintang and Leny Yuliati AIP Conference Proceedings **2237**, 020048 (2020); https://doi.org/10.1063/5.0005797

Crystalline carbon nitride for photocatalytic phenol degradation: Effect of precursor and salt melt amounts

Leny Yuliati, Mohd Hayrie Mohd Hatta, Siew Ling Lee and Hendrik O. Lintang AIP Conference Proceedings **2237**, 020049 (2020); https://doi.org/10.1063/5.0005795

Synthesis of CuO-TiO₂ nano-composite for *Escherichia coli* **disinfection and toluene degradation** Jessica Farah, M. Ibadurrohman and Slamet

AIP Conference Proceedings 2237, 020050 (2020); https://doi.org/10.1063/5.0005260

Adsorption of Au(III) on diethylenetriamine-functionalized silica coated on iron sand magnetic material

Fahmiati, Alrum Armid, Suyanta and Nuryono AIP Conference Proceedings **2237**, 020051 (2020); https://doi.org/10.1063/5.0005579 **Decolourization of methylene blue by NiO/ZSM-5 photocatalyst under UV-LED irradiation** Garcelina Rizky Anindika, Yuly Kusumawati, Didik Prasetyoko, Wahyu Bambang Widayatno and Abdul Hamid

AIP Conference Proceedings 2237, 020052 (2020); https://doi.org/10.1063/5.0005268

Isolation, characterization, and identification of endophytic bacteria by 16S rRNA partial sequencing technique from leaves of *carica papaya* and its potential as an antioxidant

Purbowatiningrum Ria Sarjono, Qisthy Hanifati Hazrina, Anggit Saputra, Nies Suci Mulyani, Agustina Lulustyaningati Nurul Aminin, Ngadiwiyana, Ismiyarto, Dewi Kusrini and Nor Basid Adiwibawa Prasetya

AIP Conference Proceedings 2237, 020053 (2020); https://doi.org/10.1063/5.0005715

Properties of starch biofoam reinforced with microcrystalline cellulose from banana stem fiber

Syahrul Fatrozi, Linda Purwanti, Sandra Kartika Sari, Muhammad Naufal Ariesta and Soerya Dewi Marliyana

AIP Conference Proceedings 2237, 020054 (2020); https://doi.org/10.1063/5.0005254

Thermal stability study of commercial lube oil at moderate temperature and long working period Husaini Ardy, Azhar Isti Hanifah and Arie Wibowo AIP Conference Proceedings **2237**, 020055 (2020); https://doi.org/10.1063/5.0005275

Analysis of chemical profile and antibacterial activity of secondary metabolites of endophytic fungi from *Annona squamosa L*. from Timor Island-Eastern Indonesia

Antonius R. B. Ola AIP Conference Proceedings **2237**, 020056 (2020); https://doi.org/10.1063/5.0005214

Gold (Au) selective adsorption using polyeugenol based ionic imprinted polymer with ethylene glycol dimethacrylate crosslink

M. Cholid Djunaidi, Nor Basid Adiwibawa Prasetya, Didik Setiyo Widodo, Retno Ariadi Lusiana and Pardoyo

AIP Conference Proceedings 2237, 020057 (2020); https://doi.org/10.1063/5.0005546

Synthesis of molecularly imprinted polymer urea based on polyeugenol with ethylene glycol dimethacrylate as crosslinking agent

M. Cholid Djunaidi, Arifatul Azizah and Gunawan AIP Conference Proceedings **2237**, 020058 (2020); https://doi.org/10.1063/5.0005544

The comparison of nitroxide radical derivative compound interaction with brookite and anatase surface: A guide to choose the best photoanode for DSSC application

Yuly Kusumawati, Leli D. Astuti, Eko Santoso and Syafsir Akhlus AIP Conference Proceedings **2237**, 020059 (2020); https://doi.org/10.1063/5.0005271

In-vivo acute toxicological studies of Vasconcellea pubescens A. DC. fruit extract against hepatic injury

Heru Sasongko, Arifin Wicaksono and Sugiyarto AIP Conference Proceedings **2237**, 020060 (2020); https://doi.org/10.1063/5.0005224

Optimization of Suweg starch (Amorphophallus paeoniifolius (Dennst.) Nicolson) and lactose as coprocessed excipient of Ibuprofen-PEG 6000 solid dispersion of effervescent tablet

Dian Eka Ermawati, Bimar Putri Andini, Fea Prihapsara, Yeni Farida, Sholichah Rohmani, Wisnu Kundarto and Estu Retnaningtyas Nugraheni

AIP Conference Proceedings 2237, 020061 (2020); https://doi.org/10.1063/5.0005632

Developing formula of SNEDDS (self nano emulsifying drug delivery system) antihypertensive herbals "Hortus Medicus"

Dian Eka Ermawati, Roro Karina Pambudi, Vinda Aviwiandari, Yeni Farida, Sholichah Rohmani, Wisnu Kundarto and Estu Retnaningtyas Nugraheni

AIP Conference Proceedings **2237**, 020062 (2020); https://doi.org/10.1063/5.0005630

Optimization of hydroxymethylcellulose and sodium CMC of transdermal patch of antihypertension "Hortus Medicus" and transport through membrane using franz diffusion cell method

Dian Eka Ermawati, Dyah Ayu Ambarwati, Niken Rosyana Dewi, Anif Nur Artanti, Sholichah Rohmani and Wisnu Kundarto

AIP Conference Proceedings **2237**, 020063 (2020); https://doi.org/10.1063/5.0005628

Liposomes from jack beans phospholipid extract for delivering vitamin C

Dwi Hudiyanti, Ratna Indria Sari, Aditya Putri Arya and Parsaoran Siahaan AIP Conference Proceedings **2237**, 020064 (2020); https://doi.org/10.1063/5.0005213

The effect of methyltriethoxysilane (MTES) concentration on hydrophobic properties of silica thin layer

Lucky Diana Mustika, Choiril Azmiyawati and Adi Darmawan AIP Conference Proceedings **2237**, 020065 (2020); https://doi.org/10.1063/5.0005240

Synthesis zeolite y from kaolin: Activation of metakaolin with various concentration of sulfuric acid and its application for esterification

Leli Endah Safitri, Ulul Khairi Zuryati, Hannis Nur Rohma, Yatim Lailun Ni'mah and Didik Prasetyoko AIP Conference Proceedings **2237**, 020066 (2020); https://doi.org/10.1063/5.0005581

Synthesis of phenylcalix[4]resorcinarena sulfonate and it's aplication as an antioxidant

Santi Nur Handayani, Heny Ekowati, Irmanto, Della Nadya Ayu Aprilia and Silva Utami AIP Conference Proceedings **2237**, 020067 (2020); https://doi.org/10.1063/5.0006139

The electronic properties study of betanin and their derivatives compound: An explanation to betanin limitation in DSSC application

Zulfa H. Damayanti, Garcelina R. Anindika, Eko Santoso, Syafsir Akhlus and Yuly Kusumawati AIP Conference Proceedings **2237**, 020068 (2020); https://doi.org/10.1063/5.0005274

Anthocyanin from butterfly pea flowers (*Clitoria ternatea*) by ultrasonic-assisted extraction Achmad Qodim Syafa'atullah, Arie Amira, Sonya Hidayati and Mahfud Mahfud AIP Conference Proceedings **2237**, 020069 (2020); https://doi.org/10.1063/5.0005289

Synthesis and characterization of carbonaceous-based nanomaterials produced in chemical vapor deposition (CVD) using copper catalyst

Teguh Endah Saraswati, Ayu Dwi Priyanti, and Oktaviana Dewi Indah Prasiwi AIP Conference Proceedings **2237**, 020070 (2020); https://doi.org/10.1063/5.0005445

Preparation of NaFeO₂ from iron sand as a raw material for cathode of sodium-ion battery

Fitria Rahmawati, Arum A. Kusumaningtyas, Teguh E. Saraswati, Iwan Yahya and Younki Lee AIP Conference Proceedings **2237**, 020071 (2020); https://doi.org/10.1063/5.0005348

Chemical interaction analysis of L-Theanine compounds from *Camellia sinensis* L. with kainate glutamate receptors and their toxicity effect as anti autism candidates based on in silico

Mohamad Amin, Nanda Hilda Khikmawati, Suryadi, Ihya Fakhrurizal Amin, Kodama Yayoi, Atmanto Heru Wibowo, Dina Maulina and Indriyani Rachman

AIP Conference Proceedings **2237**, 020072 (2020); https://doi.org/10.1063/5.0008500

Synthesis, anticancer activity, and apoptosis mechanism of some chalcone derivatives

Hery Suwito, Helda Dwi Hardiyanti, Kautsar ul Haq, Alfinda Novi Kristanti, Umrotul Furghoniyyah, Aprillia Noni Rahmawati and Diwyareta Ristya Ayuningtyas AIP Conference Proceedings **2237**, 020073 (2020); https://doi.org/10.1063/5.0005376

Synthesis of 5-benzylidene-hydantoin and 5-benzylidene-creatinine derivatives under mixed catalyst systems of urea-*p*-toluenesulfonic acid (Urea-PTSA) and guanidine hydrochloride-triethylamine (GnHCl-TEA)

Kautsar Ul Haq, Septi Rosiana Dewi, Sherly Dwi Cicilianingrum, Amalia Muti Anggraini, Zella Dwipuspita Dahana, Indrianti Yunita Sari, Rina Dewi Renjanawati, Januardi Wardana, Fandi Gunawan, Nuzilatul Muschafi, Nisa'ur Rosyidah and Hery Suwito

AIP Conference Proceedings **2237**, 020074 (2020); https://doi.org/10.1063/5.0005378

The compounds of styrene-butadiene rubber in the incorporation of palmitamide: Abrasion resistance, cure rate index and torque properties

Indra Surya and Edwin

AIP Conference Proceedings 2237, 020075 (2020); https://doi.org/10.1063/5.0005219

The compounds of montmorillonite-filled natural rubber: Cure rate index, swelling and hardness properties

I. Surya and H. Khosman AIP Conference Proceedings **2237**, 020076 (2020); https://doi.org/10.1063/5.0005218

Effect of low molecular weight organic acid (LMWOA) on the Zn^{2+} desorption from the soil of illegal land fill in Yogyakarta-Indonesia

Suherman, Ayu Maulidya Rachmanda, Roto and Kinichi Morita AIP Conference Proceedings **2237**, 020077 (2020); https://doi.org/10.1063/5.0005244

Microbial life on the surface of the soft coral for solve the self-healing concrete

Prima Endang Susilowati, Ahmad Zaeni, Sapril Kartini and I. Nyoman Sudiana AIP Conference Proceedings **2237**, 020078 (2020); https://doi.org/10.1063/5.0005712

Toxicity of benzyl benzoate from Kaempferia rotunda L. rhizome

Hartiwi Diastuti, Ari Asnani, Undri Rastuti and Mela Anggraeni AIP Conference Proceedings **2237**, 020079 (2020); https://doi.org/10.1063/5.0005554

Physico-chemical characteristics of gelatin as green template for nanomaterial production

Maria Ulfa and Windi Apriliani AIP Conference Proceedings **2237**, 020080 (2020); https://doi.org/10.1063/5.0006142

Intermolecular hydrogen bond interactions in *N*-carboxymethyl chitosan and *n*H₂O: DFT and NBO studies

Beti Safitri, Dwi Hudiyanti, Marlyn Dian Laksitorini, Nurwarrohman Andre Sasongko and Parsaoran Siahaan

AIP Conference Proceedings **2237**, 020081 (2020); https://doi.org/10.1063/5.0005287

Synthesis and anticancer study of complex nickel (II) 5,7-dibromoisatin-derived hydrazine carbothiamide

Fahimah Martak, Nofri Eka Safitri, Endah Mutiara Marhaeni Putri, Agung Bagus Pambudi and Arif Fadlan

AIP Conference Proceedings 2237, 020082 (2020); https://doi.org/10.1063/5.0005731

14th Joint Conference on Chemistry Proceeding of Chemistry Conferences vol. 5 (2020)

List of published articles in Alchemy, Jurnal Penelitian Kimia vol 17 (2020) no 2 (https://jurnal.uns.ac.id/alchemy/)

Nickel Supported ZrO₂-pillared Bentonite for Synthesis of Hydrocracking Catalyst Ahmad Suseno*, Retno Ariadi Lusiana, M Cholid Djunaid

List of published articles in Proceeding of Chemistry Conferences Vol 5 (20) (https://jurnal.uns.ac.id/index.php?journal=pcc&page=issue&op=archive)

Activation of Natural Zeolite and Its Application For Adsorben in Domestic Waste Water Treatment in Tembalang District Semarang City Suhartana*	1-10
Characteristic Changes and Antibacterial Activities of Liquid Soap from Nyamplung Seed Oil (<i>Calophyllum inophyllum L</i>) Due to Storage Senny Widyaningsih, Mochammad Chasani, Hartiwi Diastuti	11-17
Antioxidant Activities of Ethanol Extraction Product from Citronella Grass (<i>Cymbopogon nardus</i>) Distillation Residue	18-25

Eko Febrianto R, EnnyFachriyah*, Dewi Kusrini

Activation of Natural Zeolite and Its Application For Adsorben in Domestic Waste Water Treatment in Tembalang District Semarang City

Suhartana*

Department of Chemistry, Diponegoro University, Faculty of Sains and Mathematics, Diponegoro University, Prof. Sudarto SH street, Tembalang, Semarang

*E-mail: suhartana@lecturer.undip.ac.id

Abstract. Tembalang is part of one of the sub-districts in Semarang whose economic growth is fast. There are 12 subdistricts in Tembalang District, one of which is Tembalang District which is the campus area of Diponegoro University. Because the population is very dense, the problem of domestic wastewater and clean water supply is an interesting problem to study. This study aims to describe domestic wastewater in Tembalang District, Semarang City, as well as the application of activated zeolites and activated zeolites to reduce COD, pH, BOD and TSS in domestic wastewater and compare the parameters of wastewater with applicable regulations [1]. Research to improve the quality of domestic wastewater by adsorption using natural zeolite adsorbents and activated zeolites. The results showed that the adsorption treatment with natural zeolite and activated zeolite showed significant reduction results. The results of the decrease in chemical parameters of domestic wastewater are: with natural zeolite the COD reduction 78.9%, pH 11.5%, BOD 9.2% & TSS 10.8% and with HCl activated zeolite, COD reduction 78.9% , pH 16.2%, BOD 11.8% & TSS 74.4% and COD reduction 85.5%, pH 17.9%, BOD 12.6% and TSS 89.7% for H2SO4-activated natural zeolites.

Keywords: domestic wastewater, natural zeolite, activated natural zeolite, COD, pH, BOD and TSS

1. Introduction

Management of water resources and the environment often requires multidiscipline understand groundwater-surface water (GW-SW) interactions because these interactions form a key link between land activities, aquatic ecosystems, and the integrity of water resources [2]. Fixed amount of land and the ever increasing population causes the problem of clean water and waste water sources to be interesting to study, especially with the presence of active chemicals that are used directly in the household (such as detergents, shampoo, toothpaste, cooking oil) which are directly discharged into sewers water without prior treatment, the carrying capacity of the environment is reduced due to increased waste disposal [3]. Therefore, domestic wastewater and hospital wastewater treatment before disposal in the sewer is absolutely necessary, such as conducted in Doha, Qatar, which is somewhat different from the habits of the people in the country [4]. Indonesian communities in our country generally do not treat their domestic wastewater, and are immediately disposed of in the surrounding water gutters. While the material for treating domestic wastewater by adsorption (with zeolite as an adsorbent) is still wide open. In Indonesia zeolite deposits are very abundant [5]. Zeolite is a hydrated aluminosilicate crystal which has interesting properties and structures on the surface of its mesoporous. Some names of natural zeolites are well known such as mordenite, analcime, phillipsite, chabazite, heulandite, clinoptilolite, erionite, ferrierite and laumontite [6]. Zeolite is usually used as an adsorbtion and catalyst in an industry or company. Natural zeolite in general

has a thermal stability that is low, non-uniform pore size and low catalytic activity, so it is necessary to make modifications to improve the adsorbtion and catalytic properties [7].

The problem of clean water and domestic wastewater is very much felt in big cities in Indonesia. Semarang is one of them, and Tembalang sub-district as an example. Tembalang is part of one of the subdistricts of Semarang whose rapid economic growth. There are 12 kelurahans in Tembalang sub-district, but Tembalang kelurahan is crowded if compare with another kelurahan in Tembalang sub-district, because which is the location of the Diponegoro University. Thus, the need for clean water and disposal of domestic wastewater becomes quite complicated so it is interesting to study. Domestic wastewater in addition to causing environmental pollution, can cause discomfort and even health problems. One way to reduce the impact of domestic wastewater is to treat domestic wastewater before the environment is discharged.

This study aims to describe domestic wastewater before it is processed in Tembalang sub-district, Tembalang sub-district, Semarang city, as well as the application of natural zeolites and activated zeolites to reduce COD, pH, BOD, TSS and oil in domestic wastewater as well as comparing wastewater parameters with regulations applies [1]. Samples of domestic wastewater are taken from 3 kelurahan, Bulusan kelurahan, Tembalang kelurahan and Meteseh kelurahan. Water chemistry parameters measured were COD, pH, BOD, and TSS.

Previous studies of communal domestic wastewater treatment, using a multilevel screening process and water hyacinth bioremidiation [8], with satisfactory results but requiring a long time and a large area. Another way is to combine between Anaerobic Baffled Reactor (ABR), Anerobic Filter (AF) and Unaaerobic Sludge Banked (UASB), which is carried out by a number of elite house in Surabaya. The combination of these three methods gives very good results (above 80%), but requires time quite a long time, the cost is not small and a fairly large area [9]. The other way that is cheaper and easier to do is adsorption using zeolites with unsatisfactory results if only one treatment (25%) but if replicated up to 3 times will get a significant result (74.5%), whereas if combined with iron sand and zeolite give good results satisfactory (96.6%) [10]. Natural zeolites in general have low thermal stability, non-uniform pore size and low adsorbtion and catalytic activity. To improve thermal stability, the adsorption and catalytic activity of zeolites need to be modified to natural zeolites. Modifications made can be used chemical modification methods such as dealumination with acids or cation exchange with metals. In dealumination, the addition of acid causes aluminum to come out of the zeolite framework and increase the silica ratio [7].



Figure 1. Map of 12 villages in Tembalang sub-district

Referring to the research and assumptions above, encouraging research on the dealumination of natural zeolites from Bayat using acids (HCl and H_2SO_4) for adsorbent domestic wastewater. This study aims to activate natural zeolites with HCl and H_2SO_4 and apply them to improve the quality of domestic wastewater in the Tembalang sub-district of Tembalang sub-district, by means of adsorption. In this domestic wastewater treatment research an adsorption method will be used by using natural zeolites and activated zeolites (HCl and H_2SO_4) as adsorbents with measurement parameters of COD, pH, BOD and TSS as indicators of the success of the adsorption process.

The results of the dealumination of natural zeolites from Bayat using acids (HCl and H_2SO_4) were characterized by IR spectroscopy and data on the increase of Si / Al ratio in natural zeolites and zeolites of acid dealumination were analyzed by Atomic Absorption Spectrophotometry (AAS). Natural zeolite, HCl activated zeolite and H_2SO_4 activated zeolite are used for adsorption in domestic wastewater treatment in Tembalang sub-district Tembalang sub-district. The results showed that adsorption treatment with natural zeolite and HCl activated zeolite and H_2SO_4 activated zeolites and H_2SO_4 activated zeolite showed significant decreases. With natural zeolite adsorbents, HCl-activated zeolites and H_2SO_4 -activated natural zeolites are averaged from the reduction of domestic wastewater in 5 sub-districts in Tembalang sub-district with chemical parameters COD, pH, BOD, and TSS are as follows. With natural zeolite the COD reduction was 21.8%, pH 11.5%, BOD 9.2% & TSS 10.8% and with zeolite activated HCl, COD reduction 78.9%, pH 16.2%, BOD 11, 8% & 44.4% TSS and 85.5% COD reduction, 17.9% pH, 12.6% BOD and 49.7% TSS for H₂SO₄-activated natural zeolite.

2. Research Method

2.1 Materials and tools

2.1.1. Material

The materials used are domestic wastewater (as much as 1 Liter taken from 5 different kelurahans in Tembalang district as samples), 250 g of (Bayat, Klaten) natural zeolite, 6 M hydrochloric acid (HCl), sulfuric acid (H₂SO₄) 6 M, potassium permanganate (KMnO₄)) 0.5 M, distilled water, and Argentum Nitrate (AgNO₃) (Merck).

2.1.2. Tool

The tools used are a pH meter (HANNA HI 8314), IR spectrometer (IR 100 Perkin Elmer Spectrometer), Atomic Absorption Spectrophotometry (AAS) (Perkin Elmer 900F), a set of titration tools, a 100-200 mesh sieve, an oven, a 250 mL beaker, a 100 mL measuring cup, a dropper, a separating funnel, furnace, flask round, magnetic stirrer, water bath, a set of reflux apparatus, measuring flask, electric scales and hot plates.

2.2 Experimental procedure

2.2.1. Sample preparation

Bayat natural zeolite is washed and soaked with distilled water overnight. Dried at a temperature of 1100 C crushed until smooth and sieved with a size of 100-200 mesh.

2.2.2. Dealumination of natural zeolites

Zeolites selected were zeolites from the Klaten (Bayat) region. Bayat natural zeolite is washed and soaked with distilled water overnight and dried at 110 °C. Soaking with distilled water is intended to remove organic impurities present in the natural zeolite. Natural zeolite which has been dried, crushed with porcelain mortal until smooth and sieved with a 100-200 mesh size sieve. Destruction is done to increase the surface area of natural zeolites so that the catalysis ability can be more optimal. Zeolites which are free from organic matter and oxide impurities, do the dealumination process by acidifying and adding KmnO4. The acidification process is carried out by adding H₂SO₄ and HCl. Whereas KMnO₄ (as

an oxidizing agent) is intended for oxidizing organic impurities present. The activation process is carried out for 4 hours at 80 °C, allowed to stand overnight at room temperature, it is expected that alumina coming out of the zeolite framework can be optimized. Zeolite (50 grams) are added with 100 ml of 6 M H_2SO_4 and 100 ml of KMnO₄ 0.5 M. The mixture is heated at 80 °C for 4 hours, allowed to stand for one night (48 hours) at room temperature. The mixture obtained was then filtered and washed with distilled water until it was neutral (tested with AgNO3 solution until no white precipitate appeared) and dried at 110 °C for 5 hours and calcined for 3 hours at 500 °C (CODE Z1).

Zeolite as much as 50 grams is added with 100 ml of HCl 6 M and 100 ml KMnO₄ 0.5 M. The mixture is heated at 80 $^{\circ}$ C for 4 hours, allowed to stand for one night (48 hours) at room temperature. The obtained mixture is then filtered and washed with distilled water until it is neutral and dried at 110 $^{\circ}$ C for 5 hours and calcined for 3 hours at 500 $^{\circ}$ C (CODE Z2).

2.2.3. Characterization of natural zeolites and HCl-activated zeolites and H₂SO₄-activated zeolites

Characterization was performed on natural zeolites, HCl-activated zeolites and H_2SO_4 -activated zeolites, the Si / Al ratio using atomic absorption spectroscopy (AAS) and analysis of functional group changes was carried out by analyzing infrared spectroscopy (IR).

2.2.4. Adsorption Activity Test

2.2.4.1. Collection and treatmen of Domestic Waste Water Samples

Before conducting the activity test, it was taken in 5 villages in Tembalang sub-district, each from Sendangguwo, Sendangmulyo, Tembalang, Meteseh and Rowosari. A total of 100 mL samples of domestic wastewater, added AgNO₃ to remove chloride ions. A total of 1 gram of natural zeolite adsorbent was mixed into the sample, heated at 60 °C in a three-neck flask equipped with a thermometer and stirrer, then refluxed for 60 minutes. Performed on variations: natural zeolite, H_2SO_4 dealuminated natural zeolite

2.2.4.2. Separation of Residues and Filtrates

Heterogeneous mixture obtained after domestic wastewater is subjected to an adsorption process, filtered with a funnel. Then the filtrate and residue are obtained. The filtrate is wastewater that is thought to have undergone a process of adsorption perfectly and the residue is a zeolite adsorbent. The filtrate is left for a day and a night in the separating funnel, then analyzed.

2.2.5. Method of analysis

Water samples (100 mL) (from various Kelurahans in Tembalang District) were given 1 gram of natural zeolite, 1 gram of chlorinated acid zeolite and 1 gram of sulfuric acid zeolite. Stirring is done for 1 hour, then allowed to stand for 24 hours. The screening process is carried out. After the separation process, an analysis is performed on the sample solution, with COD analysis, acidity (pH) analysis, BOD analysis, and TSS analysis.

3. Results and Discussion

The acidification process is carried out by adding H_2SO_4 and HCl. Where as KMnO₄ (as an oxidizing agent) is intended for oxidizing organic impurities present. The activation process is carried out for 4 hours at 80 °C, allowed to stand overnight at room temperature, it is expected that alumina coming out of the zeolite framework can be optimized. The addition of acid aims to exchange cations to form H-zeolite. An exchange occurs between cations in zeolites and H⁺. The ion exchange between the cations in zeolites with H⁺ aims to replace all the cations in the zeolites because in the zeolites there are still alkaline or alkaline earth cations such as Na⁺, Ca²⁺, Mg²⁺ which act as zeolite balances that can be exchanged with

other cations so that all the cations will be exchanged to be H^+ . While KMnO₄ needs to be added because it is able to function as an oxidizer and able to react with acids to remove impurities [7, 11].

As a result of the addition of acids, there will be interactions between acids and Zeolites. The interaction of acids with zeolite surfaces results in the release of alumina species from zeolites. H^+ ions derived from acids affect the free electrons in the O atom to form coordination bonds. Al-O group will lack electrons so that it will be more polar and not as strong as before, so Al will break from its bonds [7, 11].

In general the range of wave numbers $300-1300 \text{ cm}^{-1}$ in the form of tetrahedral bonds, namely O-Si-O and O-Al-O. On the band 900-1250 cm⁻¹ is an asymmetrical range, the symmetrical range is shown on the band 650-850 cm⁻¹, bending the Si-O / Al-O (TO) internally appears in the area of 420-500 cm⁻¹ while for the external will appeared at 700-780 cm⁻¹ [11-13]. The spectra in Figure 1 are the results of the FTIR (Fourier Transform Infra-Red) spectrometer analysis of natural zeolites and zumolite dealumination.

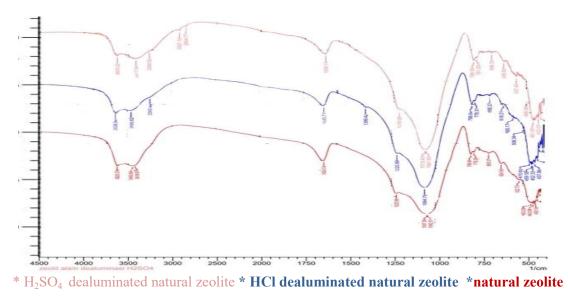


Figure 1. IR spectrum of natural zeolite H₂SO₄ dealuminated, natural zeolite HCl dealuminated and natural zeolite

Interpretation of FTIR spectrum can be seen from several uptake. Dealumination occurs when internal stretching vibrations increase and external stretching vibrations decrease in wave numbers. The absorption band in the region of wave number $420-300 \text{ cm}^{-1}$ shows the pore opening. Natural zeolite is at wave number 322.13 cm^{-1} , natural zeolite dealumination H₂SO₄ is at 313.45 cm⁻¹ and HCl is at 316.34 cm⁻¹. Pore opening belongs to the zeolite external braid vibrational spectrum [12, 14-15]. From the FTIR spectra produced, it turns out that external braid vibrations have decreased which indicates a dealumination reaction in natural zeolites [12, 14-15].

Furthermore, stating that internal vibrations associated with TO4 tetrahedral is the main structural unit. The intended spectrum is in the FTIR Spectra in the area of 950-1250 cm⁻¹. These wave numbers represent the internal interwoven tetrahedral asymmetrical stretching vibration and the external interwoven asymmetric stretching vibration. This uptake increased the wave number from natural zeolites by 1042.57 cm⁻¹ to 1072.47 cm⁻¹ in the H₂SO₄ dealumination zeolite and 1064.75 cm⁻¹ in the deaaluminated HCl zeolite [12, 14-15]. This shift in FTIR uptake is due to dealumination in natural

zeolites, resulting in tetrahedral stretching vibrations in buckling T-O (T = Si, Al). From this increase in wave number, H_2SO_4 natural zeolite has the sharpest increase compared to HCl dealumination natural zeolite, this shows that H_2SO_4 dealumination is more effective than HCl [12, 14-15].

At wavenumber 3450.80 cm⁻¹ on natural zeolite, wave number 3417.04 cm⁻¹ on natural zeolite delauminated H_2SO_4 , and wave number 3455.62 cm⁻¹ on zeolite delaumination HCl, indicating the existence of a stretching -OH bond. This group provides information that there is water (hydrate) that is owned by zeolite crystals [12, 14-15]. Table 1 is a table of the results of the natural zeolite delaumination with the natural zeolite delaumination of hydrochloric acid and sulfuric acid.

	Table 1. Ratio Si/A	1
No	Sample	Ratio Si/ Al
1	Natural Zeolite	4.5662
2	Natural Zeolite HCl dealuminated	5.4098
3	Natural Zeolite H ₂ SO ₄ dealuminated	6.4159

Unrealizedum natural zeolite has the lowest Si / Al ratio of 4.5662. It can be said that for the same time and temperature the use of H_2SO_4 with a Si / Al ratio of 6.4159 as a dealumination agent is more effective than HCl with a Si /Al ratio of 5.4098. This result has similarities with research conducted by Sriatun (2005) where dealumination with H_2SO_4 is more effective than HCl [11-14].

Adsorption activity test for zeolite dealumination in adsorption of domestic wastewater is done by mixing samples (100 mL domestic wastewater) and zeolites (1 gram) which are heated at 40° C in a three neck flask equipped with a thermometer and stirrer. Stirring is carried out at optimum temperature (40 °C) because it refers to several previous studies [11, 13]. By stirring and heating at the optimum temperature, it is expected that the impact intensity between the reactants will increase and reach the optimum point.

Domestic Wastewater measurement results from the 3 villages in Tembalang sub-district (Kramas sub-district, Tembalang sub-district and Meteseh sub-district) (with 3 measurements, averaged) and the effectiveness of the adsorption performance of natural zeolites (ZA), zeolites activated by HCl (ZT 1) and zeolites activated with H_2SO_4 (ZT 2) can be seen in Table 2.

The results of the Domestic Kramas Village Domestic Waste Water analysis were compared with the Standards of Quality Standards [1] and the effectiveness of the adsorption performance of natural zeolites (ZA), zeolites activated by HCl (ZT) 1) and zeolites activated by H_2SO_4 (ZT). 2). The adsorption capacity of the three adsorbents is measured by several parameters, such as pH, temperature, COD, BOD and TSS as shown in Table 2.

Table 2. Results of Domestic Waste Water analysis in Kramas village and the effectiveness of adsorption performance from natural zeolites (ZA), zeolites activated with HCl (ZT 1) and zeolites activated with H₂SO₄ (ZT 2)

Parameter	Unit	Method	Quality	Result	Adsorp	tion Effec	tiveness
			Standart		ZA	ZT 1	ZT 2
pН	-	SNI 06.6989.11.2004	6 – 9	7.4	11.5%	16.2%	17.9%
Temperatu	°C	SNI 06.6989.23.2005	-	27.3	-	-	-
re							
COD	mg/L	SNI 6989.2.2009	50	70.6	21.8%	78.9%	85.5%
BOD	mg/L	SNI 06.6989.72.2009	100	47.8	9.2%	11.8%	12.6%
TSS	mg/L	SNI 06.6989.10.2004	30	38.8	10.8%	44.4%	49.7%

The results of the Domestic Tembalang Village Domestic Waste Water analysis were compared with the Standards of Quality Standards [1] and the effectiveness of the adsorption performance of natural zeolites (ZA), zeolites activated by HCl (ZT) 1) and zeolites activated by H_2SO_4 (ZT). 2). The adsorption capacity of the three adsorbents is measured by several parameters, such as pH, temperature, COD, BOD and TSS as shown in Table 3.

Table 3. Results of Domestic Waste Water analysis in Tembalang and the effectiveness of adsorption
performance from natural zeolites (ZA), zeolites activated with HCl (ZT 1) and zeolites
activated with H_2SO_4 (ZT 2)

uetiv	area wittii	$11_{2}004(212)$					
Parameter	Unit	Method	Quality	Result	Adsorpt	tion Effec	tiveness
			Standart		ZA	ZT 1	ZT 2
pН	-	SNI 06.6989.11.2004	6-9	7.5	11.5%	16.2%	17.9%
Tempertau	°C	SNI 06.6989.23.2005	-	27.3	-	-	-
re							
COD	mg/L	SNI 6989.2.2009	50	86.7	21.8%	78.9%	85.5%
BOD	mg/L	SNI 06.6989.72.2009	30	59.6	9.2%	11.8%	12.6%
TSS	mg/L	SNI 06.6989.10.2004	50	56.8	10.8%	44.4%	49.7%

The results of the Domestic Meteseh Village Domestic Waste Water analysis were compared with the Standards of Quality Standards [1] and the effectiveness of the adsorption performance of natural zeolites (ZA), zeolites activated by HCl (ZT) 1) and zeolites activated by H_2SO_4 (ZT). 2). The adsorption capacity of the three adsorbents is measured by several parameters, such as pH, temperature, COD, BOD and TSS as shown in Table 4.

Table 4. Results of analysis of Domestic Wastewater Meteseh and effectiveness of adsorption performance of natural zeolites (ZA), zeolites activated with HCl (ZT 1) and zeolites activated with H₂SO₄ (ZT 2)

Parameter	Unit	Method	Quality	Result	Adsorpt	tion Effec	tiveness
			Standart		ZA	ZT 1	ZT 2
pН	-	SNI 06.6989.11.2004	6 – 9	7.3	11.5%	16.2%	17.9%
Temperatu	°C	SNI 06.6989.23.2005	-	27.3	-	-	-
re							
COD	mg/L	SNI 6989.2.2009	50	71.2	26.4%	78.9%	85.5%
BOD	mg/L	SNI 06.6989.72.2009	30	49.1	9.2%	11.8%	12.6%
TSS	mg/L	SNI 06.6989.10.2004	50	46.6	11.7%	44.4%	49.7%

As observed in Table 2, Table 3 and Table 4, the measurement results for pH, COD, BOD and TSS are relatively higher in Tembalang kelurahan compared to 2 other kelurahan (kelurahan Kramas and kelurahan Meteseh). This can be understood, because the population density in Tembalang is indeed the highest. The existence of Diponegoro University students, Semarang State Polytechnic, Dental Care Academy, Pandanaran University and others as well as the existence of food and beverage stalls adjacent to the college campuses, greatly affect the population density in the Tembalang village. So that the need for clean water and discharge of domestic wastewater that is also becoming even greater.

The degree of acidity (pH) is a description of the acidic or basic state of a solution. If the pH of the solution <7 means that the solution is acidic, whereas if the pH of the solution> 7 means that the solution is basic. So that pH can describe the acidity and alkalinity of a solution [16]. The pH values in

these 3 villages (both Tembalang and Kramas and Meteseh) still meet the standards of the Quality Standards [1]. However, domestic wastewater in Tembalang is relatively higher This may be caused by the presence of some waste water from the Toilet Washing Toilet (MCK) that has not been processed and is immediately discharged into the environment.

Chemical Oxygen Demand (COD) is the amount of oxygen needed by chemicals to neutralize organic compounds dissolved in water. In Tembalang kelurahan the measurement result of Chemical Oxygen Demand (COD) is 86.7 (mg / L) (higher than Kramas kelurahan 70.6 (mg / L) and Meteseh village 71.2 (mg / L)). This is due to the amount of population density in the Tembalang village which is more, so that the discharge of waste water from the Mandi Wash Kakus (MCK) and several food / beverage stalls also increases. The higher the COD value in a solution, the worse the quality of the water. Usually excessive organic matter content in water, resulting in turbidity, odor and the color of the solution that is no longer clear [17]. If the price of COD in a waters exceeds the specified threshold value, this can result in the destruction of ecosystems in the waters, even if this is not properly addressed will worsen the quality of the aquatic environment [18-21]. To avoid this kind of thing, it is necessary to treat / treat domestic wastewater before being discharged into sewers, so as not to pollute the environment [18, 21-22].

Biologycal Oxygen Demand (BOD) is the amount of oxygen needed by microorganisms to neutralize organic compounds dissolved in water. In Tembalang kelurahan, the measurement result of Biologycal Oxygen Demand (BOD) is 59.6 ppm (mg / L) (higher than Kramas kelurahan, 47.8 (mg/ L) and Meteseh village 49.1 (mg / L)). The higher the population density in the Tembalang village, the discharge of waste water from Mandi Cuci Kakus (MCK) and several food / beverage stalls also increased. The higher the BOD value in a solution, the worse the quality of the water. Usually excessive organic matter content in water, resulting in turbidity, odor and the color of the solution that is no longer clear [18]. Microorganisms with sufficient oxygen conditions are able to degrade organic compounds (proteins, fats, carbohydrates, etc.) dissolved in domestic wastewater into simpler molecules. If the BOD price in a waters exceeds the specified threshold value, this can result in the destruction of ecosystems in the waters, even if this is not properly addressed will worsen the quality of the aquatic environment [18-21]. To avoid this kind of thing, it is necessary to treat / treat domestic wastewater before being discharged into sewers, so as not to pollute the environment [18, 21]. However, the presence of oxygen in waters that contain lots of plants is enough to help to increase oxygen levels in these waters. The main source of oxygen is the result of plant synthesis through roots in the soil, then oxygen due to flowing water or rainwater can cause oxygen to dissolve in water [18, 22].

Total Suspended Solid (TSS) is derived from natural sources, garbage, agricultural runoff water, fisheries, urban areas and industry. In Tembalang kelurahan, the total Suspended Solid (TSS) measurement result was 56.8 (mg / L) (higher than Kramas kelurahan, 38.8 (mg / L) and Meteseh subdistrict 46.6 (mg / L)). If wastewater that is channeled into drains / gutters contains high TSS levels, it will cause water to become turbid and will also cause an increase in temperature in the water, as a result it can reduce oxygen dissolved in water, thus disrupting the life (biota) of aquatic habitat. High TSS levels result in the blocking of sunlight to water bodies, so that the photosynthesis process of plants in these waters becomes disturbed [18, 22].

4. Conclusion

The results of the IR spectrogram and the zeolite Si / Al ratio determine that zeolite acid dealumination will show a significant change in wave numbers and Si / Al ratio, where the natural zeolite Si / Al ratio of 4.57 rises to 5.41 in natural zeolites dealumination HCl and become 6.42 on natural zeolite dealumination H_2SO_4 . With natural zeolite adsorbent, HCl activated zeolite and H_2SO_4 activated natural zeolite are the average results of the reduction of domestic wastewater in 5 villages in Tembalang sub-

Proceeding of Chemistry Conferences vol. 1 (2016)

district with chemical parameters COD, pH, BOD, and TSS are as follows. With natural zeolite the COD reduction was 21.8%, pH 11.5%, BOD 9.2% & TSS 10.8% and with zeolite activated HCl, COD reduction 78.9%, pH 16.2%, BOD 11, 8% & 44.4% TSS and 85.5% COD reduction, 17.9% pH, 12.6% BOD and 49.7% TSS for H₂SO₄-activated natural zeolites.

Acknowledgments

The authors acknowledge with thanks to Diponegoro University who is willing to provide PNBP research funding in 2018, so that this research can be carried out. I would also like to thank the Tembalang District Head of Semarang and his staff who were very cooperative when we conducted the sampling.

References

- [1] PERATURAN MENTERI LINGKUNGAN HIDUP DAN KEHUTANAN REPUBLIK INDONESIA NOMOR: P.68/Menlhk-Setjen/2016 TENTANG BAKU MUTU AIR LIMBAH DOMESTIK DENGAN RAHMAT TUHAN YANG MAHA ESA MENTERI LINGKUNGAN HIDUP DAN KEHUTANAN
- [2] Conant, B. J., Robinsonb, C.E., Hintonc, M.J., & Russellc, H.A.Aj., 2019, A Framework for conceptualizing groundwater-surface water interactions and identifying potential impacts on water quality, water quantity, and ecosystems. *Journal of Hydrology*, 574, 609-627. Accepted date: 15 April 2019, DOI: doi.org/ 10.1016 / jhidrol.2019.040.50.
- [3] Comber, S., Gardner, M., Sörme, P., & Ellor, B., 2019, The removal of pharmaceuticals during wastewater treatment: Can it be predicted accurately? The removal of pharmaceuticals during wastewater treatment: Can it be predicted accurately? *Science of the Total Environment*, **676**(34), 222–230
- [4] Maadheeda, S., Goktepeb, I., Aishah, B. A., Latiffa, L., & Shomarc, B., 2019, Antibiotics in hospital effluent and domestic wastewater treatment plants in Doha, Qatar. *Journal of Water Process Engineering*, **28**, 60-68.
- [5] Kusdarto., 2008, Potensi Zeolit di Indonesia. *Jurnal Zeolit Indonesia*, 7(2), 78 86.
- [6] Altun, D., 2011, Effects Of Zeolite (Clinoptilolite) On Some Water And Growth Parameters Of Rainbow Trout. *Digest Journal of Nanomaterials and Biostructures*, **6**(3), 1111-1116.
- [7] Polat, Z., 2009, Integrated approach to whey Utilization through natural zeolite Adsorption/desorption and Fermentation, *İzmir Institute of Technology*, *Pages* 31-69
- [8] Nilasari, E., Faisal, M., & Suheryanto, 2016, Pengolahan Air Limbah Rumah Tangga Dengan Menggunakan Proses Gabungan Saringan Bertingkat dan Bioremidiasi Enceng Gondok (*Eichornia crassipes sp*) (Studi Kasus di Perumahan Griya Mitra 2 Palembang). Jurnal Penelitian Sains, 18(1), 8 - 13.
- [9] Wijaya, I.M.W., & Soedjono, E.S., 2018, Domestic Wastewater in Indonesia: Challenge in The Future Related to Nitrogen Content. *Journal international of GEOMATE*, **15**(47), 32 41.
- [10] Haderiah, H., & Dewi, N.U., 2016, Meminimalisir Kadar Detergen Dengan Penembahan Koagulan dan Filtrasi Media Saring Pada Limbah Kamar Mandi. *Higiene*, **1**(1), 34 40.
- [11] Zhang, X., Tong, D.Q., Zhao, J.J., & Li, X.Y., 2013, Synthesis of NaX zeolite at room temperature and its characterization. *Materials Letters*, **104**(5), 80–83.
- [12] Hamdan, H., 1992, Introduction to Zeolites: Synthesis, Characterization, and Modification, UTM, Malaysia.
- [13] Zhang, X., Tang, D., Zhang, M., & Yang, R., 2013, Synthesis of NaX zeolite: Influence of crystallization time, temperature and batch molar ratio SiO2/Al2O3 on the particulate properties of zeolite crystals. *Powder Technology*, 235(3), 322 – 328.

Proceeding of Chemistry Conferences vol. 1 (2016)

- [14] Araujo, L., R., G., Cavalcante Jr., C., L., Farias, K., M., Guedes, I., Sasaki, J., M., Freire, P., T., C., Melo, F., E., A., & Mendes-Filho, J., 1999, Synthesis of Cubic Y Zeolite Using a Pulsed Microwave Heating System. *Materials Research*, 2(2), 105-109.
- [15] Niboua, D., Mekatel, H., Amokranea, S., Barkat, M., & Trari, M., 2010, Adsorption of Zn2+ ions onto NaA and NaX zeolites: Kinetic, equilibrium and thermodynamic studies. *Journal of Hazardous Materials*, 173(6), 637–646.
- [16] Sawyer, C.N., & Martin, M.C., 2003, Chemistry for Environmental Engineering and Science, edisi ke 5, Mc Graw Hill & Co, New York.
- [17] Li, J., Tong, Y., Guan, L., Wu, S., & Li, D., 2019, A turbidity compensation method for COD measurements by UV-vis spectroscopy. *Optics*, **186**(6), 129 136.
- [18] Botkin, D.B., & Keller, E.A., 2003, *Environmental Science: Earth as A Living Planet*. Forth Edition, John Wiley and Sons, Inc, New York.
- [19] Putro, S.P., Hariyati, R., Suhartana & Agung Sudaryono., 2013, Evaluasi Praktek Budidaya Sistem Karamba Jaring Apung Bertingkat Berdasarkan Taksa Dominan dan Oportunistik Makrobentos. *Konferensi Akuakultur Indonesia*, 49 – 56.
- [20] Putro, S.P., Agung Sudaryono, Widowati & Suhartana, 2014, Evaluation on The Application of Stratified Double Net Cages For Freshwater Fish Aquaculture: Macrobenthos Assemblages as Indicator. *Proceeding of International Conference of Aquaculture Indonesia*, 1, 135 – 142.
- [21] Putro, S.P., Widowati & Suhartana., 2015, Assessment Level Severity of Environmental Disturbance Caused by Aquaculture Activities Using Abudances – Biomass Curves of Macrobenthos Assemblages. *International Journal of Environmental Science and Development*, **6**(3), 173 – 181.
- [22] Sawyer, C.N., & Martin, M.C., (2003), *Chemistry For Environmental Engineering and Science*. edisi ke 5, Mc Graw Hill & Co., New York.

Characteristic Changes and Antibacterial Activities of Liquid Soap from Nyamplung Seed Oil (*Calophyllum inophyllum L*) Due to Storage

Senny Widyaningsih^{a)}, Mochammad Chasani^{b)}, Hartiwi Diastuti^{c)}

Chemistry Department, University of Jenderal Soedirman, Purwokerto, Central Java, Indonesia.

^{a)}E-mail: senny.widyaningsih@unsoed.ac.id ^{b)} moch.chasani@gmail.com ^{c)} diastutihartiwi@gmail.com

Abstract. The storage time of antibacterial liquid soap from nyamplung seed oil (*Calophyllum inophyllum* L) has been determined. The stability of antibacterial liquid soap during storage greatly affects the quality of the product. The purpose of this study was to determine the relationship between the characteristics of antibacterial liquid soap to the time of storage and determine the limit of storage time. Characterization was determined for 12 weeks. The characteristic parameters were the total fatty acids, free fatty acids, neutral fat, pH, specific gravity and foam stability. Using correlation test analysis, the results showed correlation between storage time with free fatty acids, pH and neutral fat. Decreasing antibacterial activity during storage only 5.5%.

Keywords: Antibacterial, Nyamplung, seed oil, Calophyllum inophyllum L

1. Introduction

Nyamplung is a plant that is widely found on the coast of Java. Nyamplung seeds contain high levels of oil (70%) that is higher than other plants, such as jatropha (40-60%) and palm oil (46-54%) [1]. Nyamplung seed oil has been used as a basic ingredient in soap production. Nyamplung seed oil contains xanthone antibiotics that play an active role as an antibacterial that can inhibit *S. aureus*, *P. aeruginosa*, *B. subtilis*, *S. typhimurium*, and *K. pneumonia* [2]. Research on antibacterial soap from nyamplung seed oil states that soap from nyamplung seed oil has antibacterial activity against *S. Aureus* and *E.coli* [3]. Soap is a cleaning product to clean dirt and bacteria. The soap can be divided into antioxidant, antibacterial, antifungal and beauty soap [4]. The form of soap varies from solid, liquid, foam, cream or gel, and powder. Liquid soap is preferred because it is more hygienic in storage and more practical in use [5].

Soap has a time limit for use called storage time. It is the time between starting production until the quality of product decrease. Soap products that have a low quality cannot be used anymore, because it cause irritation, itching, and skin diseases [6]. Previous research did not examined the effect of storage time on the quality of soap. This research determine the characteristics and antibacterial activity of liquid soap from nyamplung seed oil due to storage time so that the soap products are safe to use.

2. Materials and methods

2.1. Materials

The research used nyamplung seeds oil, ammonium sulfate, potassium hydroxide, carboxy methylcellulose, sodium lauryl sulfate, hydrochloric acid, sulfuric acid, S. aureus bacteria, NA media (Nutrient Agar), NB media (Nutrient Broth), and tetracycline

2.2. Preparation of antibacterial liquid soap from nyamplung seed oil

Nyamplung seed oil (300 g) was heated until the temperature reached 70 °C. 150 grams of 30% KOH solution (b/v) were added. The mixture were heated for 1 hour. When the temperature decline to 60 °C, deionized water were added (1:1). Stirring continues until homogeneous. Additive such as CMC (2.25 g), SLS (4.5 g), and deodorizer (8 g) were added. The stirring process used 500 rpm for 10 - 15 minutes.

2.3. Characterization of soap products

The soap was divided into 13 containers and stored based on variations in Table 1. The characterizations that carried out during storage time were the determination of the total amount of fatty acids, free fatty acids, neutral fats, specific gravity, foam stability and pH.

Table 1. Storage time variations				
Storage time	Days			
T0	0			
T1	7			
T2	14			
T3	21			
T4	28			
T5	35			
T6	42			
Τ7	49			
T8	56			
Т9	63			
T10	70			
T11	77			
T12	84			

• .•

2.4. Antibacterial activity test

The antibacterial activity test was carried out by pouring 15 mL of Nutrient Agar (NA) medium at ± 37 °C into sterile petri dish then allowed at room temperature until the medium solidify. A bacterial cultures in Nutrient Broth (NB) medium are taken and dispersed in Nutrient Agar (NA) medium. The volume of bacteria that was taken based on the absorbance results at 600 nm. If the absorbance value is less or equal to 0.5 then te volume is taken 100 µL bacterial and if 0,6-1,0 the volume is taken 50 µL. The suspension of the test bacteria on Nutrient Agar (NA) medium is distreaked on the spread plate using drugalsky, then allowed for 15 minutes at room temperature. After drying, a paper disc with a diameter of \pm 6 mm was placed over the NA medium. Samples and controls were taken 10 μ L and dripped onto paper disc then incubated for 24 hours at 37 °C. Then measured the inhibitory diameter formed around the disc paper.

Results and discussion 3.

3.1. Characteristics of antibacterial soap from nyamplung seed oil

3.1.1. Total fatty acid

Total fatty acid is all fatty acid contained in soap, which have reacted or not reacted with alkalis. Total fatty acids during storage can be seen in Figure 1.

Proceeding of Chemistry Conferences vol. 1 (2016)

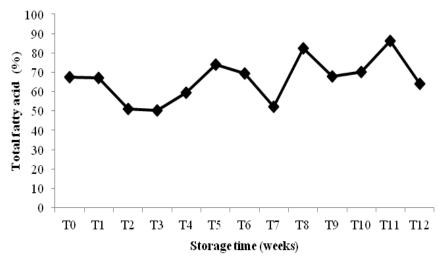


Figure 1. Total fatty acid of antibacterial soap from nyamplung seed oil during the storage

The total fatty acids showed fluctuation with values around 50.14% - 86.36%. The total fatty acids changes because the presence of oxygen which causes oxidation. The longer storage time, the higher oxygen pressure that causes increasing the rate of oxidation of fatty acids [6]. The oxidation reaction will cause the fatty acids to break into aldehydes, ketones and free fatty acids. The amount of fatty acids and free fatty acids is related to pH, that the higher fatty acids the lower pH.

3.1.2. Free fatty acid

Free fatty acid is fatty acid which have not react with potassium. Good quality soap contains a small amount of fatty acids. The results of the characterization of free fatty acids during storage time can be seen in Figure 2.

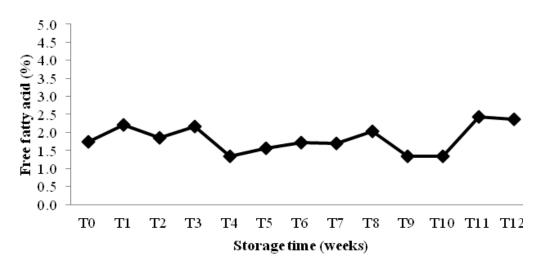


Figure 2. Free fatty acid of antibacterial soap from nyamplung seed oil during the storage

During storage, free fatty acids show a fluctuating in the range of values of 1.34% - 2.42%. Free fatty acids have increased due to oxidation and hydrolysis reactions during storage. The hydrolysis reaction occurs because of the presence of water in the product, while the oxidation reaction in the double bond also produces free fatty acids [6]. Unsaturated fatty acids break down due to heating, because hot oil or fat comes in direct contact with air. The carbon chain in the double bond is broken so that free fatty acids increase. The effect of storage time on free fatty acids shows a correlation. High free fatty acids also cause low of pH.

3.1.3. Neutral fat

Neutral fat is fat that does not react with KOH to produce soap. A good soap must contain a small neutral fat. The results of neutral fat during storage can be seen in Figure 3.

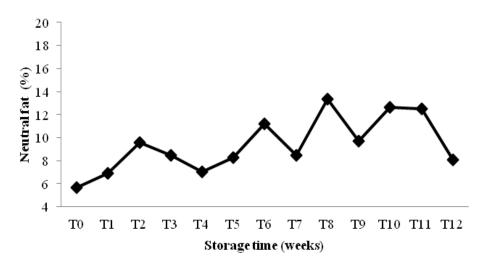


Figure 3. Neutral fatty of antibacterial soap from nyamplung seed oil during the storage

During storage, neutral fat shows fluctuating results with values 5.66% - 13.33%. The high neutral fat is due to natural nyamplung oil properties. Nyamplung oil contain high neutral fat [1]. Neutral fat can be sterols, dyes, hydrocarbons, and complex lipids. The making of this soap uses essential oil fragrance that containing terpenoid which are including one of the neutral fats.

The results of data analysis regarding the effect of storage time on neutral fat using the correlation method showed a correlation. The significance value is 0.020, which means less than 0.05, then there is a correlation between the two variables. The value of the degree of relationship is 0.634, which means the correlation is strong, and a positive sign indicates data that tends to rise.

3.1.4. pH

pH is one of the important parameters. pH is used as a parameter whether a soap is safe to use because a low pH has the potential to cause irritation such as sores, itching, or peeling of the skin. Soap generally has a pH of around 10 [7]. The results of measuring the pH of the soap during storage can be seen in Figure 4.

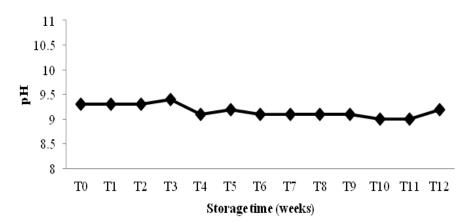


Figure 4. pH of antibacterial soap from nyamplung seed oil during the storage

Figure 4 shows that during storage time, pH decreased fluctuatively with a value of about 9.0 - 9.4. This can be caused by the increasing free fatty acids during storage time which causes soap getting more acidic. A good soap must have pH 8-11. pH which is below 8 or above 11 has a bad effect when used on the skin, it will cause irritation [8].

The results of data analysis regarding the effect of storage time with the pH generated using the correlation method shows the correlation. The significance value is 0.004, which means it is smaller than 0.05, then it is correlated. The value of the degree of relationship is -0,736 which means strong correlation, and negative sign means the data shows a decrease.

3.1.5. Spesific gravity

Specific gravity is the ratio of the weight of substances in the air at 25 $^{\circ}$ C to the weight of water with the same volume and temperature [9]. Measurement of specific gravity was conducted by comparing the weight of the sample with the weight of distilled water at room temperature using a pycnometer. The type of soap weight during storage can be seen in Figure 5.

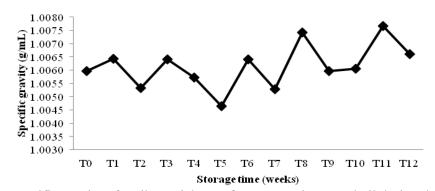


Figure 5. Spesific gravity of antibacterial soap from nyamplung seed oil during the storage

During storage, the specific gravity data showed a fluctuating increase in the range of values of 1.0053 - 1.0077 g/mL. Specific gravity is affected by the mass and the volume of the solution. The mass of soap during storage does not change because the soap is stored in a closed container and at room temperature. Based on the law of conservation of mass (Lavoiser's law), the mass of an object will remain

constant if stored in a closed container and as long as storage is not reduced or other ingredients are added. The volume of soap during storage can be reduced due to shrinkage of foam that is still present in the soap. A fixed mass and a reduced volume cause the specific gravity during storage to increase. The results of data analysis regarding the effect of storage time with specific gravity using the correlation method showed no correlation or no significant difference. The significance value is 0.163 which is greater than 0.05, meaning that the two variables are not correlated.

3.1.6. Foam stability

Abundant and stable foam soap is preferred. Foam characteristics are influenced by active ingredients of soap or surfactants or foaming stabilizers. Foam stability during storage can be seen in Figure 6.

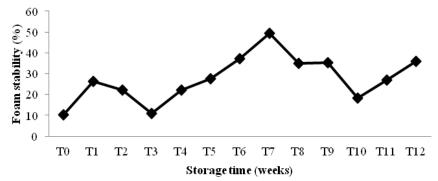


Figure 6. Foam stability of antibacterial soap from nyamplung seed oil during the storage

During storage, foam stability showed a fluctuating increase data, with a range of values of 10.31-49.30%. The stability of the foam depends on the physical and chemical properties of the surfactant used. Sooner or later the foam will break, due to the depletion of the liquid layer that forms foam [5]. The results of data analysis about the effect of storage time to foam stability using the correlation method showed no correlation or no significant effect. The significance value obtained is 0.077, it is higher than 0.05 that means it does not correlate.

3.2. Antibacterial activity

The liquid soap antibacterial activity test was conducted to determine the ability of soap to inhibit bacteria before and after storage. This test is carried out at the 0 and 12 weeks. The bacteria are S. aureus bacteria, because these bacteria usually infect the skin. Tetracycline is used as a positive control and distilled water as a negative control. Tetracycline is an antibiotic that can inhibit gram-positive and gram-negative bacteria by inhibiting protein synthesis. A distilled water is used as a negative control so that it is known that as a comparison the solvent used does not affect the results [3]. The results of the antibacterial test can be seen in Table 2.

Table 2. Antibacterial activity test results		
Sampla	Inhibitory diameter	
Sample	(mm)	
Aquades (-)	-	
Tetrasiklin (+)	35.08	
0 week	15.68	
12 week	14.81	

The results showed that distilled water has no effect to the antibacterial activity. Tetracycline as a positive control produces an average inhibition diameter of 35.08 mm. This value is greater than the zero week soap and the 12 week soap. The zero week soap produced an average inhibition diameter of 15.68 mm whereas for 12 week soap was 14.81 mm. These results indicate that storage decrease the antibacterial activity about 5.5%. The decreasing caused by the presence of light and oxygen which cause oxidation process.

4. Conclusion

The storage time affects free fatty acids, pH and neutral fat of liquid soap from Nyamplung seed oil. Antibacterial activity decreased by 5.5% during storage time.

Acknowledgments

The research was partially supported by Universitas Jenderal Soedirman through through a 2019 competency improvement research grant.

References

- [1] Fadhlullah, M., Widiyanto, S.N.B., & Restiawaty, E., 2015, The potential of nyamplung (Calophyllum inophyllum L.) seed oil as biodiesel feedstock: Effect of seed moisture content and particle size on oil yield. *Energy Procedia*, **68**, 177-185.
- [2] Hasibuan, S., Sahirman, S., & Yudawati, N.M.A., 2013, Karakteristik Fisikokimia dan Antibakteri Hasil Purifikasi Minyak Biji Nyamplung (Calophyllum inophyllum L.). *agriTECH*, **33**(3), 311-319.
- [3] Widyaningsih, S., Chasani, M., & Diastuti, H., 2018, Formulation of Antibacterial Liquid Soap from Nyamplung Seed Oil (Calophyllum inophyllum L) with Addition of Curcuma heyneana and its Activity Test on Staphylococcus aureus. In *IOP Conference Series: Materials Science and Engineering*, **349**(1).
- [4] Hasibuan, S., Sahirman, S., & Ma'ruf, A., 2014, The Quality of Transparent Soap From Farmer's Crude Calophyllum Seed Oil. *International Journal on Advanced Science, Engineering and Information Technology*, 4(5), 349-353.
- [5] Silsia, D., Susanti, L., & Apriantonedi, R., 2017, Pengaruh konsentrasi KOH terhadap karakteristik sabun cair beraroma jeruk kalamansi dari minyak goreng bekas. *Journal Agroindustri*, 7(1):11-19.
- [6] Widyaningsih, S., Chasani, M., Diastuti, H., & Rahmayanti, E., 2019, The storage time on the characteristic of liquid dishwashing soap from nyamplung seed oil (Calophyllum inophyllum L) and its antibacterial activity. In *IOP Conference Series: Materials Science and Engineering*, **509**(1).
- [7] Nauli, A.P., Darmanto, Y.S. & Susanto, E., 2015, Karakteristik Sabun Cair Dengan Penambahan Kolagen Ikan Air Laut Yang Berbeda. *Jurnal Pengolahan dan Bioteknologi Hasil Perikanan*, 4(4), 1–6.
- [8] Wasitaatmadja, S.M., 1997. Penuntun ilmu kosmetik medik. Jakarta: Penerbit Universitas Indonesia.
- [9] Voigt, R. & Soewandhi, S.N., 1994, *Buku pelajaran teknologi farmasi*. Gadja Mada University Press.

Antioxidant Activities of Ethanol Extraction Product from Citronella Grass (*Cymbopogon nard*us) Distillation Residue

Eko Febrianto R, EnnyFachriyah*, Dewi Kusrini

Laboratory of Organic Chemical, Departement of Chemistry, Faculty of Sains and Mathematics, Diponegoro University, Prof. Sudarto SH street, Tembalang, Semarang

*E-mail: enny.fachriyah@live.undip.ac.id

Abstract. Indonesia's floral diversity provides huge reserve for traditional medicinal raw materials, one of which is citronella grass (*Cymbopogon nardus*). This study aims to identify the content of secondary metabolites in its ethanol extraction product from distillation residue and determine its antioxidant activity. Ethanol extraction product of the distillation residue was blackish red in color with a yield of 8.882%. Phytochemical screening on residual powder and EDR (distillation residue ethanol extraction product) showed positive results for flavonoids, tannins, quinones, phenols and steroids. Total polyphenolcontent test obtained a concentration of 45.955 mg gallic acid equivalent/g EDR while EDR antioxidant activity test obtained IC₅₀ value of 189.905 ppm.

Keywords: antioxidant, Cymbopogon nardus, distillation residue, ethanol extraction product (EDR)

1. Introduction

Indonesia's floral diversity burgeoning traditional medicinal raw materials. Traditional medicines derived from plants have long been widely known and used by the people of Indonesia. The potency of medicinal plants is due to the presence of secondary metabolites which are present in these plants [1]. Among them is fragrant lemongrass which possesses many benefits. Fragrant lemongrass or citronella has traditionally been known to have the ability of treating sore throat, helping digestion, medicating worm, reducing fever, shed sweat, diuretics, and ease menstruation [2]. Fragrant lemongrass extract also has antioxidant properties [3]. Fragrant lemongrass leaves are extracted for its essential oils and they are widely used in various industrial fields [4]. Citronella essential oil also has a greater insecticidal activity than ethanol extract [5].

The production of citronella oil requires very large amounts of base material; around 20 tons to produce 160 liters of oil. Abundant essential oil distillation residues have the potential to be utilized optimally. Utilizations residues from fragrant citronella essential oil distillation have been limited to the use as animal feed, distillation fuel and fertilizer [6]. Previous research on chloroform extract of fragrant citronella distillation residues showed antibacterial activity [7]. Considering the potential and abundance of fragrant citronella essential oil distillation residues there is an appeal in identifying the content of secondary metabolites in the ethanol extract of distillation residues and determining their antioxidant activity. This research is hoped to provide input to increase the utilization of distillation residues that have not been optimal up to this moment. In this study, the sample used was the residue of lemongrass leaves which had been extracted for its essential oil.

2. Materials and Method

2.1. Materials and equipment

The materials used were 4 kg of fresh citronella leaves, 96% technical ethanol, technical methanol, petroleum ether, methanol p.a (Merck), ethanol p.a (Merck), chloroform p.a (Merck), aquadest, $_{FeCl3}$, ammonia (Merck), Mg powder, H_2SO_4 (Merck), Dragendorff reagent containing a solution of potassium bismuth iodide (Merck), Mayer reagent containing mercury chloride and potassium iodide (Merck), amyl alcohol p.a (Merck), acetone (Merck), NaOH (Merck), HCl (Merck), Folin-Ciocalteu (Merck) reagents, gallic acid (Sigma), Na_2CO_3 (Merck), DPPH (Merck) and quercetin (Merck).

The equipment used are macerator, standard laboratory glass wares, filter paper, stirrer, blender (Cosmos), water bath, vial bottle, electric heater, analytic balance (OHAUS), UV-Vis spectrophotometer (SHIMADZU UV-1280), and rotary evaporator (Buchi-B480).

2.2. Phytochemical residue screening

The distillation residue of fragrant lemongrass leaves was dried through aeration at room temperature and then turned into powder. The powder was later tested for alkaloids, saponins, flavonoids, tannins, quinones, steroids, terpenoids and phenols contents [8]. The same test was carried out on ethanol extraction product of the distillation residue [9].

2.2.1. Alkaloid test

As much as 5 gram of powdered fragrant lemongrass distillation residue is moistened with 5 mL of 25% ammonia and crushed in porcelain crucible. The resulting product was then added with 20 mL of chloroform and again crushed firmly. Next, filtering was carried out to separate the filtrate and the residue. For alkaloid examination, the filtrate was extracted using liquid-liquid extraction with HCl 2N where the two layers formed were separated. The top layer was divided into two equal amounts to be tested with Dragendorff and Mayer reagents. The portion which was tested with Dragendorff reagent would form brick red deposits as a positive test while the portion that was tested with Mayer reagent would form white deposits if alkaloids exist.

2.2.2. Saponin test

As much as 5 g of distillation residue powder was boiled in 100mL of water for 5 minutes then filtered in hot condition. Then 10 mL of the solution was shaken strongly in a vertical manner for 10 seconds. Positive results were shown through the appearance of foam whereinwith the addition of 1% HCl the foam remained stable.

2.2.3. Flavonoid test

As much as 10 grams distillation residue powder was added with 100 mL distilled water and then heated until boiling. The filtrate obtained was taken as much as 5 mL that was then added with Mg powder, 1 mL concentrated HCl, and 2 mL amyl alcohol. The mixture was shaken and left to allow separation where an amyl alcohol layer would be formed. Red, yellow or orange deposits in the amyl alcohol layer indicate positive results [10].

2.2.4. Tannin/ Phenolic compounds test

As much as 1 gram of distillation residue powder was filtered with 10 mL of distilled water. The filtrate was then diluted with distilled water until it is colorless. 2 mL of the solution was taken and added with 1 to 2 drops of iron (III) chloride reagent. Blue or blackish green color formed indicates the presence tannin.

2.2.5. Quinone Test

As much as 1 g of distillation residue powder was boiled in 10mL of water for 5 minutes, then cooled and filtered. Into 5 mL of the filtrate produced, NaOH 1N solution was added. Red would form if quinones exist.

2.2.6. Triterpenoid and Steroid Tests

As much as 5 gram of distillation residue powder was macerated with 20 mL ether for 2 hours and then filtered. As much as 5 mL of the filtrate was evaporated in an evaporator plate to dry and was given 2 drops of acetic acid anhydride and 1 drop of concentrated sulfuric acid. The formation of blue/green color indicates the presence of steroids while the formation of red/purple indicates triterpenoid.

2.3. Extraction of distillation residue with ethanol

As much as 200 grams of distillation residue powder was macerated using 96% technical ethanol solvent until the solution turned close to clear. The solvent was replaced every 24 hours. The extract obtained was then concentrated to obtain distillation residue ethanol extraction product (EDR).

2.4. Total phenol content test of distillation residue ethanol extraction product [11, 12]

2.4.1. Gallic acid calibration curve formation using folin-ciocalteu reagent

As much as 10 mg of gallic acid was added with 10 mL of methanol p.a so that a concentration of 1000 ppm was obtained. Concentration variations of 125, 100, 75, 50 and 25 ppm were then made. From each concentration, 0.5 mL was taken and added with 0.5 mL of distilled water and 2.5 mL of Folin-Ciocalteu reagent to be homogenized and left for 15 minutes. 7.5% Na₂CO₃ solution was later added as much as 2 mL and then left for 30 minutes. The solution was measured for its absorbance with a UV-Vis spectrophotometer at 765 nm and a linear regression curve was created to represent the relationship between the concentrations of the standard gallic acid and absorbance.

2.4.2. Total Phenol Content Determination through Folin-Ciocalteu Method

A total of 10 mg of EDR extract was dissolved with 10 mL of methanol to obtain a concentration of 1000 ppm. A total of 0.5 mL of 1000 ppm EDR solution was added with 2.5 mL of aquades and 2.5 mL of Folin-Ciocalteu reagent, homogenized and left to stand for 15 minutes. It was then added with 2 mL of 7.5% Na2CO3 and left for 30 minutes. The solution was measured for absorbance with a UV-Vis spectrophotometer at a wavelength of 765 nm.

2.5. Antioxidant activity test with DPPH method [13,14]

DPPH 0.1 mM solution was made by dissolving 3.9432 mg of DPPH powder into 100 mL of methanol. The DPPH control solution was measured for its absorbance at a wavelength of 517 nm. The EDR was made with a concentration of 250, 200, 150, 100 and 50 ppm while quercetin as a comparison was made at 50 ppm, 40 ppm, 30 ppm, 20 ppm and 10 ppm. A total of 3.8 mL of the 0.1 mM DPPH solution was added to 0.2 mL of EDR samples from each concentration. The mixture was homogenized and left for 30 minutes in a dark place. Then the absorbance was measured at a wavelength of 517 nm.

$$\% inhibition = \frac{Control \ absorbance(DPPH) - Sample \ absorbance}{Control \ absorbance} \times 100\%$$
(1)

IC₅₀ is concentration of sample that able to reduce 50% of DPPH radical activity.

3. Results and discussion

3.1. Distillation residue extraction and phytochemical screening

Extraction of distillation residue of citronella leaves was carried out by maceration using ethanol solvents. The solvent was removed using Buchii evaporator so that the product of ethanol extraction from the distillation residue (EDR) was produced. The ethanol extraction residue obtained a yield of 8.882%. The results of phytochemical screening tests carried out on the powdered residue and ethanol extraction product of citronella leaves distillation residue (EDR) can be seen in Table 1.

Test	Powdered Residue	EDR
Flavonoid	+	+
Alkaloid	-	-
Tanin	+	+
Kuinon	+	+
Saponin	-	-
Fenol	+	+
Steroid	+	+

Table 1. Phytochemical screening test of powdered residue and ethanol extraction
product of distillation residue (EDR)

Description: + present; - not present

From the table above it can be seen that ethanol extraction product still contain many secondary metabolites such as flavonoids, tannins, quinones, phenols and steroids. The results are in accordance with a study conducted by Verawati et al [15]. The results indicate that the distillation residue ethanol extraction product has the potential to be used as a material to produce traditional medicine.

3.2. Total EDR phenol content test

The absorbance measurement results of the gallic acid standard solution can be seen in Table 2. A graph of a linear regression curve is made (as shown in Figure 1), representing the relation between the concentration of gallic acid standard solution and the absorbance, to be used to determine the total phenol content in the sample using the regression equation. The graph of the linear regression curve of the relationship between the concentrations of the standard solution of gallic acid and absorbance is shown in Figure 1.

No	Concentration	Absorbance 1	Absorbance measurements		
No.	(ppm)	1	2	- Average Absorbar	ice
1.	25	0.172	0.172	0.172	
2.	50	0.265	0.267	0.266	
3.	75	0.387	0.385	0.386	
4.	100	0.524	0524	0.524	
5.	125	0.607	0.609	0.608	
		0.004x + 0.052 R ^z = 0.994 0.172 0.266	0.524 0.386	0.608	
	0 20	40 Concentra	tion (ppm) 100	120 140	

Table 2. Phytochemical screening test of powdered residue and ethanol extraction product of distillation residue (EDR)

Figure 1. Graph of linear regression of the relationship between concentration of gallic acid standard solution and absorbance.

Figure 1 shows a linear regression equation of the relation between the concentration of gallic acid standard solution and absorbance with y=0.0045x + 0.0522 and $R^2 = 0.9946$. Table 3 shows the results of absorbance measurements of EDR sample.

Table 3. Absorbance measurements of EDR sample using a UV vis spectrophotomete				
	Concentration (ppm)	Absorbance Measurement (nm)		Average
	-	1	2	-
	1000	0.259	0.259	0.259

Analysis of total phenol content was carried out to determine the antioxidant potential of EDR as an antidote to free radicals. The chemical components that act as antioxidants are phenol and polyphenol compounds. Determination of total phenol content was carried out using the equation y = 0.0045x + 0.0522 of the linear regression curve of the relationship between the concentration of gallic acid standard and absorbance previously obtained. The total phenol content in the EDR sample obtained was 45.955 mg gallic acid equivalent/g EDR.

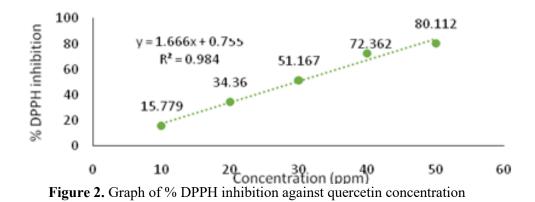
3.3. Antioxidant activity test with DPPH method

Antioxidant activity test of EDR sample was performed using the DPPH (1,1-diphenyl-2picrylhydrazyl) method with a known antioxidant quercetin as a comparison. The DPPH test was done by measuring the absorbance and wavelength of DPPH solution in methanol. The DPPH solution in methanol is dark purple in color. The intensity of the color can be reduced or turn pale yellow when DPPH reacts with other compounds that donate protons. The addition of protons to the DPPH radical structure will cause a reduction in the formation of nonradical DPPH. The optimum DPPH wavelength obtained was 517 nm. This wavelength was used to measure the absorbance of EDR sample. The absorbance measurement results of various concentrations of quercetin compound are presented in Table 4.

Concentration (ppm)	Absorbance
10	0.902
20	0.673
30	0.523
40	0.296
50	0.213

Table 4. Absorbance measurements results of quercetin compound

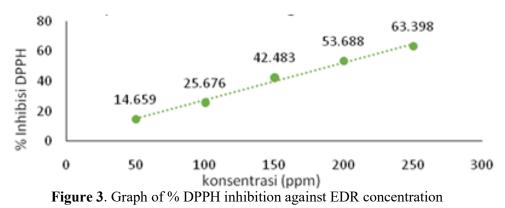
The absorbance data above are converted into % inhibition of DPPH using equation (1). The data in Table 4 are graphed as % inhibition of DPPH against the concentration of quercetin compound. The graph of% DPPH inhibition against quercetin concentration is presented in Figure 2.



ie 5. Absorbance measure	ments results of EDR	san
Concentration (ppm)	Absorbance	
50	0.914	
100	0.796	
150	0.616	
200	0.496	
250	0.392	

Table 5. Absorbance measurements results of EDR same	mple
--	------

Figure 2 shows a linear regression equation of the relationship between % inhibition of DPPH to the concentration of quercetin is obtained with y = 1.6667x + 0.7556 and $R^2 = 0.9847$. Based on calculation, the IC₅₀ comparison of quercetin is 29.546 ppm. The results of absorbance measurement of various concentrations of the EDR sample are presented in Table 5. From Table 5 above, a graph of % inhibition of DPPH against EDR concentration is created. The graph of the relationship between % inhibition of DPPH and EDR sample concentration is presented in Figure 3.



Calculation of IC₅₀ from the EDR sample is obtained from the linear equation y = 0.251x + 0.251x2.33338 with $R^2 = 0.9915$. The calculation obtained IC₅₀ value of ethanol extraction product of 189.905 ppm. EDR sample shows relatively good antioxidant activity, because the price of IC₅₀<200 ppm (16). However, its antioxidant activity is much lower when compared to the quercetin which has an IC_{50} value of 29.546 ppm. This is because quercetin is a pure compound and has been shown to be an active

antioxidant compound, while EDR (ethanol extraction product of distillation residue from citronella leaves) still contains various secondary metabolites. The antioxidant activity in the EDR sample is produced by the presence of secondary metabolites which are still present in the distillation residues of fragrant lemongrass leaves, including phenolic and polyphenol groups which are known to have antioxidant activity [11]. From the results of the antioxidant activity test of the EDR sample, even though it cannot be classified as a strong antioxidant, the ethanol extraction product of the distillation residue of citronella leaves is still prospective as a natural antioxidant.

4. Conclusion

Ethanol extraction product of distillation residue of fragrant citronella leaves contain flavonoids, tannins, quinones, phenolics, and steroids. Its total phenol content amounts to 45.955 mg gallic acid equivalent/g EDR. EDR has the potential to be an antioxidant with an IC_{50} value of 189.905 ppm.

References

- [1] Saifudin, A., 2014, Senyawa Alam Metabolit Sekunder: Teori, Konsep, dan Teknik Pemurnian, Deepublish, page 11
- [2] Khan, I. A. & Abourashed, E. A., 2011, *Leung's Encyclopedia of Common Natural Ingredients:* Used in Food, Drugs and Cosmetics, 3rd edition, John Wiley & Sons, page 201-202
- [3] Hendrik, G.W., Erwin & Panggabean, A.S., 2016, Pemanfaatan Tumbuhan Serai Wangi (Cymbopogon nardus (L.) Rendle) Sebagai Antioksi dan Alami. Jurnal Kimia Mulawarman. 10(2), 74-79. ISSN 2476-9258.
- [4] Oyen, L. & Dung, N., 1999, Plant Resources of South East Asia-Essential Oil Plant, Backhuys Publishers. Netherlands.
- [5] Doumbia, M.Yoboue, K., Kouamé, L.K., Coffi, K., Kra, D.K., Kwadjo, K.E., Douan, B.G., & Dagnogo, M., 2014, Toxicity of Cymbopogonnardus (Glumales: Poacea) against four stored food products insect pests. *International Journal of Farming and Allied Science*. 3(8), 903-909
- [6] Usmiati, S., Nurdjannah, N. & Yuliani, S., 2005, Limbah Penyulingan Sereh Wangi dan Nilam Sebagai Insektisida Pengusir Lalat Rumah (Musca domestica). *Journal of Agroindustrial Technology*, **15**(1),10-16.
- [7] Yuliyani, M., 2015, Aktivitas Antibakteri Ekstrak Kloroform Limbah Padat Daun Serai Wangi (Cymbopogon nardus) Terhadap Bakteri Pseudomonas aeruginosa dan Staphylococcus aureus. *Skripsi*, Fakultas Teknobiologi Universitas Atma Jaya Yogyakarta: 1-15.
- [8] Farnsworth, N. R., 1966, Biological and Phytochemical Screening of Plants. *Journal of pharmaceutical sciences*, **55**(3), 225-276.
- [9] Fachriyah, E., Kusrini, D., &Wibowa, P.J., 2018, Improvement of Bioactivity with Nanoparticle Fabrication: Cytotoxic Test of Ethanol, n-Hexane and Ethyl Acetate Extract from Red Galangal Rhizome (Alpiniapurpurata (Vieill.) K. Schum) in Bulk and Nanoparticle size using BSLT Method. *Journal of Scientific and Applied Chemistry*, 21(1), 39–43.
- [10] Markham, K.R., 1988, Cara Mengidentifikasi Flavonoid, Bandung, ITB-Press,
- [11] Orak, H. H., 2007, Total Antioxidant Activities, Phenolics, Anthocyanins, Polyphenoloxidase Activities of Selected Red Grape Cultivars and Their Correlations. *Scientia*, **111**(3), 235-241.
- [12] Hanis, M.Y., Hasnah, H., and dang, T.N., 2017, Total phenolic content and Antioxidant capacity of beans: organic vs inorganic. *International Food Research Journal*, **24**(2), 510-517.
- [13] Elvira, K., Fachriyah, E. & Kusrini, D., 2018, Isolation of Flavonoid Compounds from Eceng Gondok (Eichorniacrassipes) and Antioxidant Test with DPPH (1,1-diphenyl-2-Picrylhydrazyl) Method. *Journal of sciencetific and Applied Chemistry*, 21(4), 187-192.

- [14] Molyneux, P., 2004, The Use of the Stable Free Radical Diphenylpicrylhydrazyl (Dpph) for Estimating Antioxidant Activity. Songklanakarin. *Journal of Science and Technology*, 26(2), 211-219.
- [15] Verawati, A.P., Anam, K., & Kusrini, D., 2013, Identifikasi Kandungan Kimia Ekstrak Etanol serai Bumbu (Andropogoncitratus D.C) dan Uji Efektivitas Repelen Terhadap Nyamuk Aedesaegypti, Jurnal Sains dan Matematika, 21(1), 20-24.
- [16] Blois, M.S., 1958, Antioxidant Determinations by the Use of a Stable Free Radical. *Nature*, **181**(4617), 1199-1200.



Joint Conference on Chemistry

Published by: Universitas Sebelas Maret, Surakarta



ISSN: 2541-108X