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Academic Guidence

FOREWORD CHAIRMAN OF CHEMISTRY MASTER PROGRAM

Assalamu'alaikum Warohmatullohi Wabarokatuh,

Alhamdulillah, the Prospectus book for the 2019/2020 academic year Master of Chemistry Study Program, Faculty of Mathematics and Natural Sciences, UII can be published. This Prospectus book is the first edition for the Implementation of the Curriculum for the Master of Chemistry Study Program of FMIPA UII. This book is intended to provide guidance for students during their studies at the Master of Chemistry Study Program, Faculty of Mathematics and Natural Sciences, UII. Students are expected to read this Prospectus book as well as possible so that they have a comprehensive picture of the teaching and learning process in the Chemistry Masters Program, Faculty of Mathematics and Natural Sciences, UII.

The Head of the Master of Chemistry Study Program, Faculty of Mathematics and Natural Sciences, UII congratulates new students who have become new families in the Department of Chemistry, Faculty of Mathematics and Natural Sciences, Islamic University of Indonesia.

Finally, I hope that this Prospectus Book can be of use as a guideline for implementing higher education programs in the Chemistry Masters Study Program, Department of Chemistry, Faculty of Mathematics and Natural Sciences, Islamic University of Indonesia.

Wassalamu'alaikum Warohmatullohi Wabarokatuh.

Drs. Allwar, M.Sc., Ph.D.
Head of the Master of Chemistry Study Program FMIPA UII

PREAMBLE

Prospectus 2019/2020 This Master of Chemistry Study Program was compiled by the Prospectus Book Compilation Team as an effort to provide a complete picture of the academic process in the Chemistry Masters Study Program of FMIPA UII.

The Team would like to thank and appreciate all parties who have helped and / or supported the Team's task in completing the preparation of this Prospectus Book.

Finally, hopefully this Prospectus Book can be used as a guide for the implementation of educational programs in the Chemistry Masters Study Program, Faculty of Mathematics and Natural Sciences, Islamic University of Indonesia.

Yogyakarta, August 2019

Editor

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Prospectus
MASTER OF CHEMISTRY STUDY PROGRAM
FACULTY OF MATHEMATICS AND SCIENCES
UNIVERSITAS ISLAM INDONESIA
2019/2020 ACADEMIC YEAR

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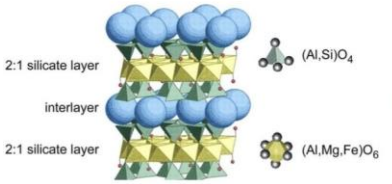
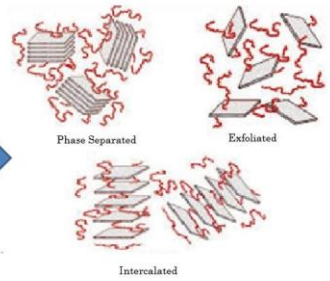
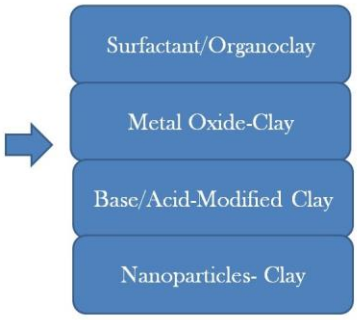
Prof. Dr. Is Fatimah, S.Si., M.Si.

- Date of Birth : 29 March 1975
- Motto : Long Life Learning
- Email : isfatimah@uii.ac.id
- Education :
- S1: UGM *S.Si* Field : Physical Chemistry
- S2: UGM *M.Si* Field : Physical Chemistry-Material
- S3: UGM *Dr* Field : Physical Chemistry-Material

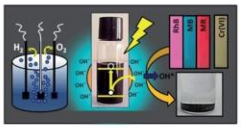






Slow Release Fertilizer

Microwave-Assisted Organic Reaction



Photocatalytic Degradation of Dyes Waste

Research Topics:

- Slow Release Fertilizer Based on Polymer-Clay Composite Superadsorbent (Universities Excellence Research Grants KEMENRISTEK-DIKTI 2016)
- Green Chemical Conversion using Microwave Assisted Organic Reaction Approach (The World Academy of Science Research Grant 2015-2016)
- Ceramic Membrane Preparation Using TiO_2-Clay Composite for Water Desinfection (Insentif Riset Terapan, INSINAS 2013-2014)
- Biogenic Silica from Agricultural Waste for Functional Materials
- Synthesis of Nanoparticles using Plant Extracts and Activity Test for Antibacterial Agent

Prof. Riyanto, Ph.D.

- Professor, Electrochemistry, Islamic University of Indonesia (UII), 2016
- Ph.D., Chemistry, National University of Malaysia (UKM), 2008
- M.Sc., Chemistry, Gadjah Mada University (UGM), 2000
- S.Pd., Chemical Education, Jambi University (UNJA), 1996

- RESEARCH HIGHLIGHTS
- Electrochemical Approaches to Humans and the Environment

- RESEARCH INTERESTS
- Preparation, characterization and application of glucose, uric acid and urea medical test using composite electrode (non enzymatic sensor) fourth generation.
- Preparation, Characterization and Application of Carbon-Modified Electrode for Electrochemical Degradation of Waste Water Batik, Textile and Laundry
- Preparation, Characterization and Application of Carbon-Modified Electrode for Electrochemical Disinfection of Drinking Water

- MAJOR RECOGNITION
- Achievement lecturers at UII and Kopertis Wilayah 5, 2015
- Achievement of Head Department at National Level, 2012

- PUBLICATIONS
- Riyanto, Muhamad Mawazi, Cahyati, Jumardin Rua, Rama Prasetia Ridwan, 2018, The Effect of Aeration and Hydrogen Peroxide on the Electrochemical Degradation of Methylene Blue Using Carbon Composite Electrodes, Chemical Engineering Transactions, 63, 811-816.
- Riyanto, Jumardin Rua, Yulanc, Mega Maghfirotul Fajrin, Zaina Rohayati, 2018, The Effect of Potential to Colour and COD Removal from Waste Textile Industry by Electrochemical Method, Chemical Engineering Transactions, 63, 751-756.
- Riyanto, Dyah Tri Untari dan Nahar Cahyandaru, 2016, Isolation and Application of the Lemongrass Essential Oil of Cymbopogon Nardus L.as a Growth Inhibitor of Lichens on Stone Cultural Heritage, Journal of Applied Chemistry, 9, 9, 109-117.
- Riyanto dan Sri Wulan Nas, 2016, Validation of Analytical Methods for Determination of Methamphetamine Using Fourier Transform Infrared (FTIR) Spectroscopy, Journal of Pharmacy and Biological Sciences, 11, 5, 51-59.
- Riyanto, Hardjono Sastrohamidjojo, Erni Fariyatun, 2016, Synthesis of Methyl Eugenol From Crude Leaf Oil Using Acid and Based Chemicals Reactions, Journal of Applied

Chemistry, 9, 9, 105-112.

- Riyanto and Mohamed Rozali Othman, 2015, Electrosynthesis and Characterization of Cu(OH)2 Nanoparticle using Cu and Cu-PVC Electrodes in Alkaline Solution, Int. J. Electrochem. Sci., 10, 4911-4921.
- Riyanto and Azan Anshori , 2014, Electroanalysis of Mefenamic Acid Using Platinum Powder Composite Microelectrode (PPCM), Anal.& Bioanal. Electrochem.6, 2, 2014, 01-11.
- Riyanto and Ahmad Safarudin, 2014, Preparation and Application of Platinum Composite Microelectrode (PCM) for the Routine Analysis of Acetaminophen in Pharmaceutical Products, Indo. J.Chem.14. 2, 109-115.
- Riyanto, 2013, Textile Industries Wastewater Treatment by Electrochemical Oxidation Technique Using Metal Plate, Int. J. Electrochem. Sci., 8, 11403-11415.
- Riyanto, 2013, Design and Application of Cu, Co, Ni, Pt and Ir Powder Composite Electrode (PCE) For Electrosynthesis and Electroanalysis in Alkaline Solution , J. App. Chem. 4, 3, 64-69.
- Riyanto, 2013, Preparation and Characterization of Nano Size NiOOH by Direct Electrochemical Oxidation of Nickel Plate, Int. J. Electrochem. Sci., 8, 4747-4760.

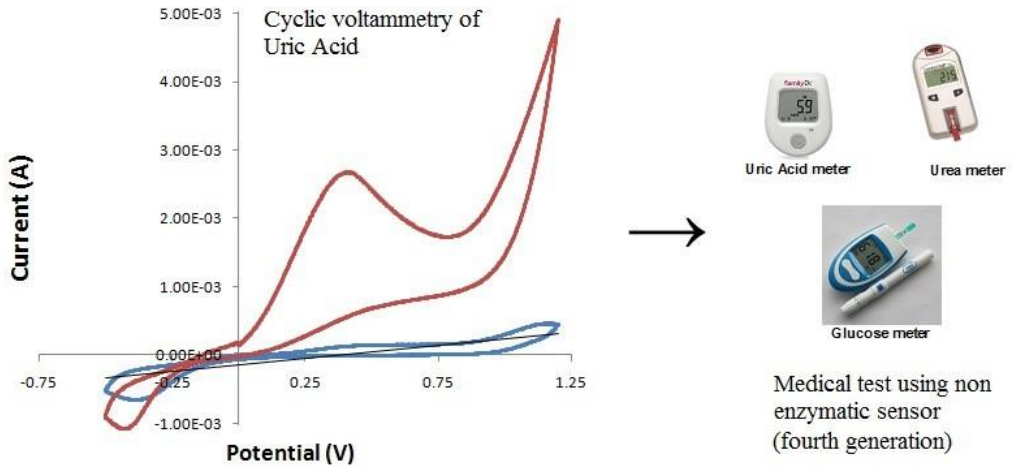


Figure 1. Preparation of medical test using non enzymatic sensor fourth generation

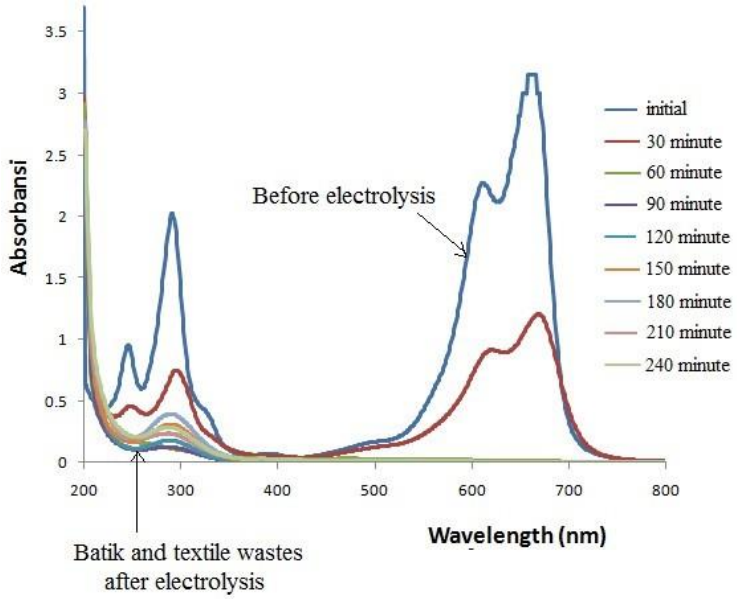


Figure 2. Electrochemical degradation of batik, laundry and textile waste

Prof. Dr.rer.nat Ir. Agus Taftazani

- Date of Birth : Jogjakarta, 22 July 1952
- Motto : Enthusiastic and istiqomah in doing good deeds
- Email : agus.taftazani@uii.ac.id or aguszani100@gmail.com
- Education :
- S1: Fak. Faculty of Engineering, Universitas Gadjah Mada (Ir.)
- Field : Nuclear Technology
- S3: Gesamt Höchschule Kassel, Germany (Dr.rer.nat)
- Field : Chemistry – Energy and Analytic

- Expertise:
  - Environmental Specimen Bank (ESB): Identification of heavy metal and Radionuclide in environment samples (mainland, river, beach) by nuclear analysis techniques.
  - Development of Nuclear Analysis Techniques (NAT) for identification of environmental and industrial sample pollutants.
  - Assessment of Air pollutants as a impact of burning coal (Pollutants: Heavy metal, natural radionuclides in coal, fly ash, bottom ash, filter (TSP, PM10 and PM2.5).
  - Quality Assurance and Quality Control of Nuclear Analytical Techniques.

- Excellent work:
- N Aziz, A. Mindaryani, Supranto, A Taftazani, D Biyantoro. Effect of Temperature to Adsorption Capacity and Coefficient Distribution on Rare Earth Elements Adsorption (Y, Gd, Dy) Using SIR. The 12th Joint Conference on Chemistry IOP Publishing IOP Conf. Series: Materials Science and Engineering 349 (2018) 012041 doi:10.1088/1757-899X/349/1/012041.
- Bernadetta Octavia, Triwibowo Yuwono dan Agus Taftazani. Isolation and Molecular Identification of Uranium Tolerant Bacteria Potential for Uranium Bioprecipitation. Jurnal Iptek Nuklir Ganendra Ganendra Journal of Nuclear Science and Technology Vol. 21 No. 1, Januari 2018: 45 – 53.
- Agus Taftazani, Roto Roto, Novitasari Restu Ananda, and Sri Murniasih. Comparison of NAA XRF and ICP-OES Methods on Analysis of Heavy Metals in Coals and Combustion Residues. Indones. J. Chem., 2017, 17 (2), 228 - 237
- Sukirno, Agus Taftazani, Sri Murniasih. “Kajian Multi Unsur Dalam Kayu Mahoni Sebagai Data Base Finger Print Dari Berbagai Lokasi” Prosiding Seminar Nasional Teknik Analisis Nuklir 2015, PSTBM –BATAN, Serpong, 6-7 Oktober 2015. ISSN : 2338-0642
- Bambang Irianto, Agus Taftazani “Optimisasi Elektrodeposisi dan Uji Rasio Isotop 238U, 235U, 234U Limbah Pasir Timah Bangka”. Prosiding Seminar Nasional Teknik Analisis Nuklir 2015, PSTBM –BATAN, Serpong, 6-7 Oktober 2015. ISSN : 2338-0642

- Sri Murniasih, Sukirno, dan Agus Taftazani. “Evaluasi Uji Banding antar Laboratorium AAN Untuk Menentukan Kandungan Unsur dalam Sampel Lingkungan” Prosiding PPI-PD Iptek Nuklir, PSTA-BATAN. Jogjakarta 10-11 Juni 2014. ISSN 0216-3128
- Sri Murniasih, Roto, Agus Taftazani, Th Rina M, dan Sutisna. “Analisis dan Pengukuran Parameter Reaktor Kartini Untuk Penerapan Metode K0-NAA. “ Jurnal Teknologi Reaktor Nuklir Tri Dasa Mega. Volume 16 No.2, Juni 2014. ISSN 1411-240x
- B. Canion, C. Jacques, S. Landsberger, A. Taftazani .“Trace analysis of Indonesian volcanic ash using thermal and epithermal neutron activation analysis”. NUKLEONIKA 2012, volume 57 No. 4, page 585-589. International Journal of Nuclear Chemistry. Institute of Nucleare Chemistry and Technology, 16 Dorodna Str., 03-195 Warsawa, Poland
- Agus Taftazani, Samin, Suzanna. “Preparation of certified reference materials (CRMs); Zircon Sand”. 13th International Symposium on Biological and Environmental References Materials (BERM 13). 25-29 Juni 2012, Vienna, Austria

Dr. Noor Fitri, S.Si., M.Si.

- Date of Birth : 6 December 1970
- Motto : Work for Worship
- Email : noor.fitri@uii.ac.id

- Education :
- S1: Universitas Hasanuddin / Field : Chemistry
- S2: Institut Teknologi Bandung / Field : Chemistry
- S3: Institut Teknologi Bandung / Field: Analytical Chemistry and Environmental Chemistry

- Expertise :
- Analytical Chemistry, Chemistry separation, Environment Chemistry and Chemistry speciation. Ongoing research focuses on chemistry separation to resolving environmental problems, development of separation methods for essential oil extraction, and for the chemical speciation of elements. Moreover, able to perform analytical techniques from AAS, UV-Vis, ICP-MS, GC- MS, LC-MS/MS, Preparative Native Continuous Polyacrilamide Elektrophoresis (CE).
- Amdal consultant

- Excellent work:
- 1. Molybdenum Speciation In Raw Phloem Sap Of Castor Bean, Noor Fitri, 2008.
  2. Profil Elusi Spesi Cd Dalam Cairan Floem Tanaman Jarak (Ricinus Communis L.)Kolom Sephadex G-25 M (Elution Profile Of Cd Speci In Floem Liquid Of Ricinus Communis L. Plant On Sephadex G-25 M Column), Noor Fitri, 2008.
  3. Molybdenum speciation in raw phloem sap of castor bean, Noor Fitri, 2008.
  4. Analisis Spesi Mangan Dalam Cairan Phloem Tanaman Jarak (Ricinus Communis L.) Dengan Metode Pnc Page -Icp Qms, Noor Fitri, 2007.
  5. Molybdenum Speciation In Raw Phloem Sap Of Castor Bean, Noor Fitri, 2007.
  6. Application Of Sec – Icp Ms For Elemental Speciation: A Review , Noor Fitri, 2009.
  7. Application Of Inductively Coupled Plasma Quadrupole Mass Spectrometry For Trace Metal Determination In Biological Materials , Noor Fitri, 2008.
  8. Chemical Gains And Losses During Hydrotherminal Alteration Of Secondary Chlorite Replacing Primary Biotite, Noor Fitri, 2008.
  9. Analisis Spesi Mangan Dalam Cairan Floem Tanaman Jarak (Ricinus Communis L) Dengan Metode Pnc Page-Icp Qms, Noor Fitri, 2007.
  10. Aplikasi Metode Sec-Icp Qms Pada Analisis Sepesi Seng Dalam Cairan Floem Tanaman Jarak (Ricinus Communis L), Noor Fitri, 2007.

11. Analysis Of Boron Species In Phloem Sap Of Castor Bean (Ricinus Communis L)

Using Page_Icp Ms, Noor Fitri, 2006.
12. Fractination Of Mg Species In Phloem Sap Of Castor Bean (Ricinus Communis L) Using Gpc_Icp Ms, Noor Fitri, 2006.
13. Analisis Spesies Boron Dalam Cairan Floem Tanaman Jarak (Ricinus Communis L.) Dengan Metode Pnc Page – Icp Ms, Noor Fitri, 2006.
14. Fraksinasi Magnesium Dalam Cairan Phloem Tanaman Jarak (Ricinus Communis L.) Dengan Menggunakan Metode Gpc-Icp Ms, Noor Fitri, 2006.
15. Calcium speciation in Phloem sap of Ricinus communis L. by size exclusion chromatography coupled off line to ICP-QMS, Noor Fitri, 2004.
16. Elemental fractionation of phloem sap from Castor bean on Sephadex G-50 SF column, Noor Fitri, 2004.

Drs. Allwar, M.Sc, Ph.D

Date Of Birth : Pekanbaru, 2 May 1962
Motto : Stupid Person is never Thankful
Email : allwar@uii.ac.id

Education:

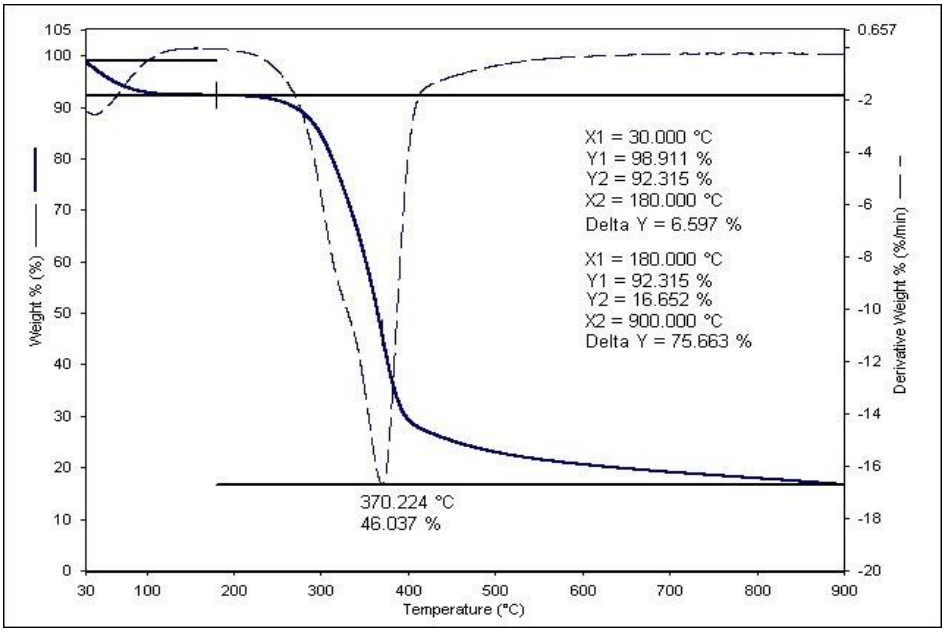
S1:(Drs) Univesitas Riau (UNRI) Pekanbaru, Indonesia
Field: Chemistry

S2:(M.Sc) Howard University (HU), Washington. D.C. USA
Field: Inorganic chemistry

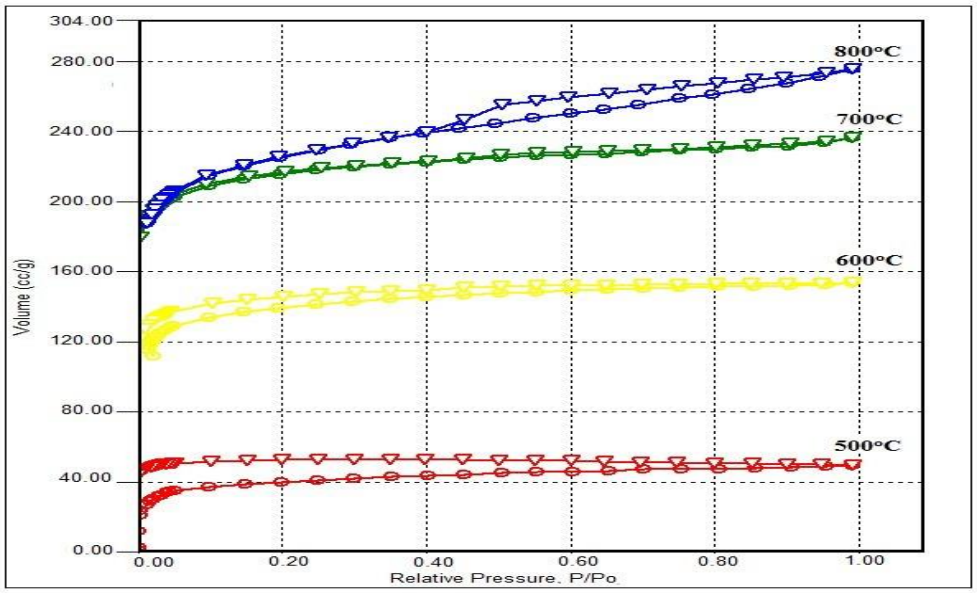
S3:(Ph.D) Universiti Sains Malaysia (USM),Malaysia
Field: Enviromental Chemistry & Material Sciences

Expertise**:**

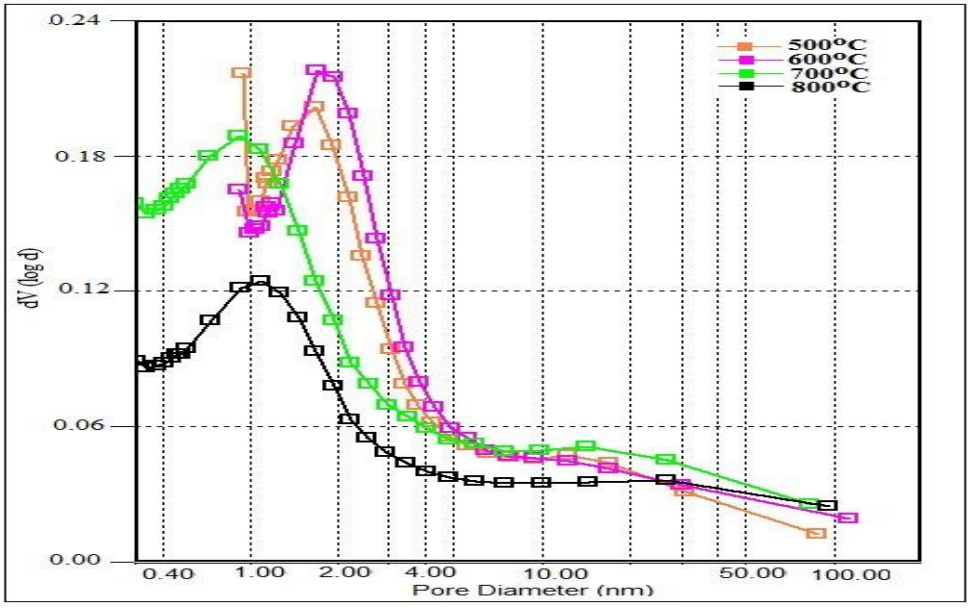
Synthesis and characterization of Nano composite metal oxide and activated carbon from biomass waste were used as adsorbent for multipurpose of separation and purification methods. Since the adsorbents have excellent properties, they have been used for removal of heavy metals and organic/inorganic pollutant. In the future, the research will be focused on the synthesize and improvement of many types of nano composite from waste of raw materials and metal oxide Characterization and application of nano composite will be carried out by FTIR, EXD, SAA, SEM-EDX, SAA, UV-Vis, Thermogravimetery, etc.



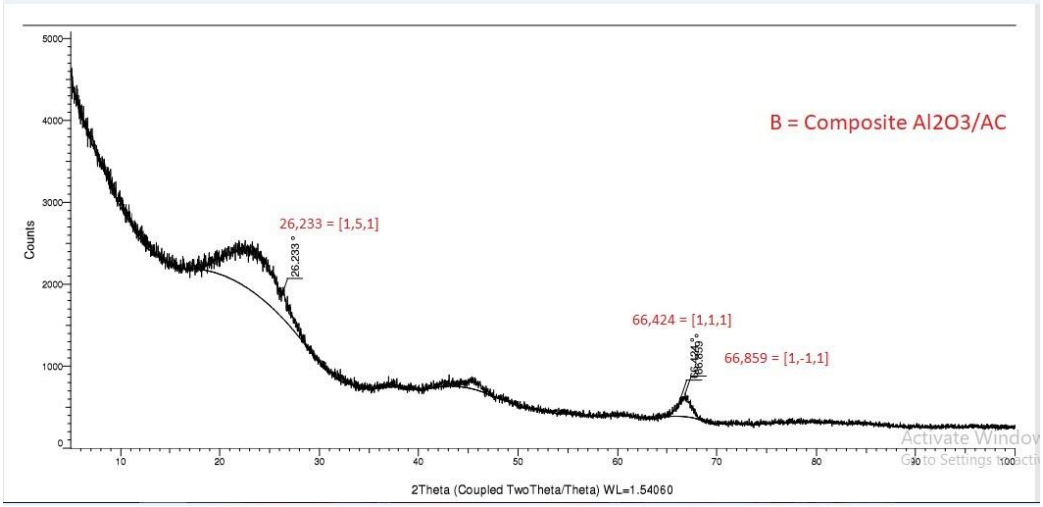
Characteristics of biomass empty fruit bunch using thermogravimetric analysis



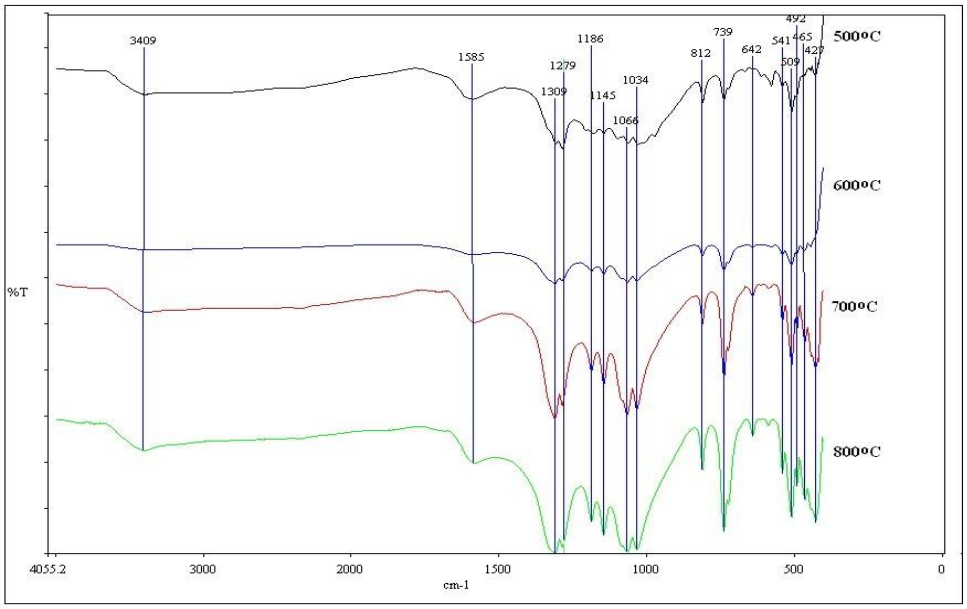
Nitrogen adsorption desorption isotherms at 77K of activated carbons prepared with 65% potassium hydroxide



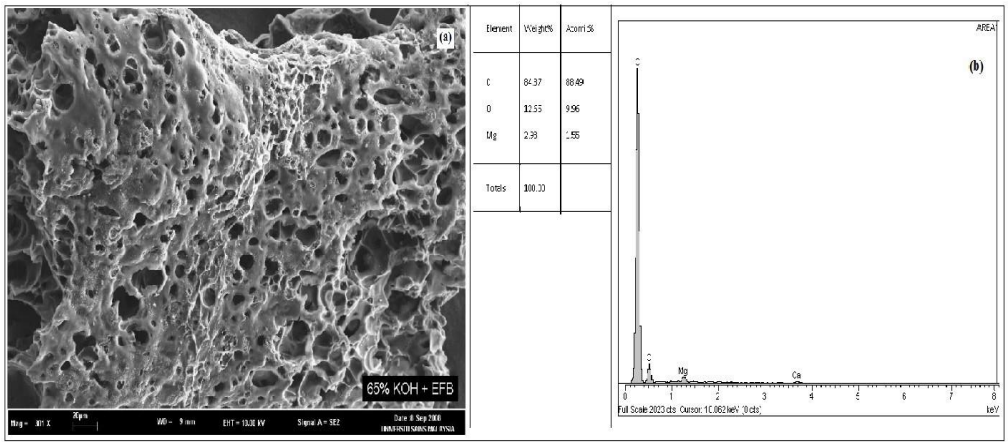
Pore size distribution for activated carbon prepared with 65 % phosphoric acid at different temperatures



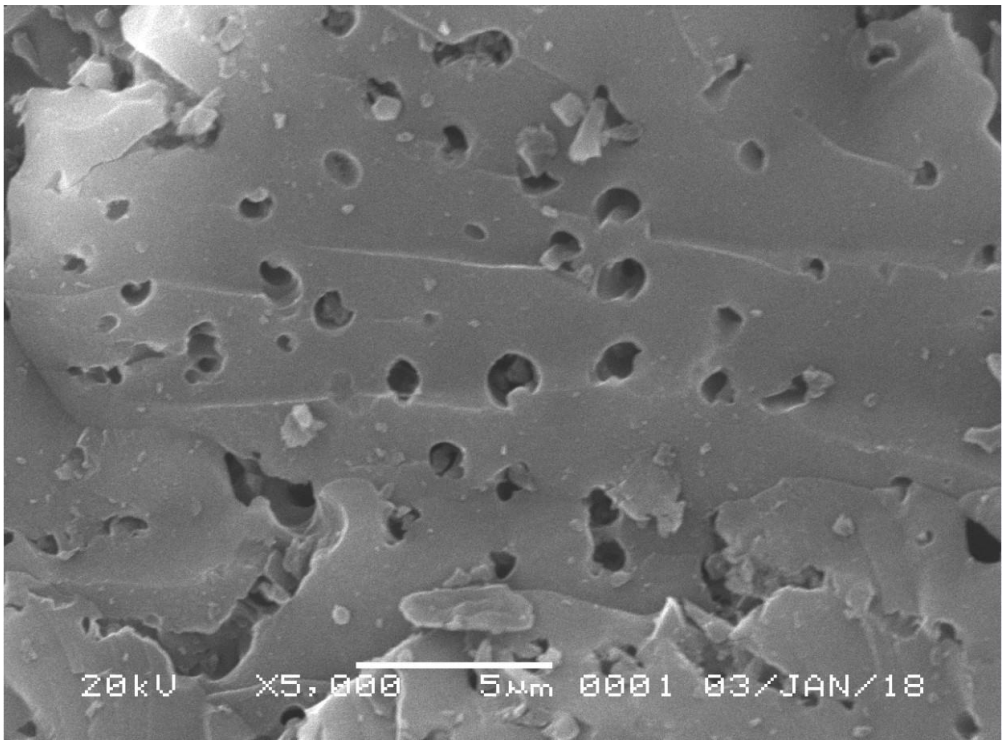
XRD Analysis of composite Al_2O_3/activated carbon



FT-IR spectra of activated carbon with phosphorous acid at different temperatures



Structural morphology of activated carbon from biomass empty fruit bunch prepared with 65% potassium hydroxide at 700ºC: (a) external structure, (b) chemical composition of the activated carbon by EDX



Activated carbon palm oils shell

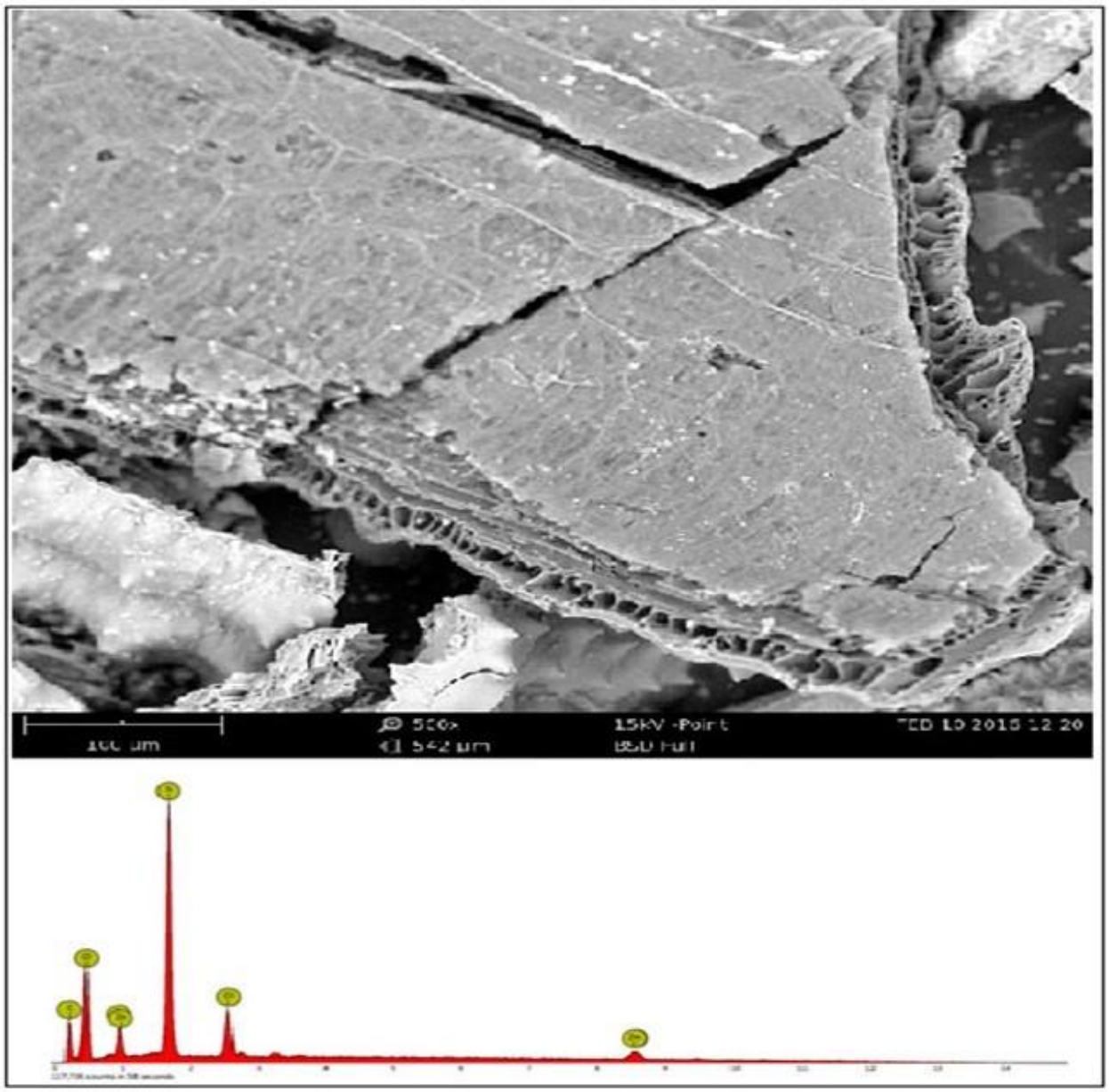


Figure 4: Surface morphology and elemental analysis of rice husk activated carbon

Publication**:**

1. Allwar, dkk, Characterization and application of activated carbon from oil palm shell prepared by physical activation and nitric acid for removal of phenol and 2chlorophenol, International Journal of Science and Research (IJSR) (2017), Volume 6, Issue 2
2. Allwar, dkk, Effect of nitric acid treatment on activated carbon derived from oil palm shell, (2017), AIP Conference Proceedings, 1823 (020129):

3. Allwar, Removal of 2-Chlorophenol using Rice Husk Activated Carbon Prepared by ZnCl2/H3PO4 Activation, Oriental Journal of Chemistry (2017), Volume 33. No 5
4. Allwar, dkk, Synthesis and characteristics of activated carbon from hydrothermal banana empty fruit bunch for adsorption Cu(II) and Cr (VI) in aqueous solution, Asian journal of Chemistry, (2018) Vol. 30
5. Allwar, Preparation and Characteristics of Activated Carbon from Oil Palm Shell for Removal of Iron and Copper from Patchouli Oil, International Journal of Applied Chemistry. ISSN 0973-1792 Volume 12, Number 3(2016) pp. 183-192
6. Allwar, Lily NurmalASari, KrisnaMerdekawati, DwiarsoRubiyanto, *Removal of Fe and Cu Ions from Patchouli Essential Oil Using ZnCl2-Activated Carbon Adsorbent Modified With Ammonia,* OSR Journal of Applied Chemistry (IOSR-JAC)e-ISSN: 2278-5736. Volume 8, Issue 2Ver. I. (Feb. 2015), PP 17-23
7. Allwar, Characteristics of Micro-and Mesoporous Structure and Surface Chemistry of Activated Carbons Produced by Oil Palm Shell, International Conference on Chemical, Ecology and EnvironmentalSciences (ICEES'2012) march 17-18, 2012 Bangkok
8. Allwar, *Characteristics of Pore Structures and Surface Chemistry of Activated Carbons by Physisorption, FtirAnd Boehm Methods.* IOSR Journal of Applied Chemistry 2012. **2**: p. 9-15.
9. Allwar, A., Ahmad M,N., MohdAsri M.N., Abdul K, Suryani, S., *Toward Production of the Micro- And Mesoporous Activated Carbon From Oil Palm Shell by Chemical Activation Process with ZnCl2, H3PO4 and KOH Under Nitrogen and Carbon Dioxide Condition*, in *CHEMECA*. 2009
10. Allwar, A., Ahmad M,N., MohdAsri M.N., Abdul K, Suryani, S. , *Toward Production of the Micro- And Mesoporous Activated Carbon From Oil Palm Shell by Chemical Activation Process with ZnCl2, H3PO4 and KOH Under Nitrogen and Carbon Dioxide Condition. in Proceeding CHEMECA. Burswood Entertainment Complex, Perth, Australia.* 2009.
11. Allwar, M.N., Ahmad, M. N., MohdAsri, *Textural Characteristics of Activated Carbons Prepared from Oil Palm Shells Activated with ZnCl2and Pyrolysis Under Nitrogen and Carbon Dioxide* Journal of Physical Science, 2008.

Rudy Syah Putra, Ph.D

Date of Birth : Aceh Timur, 3 August 1972
Motto : Tidaklah suatu yang sempurna melaikan berkurang sesudahnya

Education :

S1: Universitas Gadjah Mada / Field: Chemistry (1997)
S2: Universitas Gadjah Mada / Field: Analytical Chemistry(2002)
S3: Hokkaido University
Field: Environmental Science Development (2011)
Post-Doctoral: Hokkaido University
Field: Environmental Remediation Analysis (2011 – 2012)

Expertise**:**
Environmental Chemistry, Environmental Remediation Chemistry and Chemical instrumentation Analysis.

Completed and ongoing projects/research:

1. The preliminary study of silver-selective membrane electrodes based on liphophilic stearic acid: a comparison between coconut oil and dibenzyl ether (dbe) as a plasticizer, 2000. (member of team)
2. Synthesis of butane-1,4-diyl[bis(chloroethanoate)] and its utilization as ionophore on ammonium-selective membrane electrodes, 2002. (principle investigator)
3. Quality on undergraduate education program batch V, “The Application of Hybrid Problem-Based Learning to Increase Teaching-Learning Process”, The Ministry of National Education, April 2003 – November 2004. (member of team)
4. Study on remediation of aquatic environment from heavy metal pollutant by aquatic plants, March 2004 – December 2008. (principle investigator)
5. Development of lead (Pb) removal from contaminated soil using EAPR and EZ-EK system, April 2008 – June 2011. (principle investigator)
6. Development remediation method for Cs radionuclide contaminated soil using EAPR and EZ-EK system, July 2011 – present. (principle investigator)
7. Application of EAPR system and electrocoagulation process on the treatment of aquatic contaminated plume, April 2013 – present. (principle investigator)
8. Application of electrolysis on the production of biodiesel using acid or alkaline catalyst, April 2014 – present. (principle investigator)

Research Roadmap:

Environmental remediation research group – Development of methods for remediation of polluted soil and water with EAPR process, EZ/EK and electrocoagulation

The purpose of this research is to evaluate the combined EAPR (electro-assisted pytoremediation), EZ/EK (entrapping zone/electrokinetic) process, and electrocoagulation process for polluted soil and water remediation by heavy metal.

Figure 1 shows a schematic diagram of the research being developed in the soil and water remediation research group.

Phytoremediation is a technique of using plants to reduce and decrease the availability of contaminants in soil or water. Some of the advantages of this phytoremediation method such as the plants have the ability to reduce heavy metal concentrations. The heavy metals will accumulate in the roots and then translocate to the stems and leaves of the plant. However, the phytoremediation process also has several disadvantages, including short plant roots and slow biomass growth. In addition, the phytoremediation process of cleaning takes a relatively long time. Some of the weaknesses possessed by the phytoremediation process are then overcome through a combination of the phytoremediation process with electrochemistry which is then introduced by the term electro-assisted phytoremediation (EAPR). In the EAPR system, the electrodes used will function to mobilize metal ions through the electromigration process so that metal ions will be pushed and accumulated in the plant root area which is then followed by the absorption process by the plant roots. The advantage of the EAPR method is that it allows you to use plants with short roots so that it will overcome the shortcomings that exist in the phytoremediation process. **Figure 2** shows the application of the EAPR process for the remediation of Pb metal contaminated water.

Figure 1. Research schemes in the water and soil remediation research group

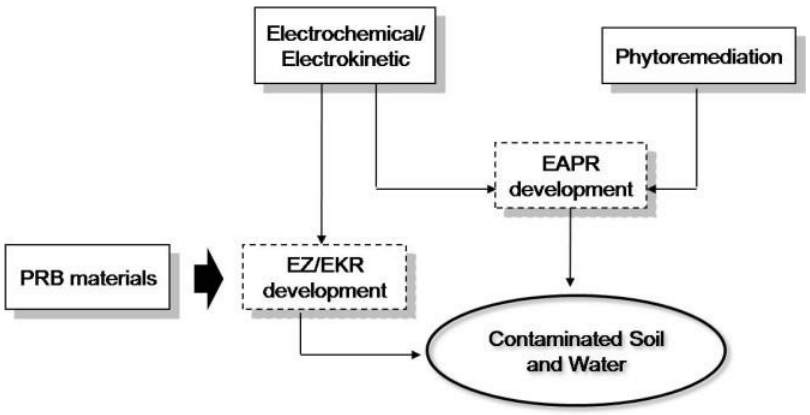


Figure. EAPR system reactor (A) and water sampling point in reactor (B) and pot-shaped cathode (C)

New and renewable energy research group - Application of electrolysis processes for the production of biodiesel with acid and alkaline catalysts

Fuel oil is the energy source with the largest consumption when compared to other energy sources so that currently the world is facing a fuel oil crisis. The limited energy that comes from petroleum has demanded Indonesia to look for other energy sources whose availability can be renewed. Biodiesel is seen as an alternative future fuel that can be used as a substitute for petroleum. The advantage of biodiesel as a substitute for diesel fuel is that it is environmentally friendly, *non-toxic, renewable, biodegradable* and the abundant raw materials come from vegetable oils and animal fats. Further research plans will be developed on making biodiesel with a combination of modified methods of electrolysis process and chitosan heterogeneous catalyst modified in the sol-gel phase (hydrogel, xerogel, cryogel and aerogel).

Another advantage of this method is that the water content contained in used cooking oil, which is usually problematic to the quality of biodiesel, will be utilized in the electrolysis process to produce biodiesel with low water content (< 1%) with high conversion results (≥ 97%). Previous research has shown the successful use of a combined electrolysis process with chitosan as a heterogeneous base catalyst in the biodiesel production process from used cooking oil with a low conversion yield of 59.1% (Putra dkk. (2014)) as shown in **Figure 3**. Improvement in this research was carried out by modifying the chitosan catalyst in the form of a gel phase. The catalyst will be distributed to the surface of the graphite electrode, so it is expected that the graphite electrode alloy and chitosan gel will be able to increase the alkaline atmosphere to

transesterification process of used cooking oil into biodiesel. The combination of the two methods will then be used for

developed a proto-type biodiesel production using chitosan gel coated electrodes in the electrolysis process as shown in **Figure 4**.

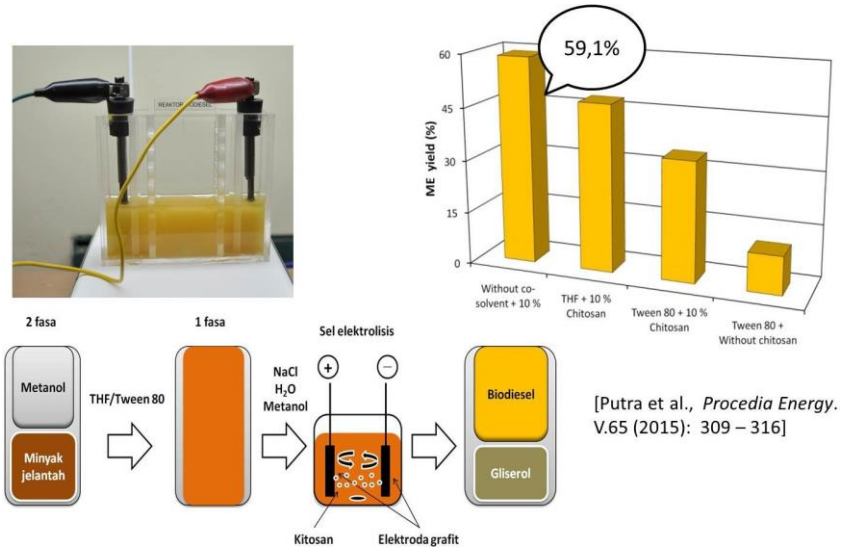


Figure 3. Biodiesel production by electrolysis and chitosan catalyst

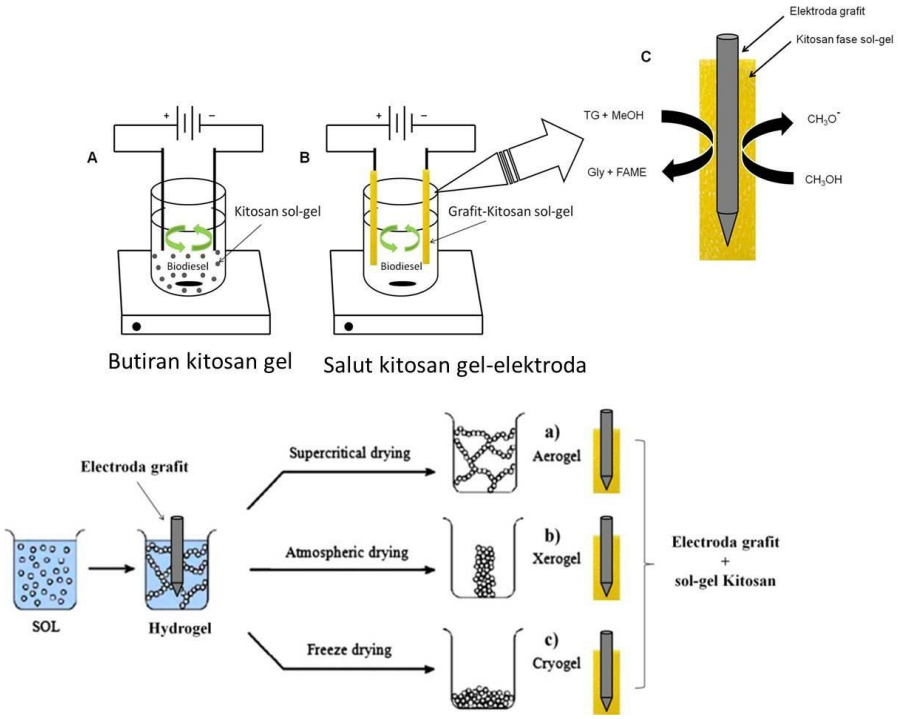


Figure 2. The biodiesel production scheme by electrolysis uses a graphite electrode covered in chitosan gel

Excellent work:

Scientific work

1. **Putra**, R.S., Antono, Y., 2017, Carbon@Chitosan composite as catalyst on the synthesis of FAME from soybean oil with electro-catalytic, IOP Conf. Series: Journal of Physics: Conf. Series 877 (2017) 012063.
2. **Putra**, R.S., Liyanita, A., Arifah, N., Puspitasari, E., Sawaludin, Hizam, MN., 2017, Enhanced electro-catalytic process on the synthesis of FAME using CaO from eggshell, Energy Procedia 105 (2017) 289 – 296.
3. **Putra**, R.S., Trahadinata,G.A., Latif, A., Solehudin, M., 2017, Wastewater treatment of chemical laboratory using electro assisted-phytoremediation (EAPR), AIP Conf. Proc. 1823, 020077-1–020077-5.
4. **Putra**, R.S., Pratama, K., Antono, Y., Idris, M., Rua, J., and Ramadhani, H., 2017, Enhanced electrolytic biodiesel production with chitosan gel (hydrogel and xerogei), Procedia Engineering, 148, 609 – 614.
5. **Putra**, R.S., Cahyana, F., Novarita, D., 2015, Removal of lead and copper from contaminated water using EAPR system and uptake by water lettuce (*Pistia Stratiotes* L.), Procedia Chemistry, 14, 381-386.
6. **Putra**, R.S., Hartono, P., and Julianto, T.S., 2015, Conversion of methyl ester from used cooking oil: the combined use of electrolysis process and chitosan, Energy Procedia, 65, 309-316.
7. **Putra**, R.S., Julianto, T.S., Hartono, P., Puspitasari, R.D. and Kurniawan, A., 2014, Pre-treatment of used-cooking oil as feedstocks of biodiesel production by using activated carbon and clay minerals, Int. Journal of Renewable Energy Development, 3(1), 33-35.
8. **Putra**, R.S., Ohkawa, Y., and Tanaka, S., 2013, Application of EAPR system on the removal lead from sandy soil and uptake by Kentucky bluegrass (*Poa pratensis* L.), Separation and Purification Technology,102,34–42
9. Yasuhisa Ohkawa, Syah **Putra** Rudy, Naoya Fujiwara, Kazuo Jin, Shunitz Tanaka, 2012, Presumption of the source of lead contaminated soil by isotope analysis with sequential extraction, BUNSEKI KAGAKU, 61 (2), 95-101. (in Japanese)
10. **Putra**, R.S., and Tanaka, S., 2011, Aluminum drinking water treatment residuals (Al-WTRs) as an entrapping zone for lead in soil by electrokinetic remediation, Separation and Purification Technology, 79, 208-215.
11. **Syahputra,** R., 2005, Phytoremediation of Heavy Metal Cd and Pb by Water Lottuce (*Pistia statiotes*), LOGIKA, 2(2), 57-67.
12. **Syahputra**,R., Siswanta, D., and Kuncaka, A., 2003, Synthesis of Butane-1,4-Diyl[Bis(Chloroethanoate)] and Its Utilization as Ionophore on Ammonium-Selective Membrane Electrodes, TEKNOSAINS, Seri A, 16 (3), 343-355.
13. **Syahputra,** R., 2002, Simulation of Separation Factor in Counter Current Extraction : A Spreadsheet Approach, EKSAKTA, v.4., 2. 57-61.

14. **Syahputra**.,R.., Hasri, Imelda, F., Siswanta, D., 2000, The Preliminary Study of Silver-Selective Membrane Electrodes Based on Lipophilic Stearic Acid : A Comparison Between Coconut Oil and Dibenzyl Ether (DBE) as A Plasticizer, EKSAKTA, v. 1., 2, 56-63.

Appreciation:

1. Beasiswa Pascasarjana (BPPS), 1999 – 2002, Program Magister Kimia, Ditjen Dikti, Kementrian Pendidikan dan Kebudayaan.
2. Beasiswa Pascasarjana, 2008 – 2011, Program Doktoral, Ditjen Dikti, Kementrian Pendidikan Nasional.
3. Visiting researcher, Graduate School of Environmental Science, Hokkaido University, Japan, 5-11 November 2006 (sponsored by JSPS, MEXT Japan)
4. Visiting researcher, Graduate School of Environmental Science, Hokkaido University, January – June 2008 (sponsored by BKLN, Kementrian Pendidikan Nasional).
5. Visiting researcher, Graduate School of Environmental Science, Hokkaido University, September – October 2013 (sponsored by SAME Program 2013, Direktorat Pendidik dan Tenaga Kependidikan, Ditjen Dikti, Kementrian Pendidikan Nasional).
6. Graduate Assistant, Division of Environmental Science Development, Hokkaido University Presidential Scholarship for distinguish student, April – October 2008 (sponsored by Global Centre of Excellent (GCOE), MEXT, Japan).
7. Travel Grant, The 12th Seoul National University - Hokkaido University Joint Symposium on Environmental Science, Seoul, Korea, 19 – 24 November 2009 (sponsored by GCOE, MEXT, Japan)
8. Travel Grant, The 9th International Symposium on Electrokinetic Remediation (EREM) 2010, Kaohsiung, Taiwan, 27-30 June 2010 (sponsored by GCOE, MEXT, Japan)
9. Travel Grant, 2nd International Conference of Natural Sciences (ICONS 2014), Machung Univ., Malang, 25 -28 September 2014 (sponsored by Alexander van Humboldt Foundation)
10. Pioneer Spirit Award (economy, industry and energy field) for the best poster in Sustainability Weeks 2010, November 2nd 2010, Hokkaido University, Sapporo, Japan.
11. Secretary General, The 11th International Symposium on Electrokinetic Remediation (EREM) 2012, 8 – 11 July 2012, Sapporo, Japan.
12. Secretary General, The 2nd International Conference of the Indonesian Chemical Society (ICICS) 2013, 22 – 23 October 2013, Yogyakarta, Indonesia
13. The Best 10th Poster in Humboldt Kolleg – International Conference on Natural Sciences, HK-ICONS 2014, 25 – 28 September 2015, Ma-Chung University, Malang, Indonesia
14. Environmental Protection and Green Technology (EPGT) Program 2014 in National Tsing Hua University, 9 – 14 November 2015, Tsinchu, Taiwan.
15. LPDP Reward for International Publication (PPII Batch I), 2 papers, Ministry of Research and Technology and Higher Education, The Republic of Indonesia, August 2016.

Dr. Dwiarso Rubiyanto, S.Si., M.Si.

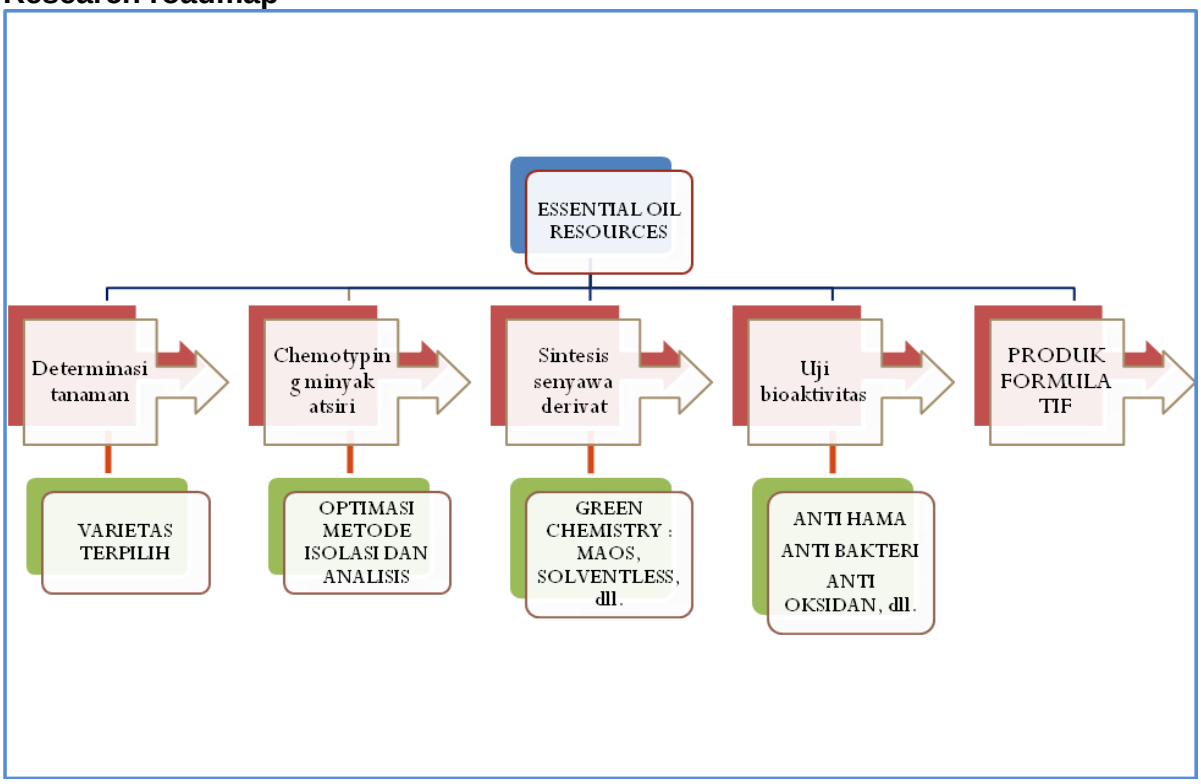
Date of Birth : Bantul, 15 May 1974
Motto : Semua amal bergantung pada niatnya dan hanya harapkan balasan amal hanya dari Alloh SWT semata

Education :
S1: Universitas Gadjah Mada / Field: Organic chemistry
Topic : food flavor (Arabica and Robusta coffee bean species)
S2: Universitas Gadjah Mada / Field : Organic chemistry,
Topic : essential oil of citronella (synthesis of Cymbopogon winterianus derivatives)
S3: Universitas Gadjah Mada / Field: Organic chemistry,
Topic : essential oil of basils (chemotyping, analysis, synthesis and utility of Ocimum basilicum species)

Main Activity and Expertise :

1. The main field of work is the chemistry of natural ingredients from Indonesia, particularly essential oils, which includes exploration of new sources and their uses. Research that focuses on the isolation, analysis and conversion of essential oil components into more valuable products. Such as fragrant lemongrass oil, basil oil, jasmine oil, cananga oil, tuberose flower oil, lime oil, basil oil, oil from spices.
2. Consultant for essential oil production and analysis. The processing of essential oils into natural biopesticides, micro / nano encapsulation of essential oils for raw materials for the perfume industry, and refining of crude essential oils into refining products that have sale value are some of the most recent research activities undertaken.

Research roadmap



Excellent work:

Grants:

a. Young Lecturer Research Grant (internal, DPPM), 2006, Isolation and Analysis of Main Components of Citronella Oil (*Cymbopogon winterianus Jowitt*).
b. Research Excellence Scholarships Depdiknas, 2007, Isolation and analysis of pineapple aroma using the C-VAT method (Cold Vapor Aroma Trapping).
c. Grants compete, as team members, DIKTI, 2008, Conversion of Citronellal in Citronella Oil to Isopulegol using ZrO_2-montmorillonite Catalyst.
d. Basic Research Grants (internal, DPPM), 2009, Isolation and Analysis of Basil Essential Oil (*Ocimum citriodorum*) and testing its Bioactivity against Grasshoppers.
e. Grants compete as team leader, DIKTI, 2011, Biocontrol and biopesticides of Vegetable and Fruit Plants from the Essential Oil of Basil, Purple and Green Basil.
f. Basic Research Grants (internal, DPPM), 2011, The main compounds contained in purple basil oil (*Ocimum canum, Sims*) and testing of bioactivity.
g. Grants competition as team leader, DIKTI, 2012, Biocontrol and biopesticides of Vegetable and Fruit Plants from the Essential Oil of Basil, Purple and Green Basil,

subtitles: Utilization of Essential Oil Derivative Compounds of Purple Sweet Basil (*Ocimum Canum, Sims*) as Antibacterial Materials

h. Featured Research Grants (internal, DPPM), 2012, MAOS (Microwave Assisted Organic Synthesis) Based Synthesis on Methyl Kavikol in Green Basil Essential Oil (*Ocimum violaceum*) and Testing its Antibacterial Activity against *Staphyllococus aureus* and *Escherichia coli* Bacteria
i. Basic Research Grants (internal, DPPM), 2014, Isolation of Citral Compounds in Basil Essential Oil (*Ocimum citriodorum, L*.) by Bisulfite Extraction Method and Atmospheric Steam Distillation Method
j. Featured Research of Sleman Regency (RUD), 2014, The Use of Fruitfly Trapper with Purple Basil Essential Oil (*Ocimum Canum, Sims*) to Overcome Fruit Fly Pests.
k. Community Service Grant DIKTI 2015-2016, Science and Technology for Campus Innovation and Creativity Production and Essential Oil Consultant Services of CEOS FMIPA UII.

Journals

1. Journal (author member): Tandem Siklisasi-hidrogenasi Sitronelal Berkatalis ZrO2-montmorillonit dengan Variasi Metode Reaksi Vol. 18, no. 2, Oktober 2013, ISSN : 1412-3991 Jurnal SAINTEK.
2. Journal (first author) : Antibacterial Activities of Green Basil (Ocimum Violaceum) Essential Oil and Derivatives By MAOS (Microwave Assisted Organic Synthesis) Against Staphyllococus Aureus and Escherichia Coli Vol.14. No.1, Februari 2014, ISSN : 1411-1047 Jurnal EKSAKTA.
3. Journal (author member) : Effect of Sulfation on Zirconia-Pillared Montmorillonite to the Catalytic Activity in Microwave-Assisted Citronellal Conversion Volume 2014, Article ID 950190, http://dx.doi.org/10.1155/2014/950190 Hindawi Publishing Corporation/ International Journal of Chemical Engineering (IJCE Journal).
4. Journal (author member) : Konversi Sitral dalam Minyak Kemangi dengan Metode MAOS, Vol. 1, No. 1 ISSN : 2354-9610 KIMIA UII/Indonesian Journal of Chemical Research (IJCR Journal).
5. Journal (single author) : Penggunaan Fruitfly Trapper Berumpan Minyak Atsiri Selasih Ungu untuk Mengatasi Hama Lalat Buah Vol. II, No. 1 ISSN : 2406-7520 Jurnal Hasil Penelitian di Kabupaten Sleman.
6. Journal (author member) : Removal of Fe and Cu Ions from Patchoulli Essential Oil using ZnCl2-Activated Carbon Adsorbent Modified with Ammonia, Vol. 8, Issue 2, e-ISSN: 2278-5736 http://dx.doi.org/ 10.9790/5736-08211723 International Organization of Scientific Research (IOSR)/ IOSR Journal of Applied Chemistry (IOSR-JAC).
7. Journal (author member) : Preparation And Characterization Of Ni/Zr-Saponite As Catalyst In Catalytic Hydrogen Transfer Reaction Of Isopulegol, Vol 827, pp 311-316 Trans Tech Publications /Materials Science Forum.

8. Journal (first author) : Complete Chemo Type of Three Species of Basils (*Ocimum basilicum*) Grown in Indonesia, DOI : http://dx.doi.org/10.1080/0972060X.2014.960274, Journal of Essential Oil Bearing Plants, http://www.tandfonline.com/toc/teop20/current, Informa UK Limited.

Appreciation :

Piagam Penghargaan dari Bupati Sleman sebagai Nominator Peneliti RUD Krenova 2014.

Books:

1. Book "Teknik Dasar Kromatografi", 2012, ISBN 602280152-8, Publisher Deepublish, Yogyakarta.
2. Book "Metode Kromatografi : Prinsip Dasar, Praktikum & Pendekatan Pembelajaran Kromatografi", 2017, ISBN 978-602-401-780-4, Publisher Deepublish, Yogyakarta.

Patent :

1. Inventor : Dwiarso Rubiyanto, M.Si., patent title : Basil Oil Formulation (*Ocimum citriodorum sp*.) and its use, patent number: P 00201100634**.**
2. Inventor : Dr. Noor Fitri, M.Si. and Dwiarso Rubiyanto, M.Si., patent title: Edible Coating Formulation of Chitosan-Basil Oil to Extend the Shelf Life of Strawberries (*Fragaria vesca, Linn*.), patent number: P 00201100635.
3. Inventor : Dwiarso Rubiyanto, M.Si., patent title: Method of Determination of Complete Chemical Type (Complete Chemotype) Essential Oil of Basil *(Ocimum Citriodorum Sp.*), patent number: EP22201300004

Copyright :

No.	Copyright holders	Type and title of work	No and Copyright date
1.	Dwiarso Rubiyanto	Book / Teknik Dasar Kromatografi	C22201701342, 07 April 2017
2.	Dwiarso Rubiyanto	Book / Metode Kromatografi : Prinsip Dasar, Praktikum & Pendekatan Pembelajaran Kromatografi	EC00201806142, 13 March 2018

Structural Position Experience

1. Chairman of the Chemistry Study Program : 2018-Now
2. Chairperson of the UII Center for Essential Oil Studies : 2013-Now
3. Head of the Essential Oil Laboratory 2014

4. Secretary of the Chemistry Study Program : 2008-2011
5. Chairperson of the UII Center for Essential Oil Studies : 2007-2009
6. Coordinator of the Head of the Chemistry Laboratory of FMIPA UII : 2006-2010
7. Secretary for Diploma 3 in Analytical Chemistry, FMIPA UII : 2003-2006
8. Head of the Laboratory of Basic Chemistry, FMIPA UII : 2001-2005
9.

Experience as Executor of Competitive Grants for Chemistry Study Program Development

1. Semi Qualitative Under Graduate (Semi QUE - Project) V DIKTI : 2003 – 2005
2. Institutional Competition Grant Program (PHKI) DIKTI : 2008 – 2010
3. Study Program Competition Grant Program (PHK-PS) Internal UII : 2011 – 2012
4. Study Program Competition Grant Program - Study Program Development (PHKPS-PP) Internal UII: 2012 – 2013
5. Study Program Competition Grant Program - Excellent Study Program (PHKPS-UP) Internal UII: 2013– 2014
6. Study Program Competition Grant Program - Internationalization of Study Programs (PHKPS-IP) Internal UII Batch 1 : 2014 – 2015
7. Study Program Competition Grant Program - Internationalization of Study Programs (PHKPS-IP) Internal UII Batch 2 : 2015 – 2016
8. Study Program Priority Grants (PHK-Prioritas) for Curriculum Development 2017: 2017
9. Grant Program for Implementation of Foreign Cooperation with Prince of Songkhla University (PSU), Thailland : 2017
10. Study Program Priority Grants (PHK-Prioritas) for Curriculum Sharpening and Lecturer Capacity Building in the Framework of Improving the Quality of Graduates : 2018

Dr. Tatang Shabur Julianto, S.Si., M.Si.

Tanggal Lahir : 17 Juli 1976
Motto : It is nice to be important but it more important to be nice
Email : tatang_shabur@uii.ac.id
Pendidikan:
S1: Universitas Diponegoro, Semarang (S.Si.)
Field: Natural Material Chemistry/ Biochemistry
S2: Universitas Gadjah Mada Yogyakarta (M.Si.)
Field: Synthetic Organic Chemistry
S3: Universitas Gadjah Mada, Yogyakarta (Dr.)
Field: Synthetic Organic Chemistry

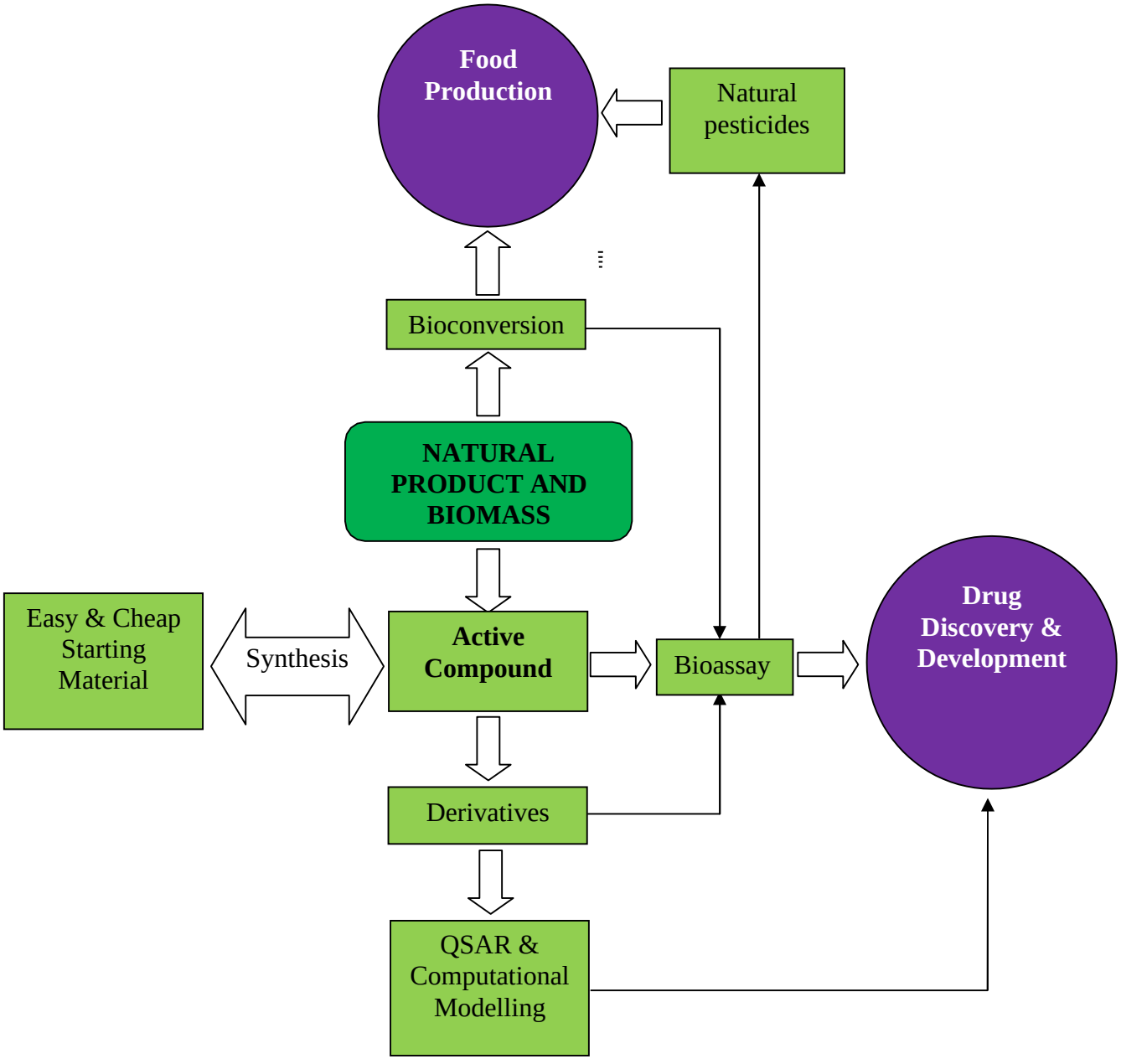
Expertise :

- Development of Medicinal Plant Natural Materials and Organic Synthesis
- Food Modification and Diversification
- Development of Natural Pesticides

Indonesia is a country rich in plant species, which is estimated to reach around 25,000 species or more than 10% of the world's flora species. Coupled with the number of types of moss and gangang which amount to ± 35,000 species, of which 40% are endemic species or only found in Indonesia. With the high natural wealth possessed by Indonesia, seen from the diversity of existing plants, it is possible to find various types of chemical compounds, although some of these chemical compounds have been found but based on the history of discovery and development it has proven that the opportunity for new discoveries to occur is very large. Based on this, as a country that is a mega-biodiversity country, chemical research on natural ingredients has become the spearhead of research by Indonesian chemists.

Secondary metabolites compounds in natural materials, although they are not very important for the existence of an individual, but often plays a role in the survival of one species in the struggle against other species. For example in plants, secondary metabolite compounds are commonly used as weapons against pests and diseases. Whereas in animals, secondary metabolites such as pheromones are used as sex attractants. So far it is known that plants produce more secondary metabolites than animals. These metabolites can be isolated and modified either through organic synthesis or bioconversion using the help of microorganisms. The results of chemical structure identification and modification can be developed in an effort to find new drugs and types of food variants with higher nutritional value.

Roadmap

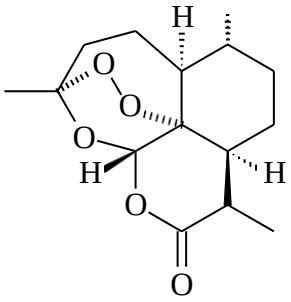


Research Targets

Research for the next 3 years will be focused on the development of anti-malarial drugs through both total organic synthesis and isolation of natural materials.

Currently, researchers are developing a new synthesis method for the antimalarial compound Artemisinin using 3-carene (one of the main compounds in turpentine oil) with short stages. Artemisinin is a compound the antimalarials currently

recommended by World Health Organisation (WHO). Currently this important compound is isolated from the Artemisia annua plant which only grows in sub-tropical areas such as China, the United States, Vietnam and etc. The isolation and extraction methods are quite expensive, besides the yield obtained is very little. This causes the price of artemisinin to be expensive. Ironically, this plant is difficult to grow in Indonesia which incidentally is one of the malaria endemic countries in the world. Therefore, Indonesia must import these compounds. The short synthesis pathway provides advantages and opportunities for industry to be able to mass produce Artemisinin.



The structure of the antimalarial compound Artemisinin

Apart from artemisinin, researchers are also conducting isolation of the anti-malarial compounds contained in the Kayu Songga (Snake Wood) plant. This plant is believed by traditional people to cure malaria. This plant comes from the provinces of West Nusa Tenggara, East Nusa Tenggara and Papua.

Songga Wood Extract as Antimalarial

Scientific Publications:

Tatang Shabur Julianto, Restu Ayu Mumpuni, 2016, Chitosan and N-Alkyl Chitosan as Base Heterogeneous Catalyst in Transesterification of Used Cookong Oil, IOP, 10th Joint Conference on Chemistry, Surakarta

Tatang Shabur Julianto, Jumina, Mustofa, Hardjono S., Maryanti, 2015, Free Solvent Isomeization 3-carene to 2-carene in Isolimonene Production as Starting Material of Antimalaria Artemisinin, RSCE 2015, 24-25 September 2015, Bangkok

Tatang Shabur Julianto, Nurul Atikah, 2014, Penerapan Reverse Rotating Reactor Untuk Produksi Biodiesel Minyak Jelantah Menggunakan Katalis Heterogen Kitosan, EKSAKTA, Jurnal Ilmiah MIPA, 13 (1)

Rudy Syah Putra, Tatang Shabur Julianto, Puji Hartono, 2014, Pre-treatment of Used-Cooking Oil as Feed Stocks of Biodiesel Production by Using Activated Carbon and Clay Minerals, International Journal of Renewable Energy Development (IJRED), 3 (1)

Book:

Tatang S Julianto, 2016, Minyak Atsiri Bunga Indonesia, ISBN 978-602-280-154-2 Publisher Deepublish, Yogyakarta

Tatang S Julianto, 2013, Biokimia: Biomolekul dalam perspektif Al-Quran, ISBN 978-602-280-154-2 Publisher Deepublish, Yogyakarta

Patent:

Tatang Shabur Julianto, 2016, Metode Penurunan Kandungan Asam Lemak Bebas Dalam Minyak Jelantah Sebagai Bahan Baku Pembuatan Biodiesel, Patent Pending

CHAPTER I
INTRODUCTION

A. Brief History of UII

Study at the Universitas Islam Indonesia (UII) is a process of instilling values, morals, and learning science to students so that they can contribute to improving the quality of the environment in the future, as well as being a person capable of carrying out the mission of rahmatan lil 'alamin. Guided by this futuristic vision and supported by a long history of pioneering, as well as a desire to carry out a treatise of perfection, UII strives to lead to excellence in Indonesian education.

With the name of the Islamic High School (STI), UII was originally founded by several national figures such as Dr. Muhammad Hatta, KH. Abdulkahar Muzakkir, Moh. Roem, KH. A. Wahid Hasyim and M. Natsir and other figures in Jakarta on July 8, 1945. STI became the first national higher education institution in Indonesia which later changed its status to become a university and was named the Universitas Islam Indonesia on December 14, 1947 and on June 5, 1948 to become the Universitas Islam Indonesia, in response to the desire and need to integrate knowledge and spiritual education.

UII is one of the leading private universities in Indonesia. Inspired by the spirit of nationalism and guided by perennial values, UII was founded about one month before the proclamation of Indonesian independence in 1945. Currently, UII has grown to become the chosen learning place. Located north of Yogyakarta, the heart of Javanese culture, UII's main campus overlooks the stunning beauty of Merapi Mount, which makes UII the perfect place to study.

Learning means digging for the treasure that is within oneself. With a growing selection of Doctoral, Masters, Professional, Bachelor and Diploma programs covering a wide spectrum of knowledge, UII enables its students to discover their own treasures and achieve a bright future.

B. MEANING OF THE SYMBOL UII

The meaning of the UII symbol is based on 2009 statute:

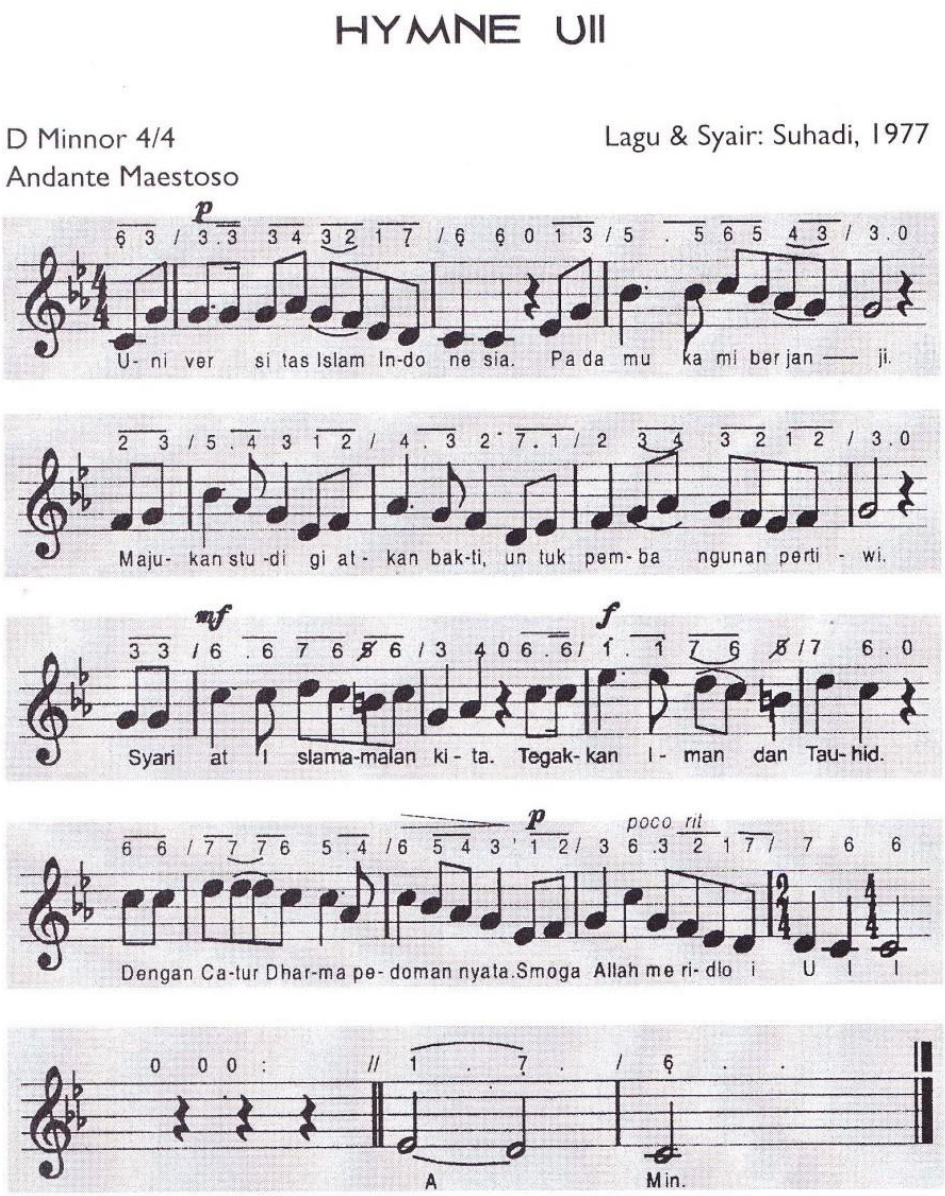
The UII emblem consists of 3 colors, namely:

- **Blue Color** means firmness, or authority. It means authority, UII in producing wise Islamic scholars.
- **Yellow Color** gold decoration means hope. Besides that, as a symbol of education. That is, UII will produce scholars of the hope of the nation who will be able to carry on and continue to spread knowledge through Islamic education.
- **White Color** means sincere, honest and diligent. It means that the scholars who have been produced by UII are scholars who are honest, loyal to their country and nation as well as diligent and devoted to Allah SWT, in accordance with the teachings and ideals of Islam.

The meaning of the symbol of the Universitas Islam Indonesia, namely:

- The shield form means resilience and defense.
  That is, UII will maintain its name as one of the universities capable of producing scholars in accordance with UII goals.
- The shape in the middle is distilled into a mosque dome
  The point is a symbol of Indonesian culture in accordance with Islamic teachings.
- Flowers that have five crowns can be interpreted as Pancasila, which can also be interpreted as the pillars of Islam.
- The pistil above forms a trident.
  That is, the symbol of a college with three basic objectives (Tri Dharma of University).
- The pen-shaped trident means education.
- On the middle leaf petals are the stylings of the book, which means the Holy Qur'an.
- On the lower petals there are two supports.
  The point is two sentences creed. So, the symbol in the middle as a whole means the purpose of UII which is based on Islamic teachings and is based on Pancasila. Meanwhile, the shape of the ship's pyramid as the door of the mosque under the lid is intended as the color of Islamic culture.

C. HYMNE UII


HYMNE UII
D Minnor 4/4
Andante Maestoso
Lagu & Syair: Suhadi, 1977
p
U- ni ver si tas Islam In-do ne sia. Pa da mu ka mi ber jan — ji.
Maju- kan stu -di gi at - kan bak-ti, un tuk pem- ba ngunan perti - wi.
mf
f
Syari at I slama-malan ki - ta. Tegak- kan I - man dan Tau- hid.
p
poco rit
Dengan Ca-tur Dhar-ma pe- doman nyata.Smoga Allah me ri- dlo i U I I
A
Min.

CHAPTER II
STUDY PROGRAM FROM MASTER OF CHEMISTRY FMIPA UII

D. A BRIEF HISTORY OF THE STUDY PROGRAM

Master of Chemistry Study Program (PSMK) Faculty of Mathematics and Natural Science Universitas Islam Indonesia (FMIPA-UII) is a new study program that was founded in 2018. Chemistry Master Study Program becomes the 4th study program under the Chemistry Department of FMIPA, apart from S1-Chemistry Study Program, S1-Chemistry Education, and D3-Chemical Analysis based on the Director General Decree DIKTI No.1142/KPT/1/2018.

The establishment of the Master of Chemistry Study Program at FMIPA UII was motivated by the high market demand for chemistry graduates with master competency, such as as researchers in private and government research institutes, consultants / experts in various fields of chemistry, lecturers / teachers, and research-based entrepreneurs (techno / sciencepreneur). In addition, with the establishment of the Chemistry Master Program, Faculty of Mathematics and Natural Sciences, UII will improve the quality of research results and outputs from the Department of Chemistry, FMIPA UII in particular, and UII in general.

Education in the Master of Chemistry Study Program at FMIPA UII is designed to prepare chemistry master graduates who have perfect faith and devotion so that it can become the basis for the development of science and research to face the challenges of change. Global changes in the industrial era 4.0 will create many challenges that are closely related to the fields of industry, health, energy and the environment. Therefore, graduates of the UII Chemistry Master Program are designed to be able to make a major contribution to this global change for the good of the universe.

E. VISION, MISSION, GOALS AND OBJECTIVES

PSMK has a draft vision, mission, goals and objectives (VMTS) the program which is translated into several program implementation tools consists of a curriculum design, design of lecture development patterns and final assignments, development of lecturers and educational staff, development patterns of research activities for lecturers, students and educators, community service, and Da'wah Islamiyah.

In accordance with the VMTS design, the draft PSMK vision is formulated in the framework of opening the program and becomes the motivation for the study program to be able to face competition and challenges in scientific development, higher education, as well as the needs of the world of work in the future. The draft vision so far has been compiled based on input from the faculty board at the departmental level, the direction and goals of developing the Master of Chemistry Study Program, various stakeholders consisting of alumni, graduate users (stakeholders), and professional organizations (Indonesian Chemists Association / HKI).

The PSMK's draft vision is:

"In 2030 the Master of Chemistry Study Program of FMIPA UII will become the Best Chemistry Master Study Program in Indonesia, in the field of developing essential oils, materials

and electrochemistry for energy, isolation and synthesis of non-essential ingredients for health and as rahmatan lil alamin". The PSMK mission is as follows:

1. Making the Master of Chemistry Study Program superior in organizing world-class higher education management in the field of Master of Chemistry by upholding the divine revelation and sunnah of the Prophet as the source of eternal truth that brings grace to the universe.
2. Making the Master of Chemistry Study Program superior in conducting research as science and technology development, producing works that are recognized nationally and internationally and are beneficial to people's lives.
3. Making the Master of Chemistry Study Program superior in organizing community service in a professional manner to actualize research results so as to establish a close relationship with the community and an increase in community welfare.
4. Making the Master of Chemistry Study Program superior in conducting collaborations to build networks in education, research, community service and Islamic da'wah activities.

The Goals of the UII Chemistry Master Program are:

1. Accelerate the achievement of UII's vision and mission by providing quality and high quality education according to national education standards by building a superior and high quality study program management system.
2. Producing quality study program services and oriented to customer satisfaction (customer satisfaction) to all stakeholders.
3. Produce graduates who have high competence in the field of chemical research to respond to market needs
4. To produce research products in the form of outputs with international reputation including scientific works, books, patents and technology products that can be applied in the field of chemistry, so that they are able to compete at the national and international levels.
5. To produce community service activities based on professional research results in order to participate in solving national and international problems, especially in the field of Master of Chemistry in particular and the problems of the nation in general.
6. Producing mutually beneficial cooperation activities through partnerships and networks at the national and international levels to build an education system for managing study programs, research and community service as well as international standard Islamic da'wah. Producing mutually beneficial cooperation activities through partnerships and networks at the national and international levels to build an education system for managing study programs, research and community service as well as international standard da'wah Islamiyah.
7. Produce international quality Islamic da'wah activities to accelerate the realization of rahmatan lil'alamin.

E. THE DEVELOPMENT PLAN OF MASTER OF CHEMISTRY

Scheme of the development direction of the Master of Chemistry Program in UII which is in line with changing global issues as in **Figure 2.1.**

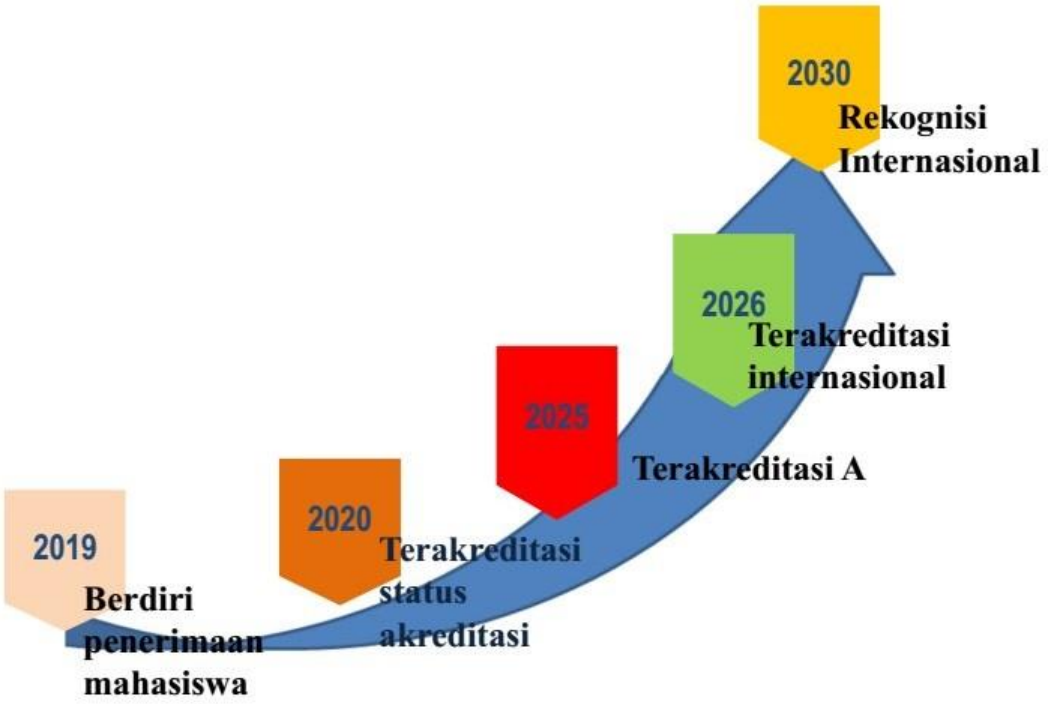


Figure 2.1. Roadmap for the Master of Chemistry Study Program FMIPA UII (2019-2030)

A year after the establishment of PSMK, a national accreditation application will be made to BANPT with the minimum target of having an accredited status. With this status, it is hoped that PSMK will continue to improve into a qualified study program. In the next 5 years, PSMK will apply for re-accreditation with the target of achieving accredited A status. To support this, the teaching and management system of PSMK will refer to the quality standards that have been set. Simultaneously with the process of submitting BANPT re-accreditation, PSMK will also prepare applications for international accreditation to institutions such as RSC / AUNQA / others, so that in 2026 PSMK will be internationally accredited. This international accreditation is important, in order to ensure that the material taught and the management of PSMK education are equal, both in terms of depth, breadth, and professionalism, with a chemistry master's program in the ranks of the world's best universities.

F. RESEARCH FOCUS OF MASTER OF CHEMISTRY STUDY PROGRAM

The Master of Chemistry Study Program has determined research excellencies which lead to 3 (three) excellent topics, namely:

1. Development of essential oils
2. Materials and electrochemistry for energy and the environment
3. Development of natural materials for health and food

The pattern of research development that supports learning activities and community service is carried out according to the scheme in Figure 2.2.

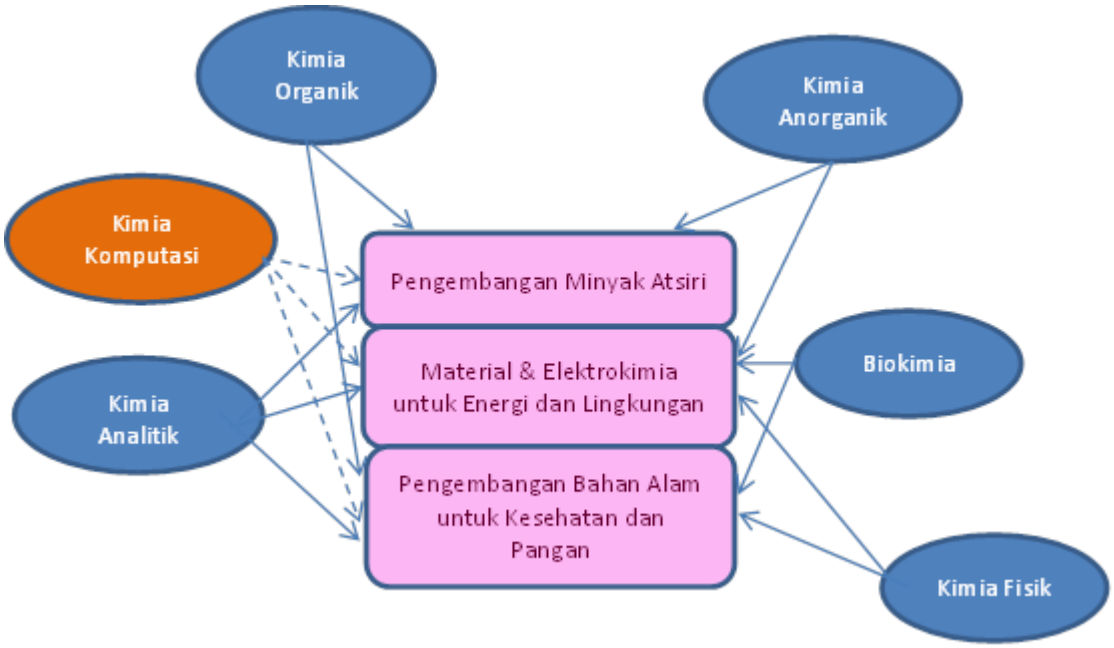


Figure 2.2. Map of Research Excellencies for Master of Chemistry Study Program, FMIPA UII

The realization of the determination of research excellence is carried out through empowerment research group laboratory. Based on this scheme, currently PSMK has one research laboratory with lecturers and students and 5 (five) research group labs.

Development of essential oils

The focus of research on the leading topics of essential oil development includes the isolation and synthesis of essential oil derivatives (clove oil, ginger oil, patchouli oil, jasmine oil, etc.).

Materials and electrochemistry for energy and the environment

Research on Materials for Energy and the Environment is focused on the development of materials (natural and synthetic zeolite and clay class materials, silica, carbide, natural cellulose-based materials, natural starch, and agricultural industrial waste as well as activated carbon, mining-based materials, semiconductor materials, marnegtik, chitin based material, as well as natural and synthetic polymer materials. In addition, Electrochemical for Energy and Environment research focuses on electrochemical technological approaches for humans and

the environment, including electrochemical applications for enzyme-based sensors (electroanalysis), degradation of wastewater (electrodegradation), and water disinfection (electrodisinfection).

Development of natural materials for health and food

On the leading research topic Isolation and Non-Essential Synthesis for Health and Food, it focuses on the development of natural plant-based drugs and organic synthesis, food modification and diversification, and the development of natural pesticides.

G. LIST OF LECTURERS

Educational and teaching activities in the Chemistry Master Program are managed by 7 permanent teaching staff, 5 laboratory assistants and technicians. The permanent teaching staff has met the minimum criteria for strata 3 (doctorate) with the following details:

Professor:

1. Prof. Dr. Is Fatimah, S.Si., M.Si.
2. Prof. Riyanto, S.Pd., M.Si., Ph.D.
3. Prof. Dr.rer.nat. Ir. Agus Taftazani

Associate Professor:

4. Dr. Noor Fitri, S.Si., M.Si.
5. Drs. Allwar, M.Sc., Ph.D.
6. Rudy Syah Putra, S.Si., M.Si., Ph.D.
7. Dr. Dwiarso Rubiyanto, S.Si., M.Si.

Asisstant Professor:

8. Dr. Tatang Shabur Julianto, S.Si., M.Si.

In addition, the teaching and learning process is also assisted by lecturers from several related institutions as well as Foreign Lecturers according to the expertise of world-renowned university cooperation partners, including:

1. Khoirul Himmi Setiawan, S.Si., M.Sc., Ph.D. (LIPI Biomaterial Research Center)
2. Assoc.Prof. Dr. Azlan Kamari (UPSI, Malaysia)
3. Prof. Dato'. Dr. Musa Ahmad (USIM, Malaysia)
4. Assoc.Prof. Dr. Juliana Jumal, M.Sc. (USIM, Malaysia)
5. Assoc.Prof. Dr. Oki Murazza (King Fahd University of Petroleum and Minerals, Saudi Arabia)
6. Prof. Hideya Kawasaki (Kansai University, Jepang)
7. Assoc.Prof. Dr. Sim Yoke Leng (UTAR, Malaysia)
8. Prof. Ruey Doong (National Tsing Hua University, Taiwan)
9. Assoc. Prof. Dr. Lemtong Laemm Chuenchom (Prince Songkla University, Thailand)
10. Dr. Tengku Shafazila (USIM, Malaysia)
11. Prof. Fethi Kooli (Taibah University, Saudi Arabia)

I. LABORATORY FACILITIES

To support the implementation of the teaching and learning process, the Master of Chemistry Study Program of FMIPA UII is supported by 7 (seven) laboratories equipped with adequate references and sophisticated instrumentation:

- Research Excellencies Laboratory
- Educational Chemistry Laboratory
- Research Chemistry Laboratory
- Computational Chemistry Laboratory
- Instrumentation Chemistry Laboratory
- Essential Oil Laboratory
- Integrated Laboratory
- Chemistry Laboratory Reference Room

J. INNOVATION DEVELOPMENT FACILITIES

1. Center for the Study of Essential Oils (*Center of Essensial Oil Studies*/CEOS)

The existence of a study center is an added value for higher education that is consistent in developing science and technology. Even though the establishment of a study center is not an obligation, the rapid development of the world today requires a means that has capable resources to be able to follow and adapt to it.

For this reason, the Islamic University of Indonesia takes concrete steps by taking the role of an institution that explores, researches, studies, uses and disseminate the results of the development of science and technology obtained through the Study Center. One way to do this is through the establishment of the Center for Essential Oil Studies or better known as CEOS: Center of Essential Oil Studies.

In real terms, the existence of CEOS UII has been recognized through various activities carried out by CEOS involving people related to essential oil processing in the fields of: process/ technology, chemistry, pharmaceuticals and health, marketing, essential oil farmers/ producers and financiers. Activities in the form of workshops, training, seminars, and mentoring are outlined in several MoU. The general public such as farmers, traders and financiers as well as the academic community such as lecturers, students, teachers and students are the strata of society that have been invited to cooperate.

Essential oil is a type of oil obtained from plants. Essential oils have a distinctive smell according to the type of plant; some smell soft, some are stinging and even smell bad for those who are sensitive to smell. Essential oil is a type of material in the form of oil which is composed of a mixture of organic compounds, most of which are classified into terpenoid compounds.

Indonesia essential oil is one of the economic commodities that has existed since the Dutch colonial era and is one of the world's traditional industrial products. However, there are still many people who don't recognize or even can not distinguish essential oils from other types of oil until now.

Indonesia is one of the most famous essential oil producing countries in the world. The types of Indonesian essential oils that have entered the international market include patchouli,

cloves, lemongrass, vetiver, cananga / ylang-ylang, ginger, nutmeg, gaharu, sandalwood and others.. The diversity of plants that produce essential oils is estimated to be hundreds of species belonging to various plant families such as Labiatae, Lauraceae, Graminae, Myrtaceae, Umbiliferae and others.

The perfume / fragrance industry, flavors, soaps, medicines, cosmetics and others are the largest users of essential oil commodities in addition to their direct use in the fields of agriculture, health, beauty and aromatherapy.

Vision of CEOS UII

Making the Center for the Study and Industry of Essential Oils (CEOS UII) as a center for research, study and application of science and technology (science and technology) for essential oils in Indonesia and the world

Mission of CEOS UII

a. Improve and develop research activities and studies of science and technology (science and technology) in the field of essential oils;
b. Applying science and technology (science and technology) in solving problems in the essential oil field in society;
c. Building and strengthening mutualistic cooperation with various parties at the national and international levels in conducting research and the development of science and technology (science and technology) in the field of essential oils.

Goals of CEOS UII

a. Disseminating science and technology to the public about essential oils and their benefits
b. Increase the role of UII, private industry and government in the essential oil sector
c. To produce quality and standardized essential oils and their derivative products
d. Carry out further processing of crude essential oil products
e. Formulate a mutually beneficial trading system through a scheme based on mutual trust and equity.
f. Making Indonesia an independent country in meeting needs related to essential oil ingredients and products
g. To conserve natural resources of essential oils in a sustainable manner.

Road map Of CEOS UII

CEOS moves to meet the needs of stake holders through the following road map:

Figure 2.3 Road map of CEOS UII

Routine activities and service receipts for:

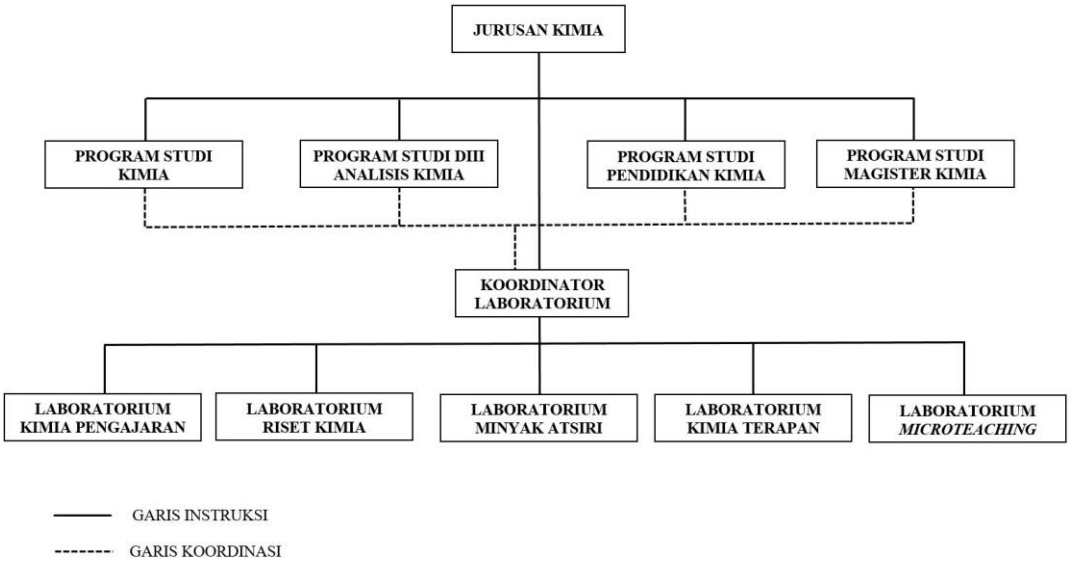
1. Explore potential sources of essential oils such as temu-finding, ginger, turmeric, orange, basil.
2. Industrial material formulations based on essential oils such as sanitary materials, toiletries, perfume.
3. Routine analysis and identification of essential commodities such as patchouli, cloves and lemongrass
4. Synthesis of essential oil derivatives for agriculture, health, medicinal and environmental.
5. Development of essential oil distillation and extraction techniques.
6. Workshops and training, both private and corporate

2. Essential Oil Research and Testing Laboratory

The Essential Oil Research and Testing Laboratory is a facility owned by the Chemistry Department and is currently being proposed as an ISO 17025: 2008 certified testing laboratory.

K. ORGANIZATION STRUCTURE OF MASTER Of CHEMISTRY

The Master of Chemistry Study Program at FMIPA UII has the following organizational structure:



Head of the Department of Chemistry : Dr. Is Fatimah, S.Si., M.Si.
Head of Chemistry Master Study Program : Drs. Allwar, M.Sc., Ph.D.
Coordinator of Head of Laboratory : Mai Anugrahwati, M.Sc.
Head of Laboratory
1. Chemistry Teaching Laboratory : Amri Setyawati, S.Si., M.Sc.
2. Research Chemistry Laboratory : Wiyogo Prio Wicaksono, S.Si., M.Sc.
3. Essential Oil Laboratory : M. Miqdam Musawwa, S.Si., M.Sc.
4. Applied Chemistry Laboratory : Bayu Wiyantoko, M.Sc.
5. Microteaching Laboratory : Artina Diniaty, M.Pd.

Laboratory Administration Staff : Cecep Sa'bana Rahmatillah, S.Si.
Laboratory Assistant : Dwi Mahmudi, BA.
Cecep Sa'bana Rahmatillah, S.Si.
Nur Isnaini, A.Md.
Tohari, S.Si.
Norra Gus Priambodo, S.Si.
Prodi staff : Supwatul Hakim, S.Si., M.Sc

L. INTERNATIONAL COOPERATION

Collaborations that have been established with universities abroad make it possible for students of the Master of Chemistry Study Program to carry out Student Mobility in the form of Seat In or Research Collaboration, these universities include:

- Hokaido University, Japan
- Kansai University, Japan

- Universiti Tunku Abdul Rahman (UTAR), Malaysia
- Universiti Sains Islam Malaysia (USIM), Malaysia
- Universiti Kebangsaan Malaysia (UKM), Malaysia
- Princes Songkhla University (PSU), Thailand
- Curtin University, Australia
- National Tsing Hua University (NTHU), Taiwan
- National Chiao Tung University (NCTU), Taiwan
- Taibah University, Saudi Arabia
- International Islamic University Malaysia
- Metrohm Netherland

M. INTERNATIONAL CHEMISTRY INSTITUTIONS

N. Royal Society of Chemistry (RSC)

RSC is one of the oldest chemical organizations in the world. RSC was based in England, UK, in 1841, 178 years ago. RSC publishes books, journals, also develops international accreditation of chemistry courses. According to RSC, chemistry is at the center of everything you can see, smell, touch and taste. For more details on reading the current developments in chemistry and the RSC, you can visit https://www.rsc.org/ and https://pubs.rsc.org.

American Chemical Society (ACS)

ACS was founded in 1876 in the United States and is the largest scientific organization in the world. ACS has a vision to improve the quality of human life by harnessing the power of chemistry. ACS mission is to advance the chemical-based industry and its practitioners for the benefit of life on earth. ACS provides a number of scholarships, research grants, and also supports the quality of teaching chemistry in education through various activities. In addition, ACS also publishes scientific books and journals. ACS details can be followed on the https://www.acs.org and https://pubs.acs.org channels.

International Union of Pure and Applied Chemistry (IUPAC)

The IUPAC, which is currently headquartered in the United States, was formed in 1919 by a chemist who felt the need for international standardization in the field of chemistry, both regarding the measurement, naming, registration of new elements in the periodic system of elements, as well as symbols in chemistry. IUPAC plays a role in developing the basics of chemistry and as an unifier for the development of chemistry. According to the IUPAC congress in 2019, there are 10 chemical technology issues that will develop today and in the future, including nanopesticides, enzyme-selective organicists, solid-state batteries, flow chemistry, reactive extrusion, Metal-Organic Frameworks (MFOs) materials, Directed Evolution of Selective Enzymes, conversion of plastics to monomers, reversible deactivation of radical polymerization, and 3D-bioprinting. For more details, IUPAC information can be accessed on the https:// blowingac.org page.

CHAPTER III
ACADEMIC RULES

A. GENERAL PROVISIONS

1. The system for implementing the teaching and learning process in the chemistry master study program (PSMK) of FMIPA UII refers to the National Higher Education Standards Number 49 of 2014 and KKNI.
2. Implementation of semester learning is conducted based on the amount of semester credit units (SKS).
3. One credit is equivalent to 160 (one hundred and sixty) minutes of learning activities per week per semester. Semester is a unit of time for effective learning activities for 16 (sixteen) weeks.
4. Students are given the freedom to prepare a study plan by taking into account the courses offered, prerequisite courses and achievement indexes.
5. The process of organizing lectures, exams, registration, and holidays can be seen through the academic calendar.

B. STUDENT REGISTRATION

At the beginning of each semester, students who will actively participate in academic activities and other activities are required to register / register, with the following procedure:

1. Active students, pay tuition fees according to the schedule set by the university.
2. Students who are active returning from academic leave:
   a. Arrange for re-active permit from the faculty.
   b. Active students, pay tuition fees according to the schedule set by the university.
3. Updating student personal data through the platform computer or online at Unysis

Students who have registered are required to submit a plan for academic activities, including students who are only / currently working on a thesis. Submission of academic activity plans is carried out by students directly by entering the courses to be taken into the Semester Academic Plan (RAS) online.

The maximum number of credits that can be taken is 22 credits per semester, depending on the student's academic achievement and other provisions relating to certain courses. The RAS filling period is determined by the University / Faculty and is listed in the Academic Calendar. For students who need consultation on courses to be taken or other problems related to academics, the Faculty / Department / Study Program provides Academic Advisors (DPA). The purpose of providing DPA is to assist / direct students in choosing courses, choosing study concentrations, and other academic problems.

The provisions and procedures for filling out the RAS are as follows:

1. New students (first semester)
   a. Has registered.
   b. RAS is filled in by operators of each department / study program
2. Old students
   a. Has registered.
   b. Meet all the requirements to be able to fill the RAS.
   c. If needed requires DPA guidance.
   d. Meet the defined RAS filling schedule.
   e. e. Filling in directly to the computer of the courses taken according to the SKS allotment, and requesting a print out of the RAS fields to the operators of the Faculty / Department / Study Program after filling in the RAS.
   f. f. Changes to the RAS entry, both changes in courses and classes, can only be made during the stipulated RAS revision period.
   g. g. RAS can be filled in through the UII website (www.uii.ac.id)
3. Number of credits / courses that can be taken
   a. For New Students (first semester) the number of credits that can be taken is determined according to the semester I course package between 18-22 credits.
   b. For old (active) students, the number of credits that can be taken is based on the combined matrix of n-1 semester IP and cumulative IP.
   c. For students who are active again:
      • For students who have an academic leave permit, the SKS allotment is based on the last semester quota prior to leave.
      • For students who do not have an academic leave permit, the maximum SKS allowance is 12 credits.
4. For those who take the Thesis
   • When registering a thesis, students must have taken a minimum of 30 credits.
   • Students must have taken Research and Publication Design courses.
   • The thesis is more fully regulated in the Thesis Guide.
5. Thesis Examination
   • The thesis examination can be carried out with the following requirements:
   • Have taken a minimum of 42 credits with the provisions for compulsory courses of 36 credits and a minimum of 6 credits of elective courses.
   • Has passed the Judicum Close theory.
   • Submit a thesis that has been approved by Supervisor I and Supervisor II, with regular binding without hard cover.
   • Have paid the cost of guidance and education in accordance with the Dean's Decree or applicable regulations.

1. Students who do not complete the RAS during the RAS filling period can complete the RAS during the RAS revision period with a fine of 3 credits.
2. Students who do not fill in the RAS even though they have registered / paid tuition fees are advised to apply for academic leave and the tuition fee I or III is returned.

C. NON ACTIVE

Non-active students are not entitled to:

1. Following the teaching and learning process;
2. Participating in student activities; and
3. Receive academic services.

D. STUDENT STATUS

In Article 42 of the Indonesian Islamic University Regulation No. 2 of 2017 concerning the Education and Learning Process in the Universitas Islam Indonesian:

1. Students who are unable to complete the study are grouped into:
   a. Resign; and
   b. Issued.
2. Students are declared to resign as referred to in paragraph (1) if the student:
   a. Declare resignation in writing;
   b. Declare moving in writing;
   c. Die;
   d. Inactive in the second semester of the first year for new students;
   e. Inactive without written permission from the Rector for 2 (two) consecutive semesters.
3. Inactive students as referred to in paragraph (2) letter e and letter f are students who are not registered in a certain semester without the Rector's permission.
4. Students who are inactive as referred to in paragraph (3) can be given a Resignation Certificate to the Rector.

In Article 43 of the Indonesian Islamic University Regulation No. 2 of 2017 concerning the Education and Learning Process in the Indonesian Islamic University:

1. Students are declared expelled if they do not pass the mid-course evaluation as referred to in Article 42 of the Regulation of the Islamic University of Indonesia No. 2 of 2017.
2. The minimum number of credits and minimum GPA as referred to in paragraph (2) is determined with a minimum of 18 (eighteen) credits with a minimum GPA of 3.00 (three point zero zero) for the master program.

3. Students are declared to be expelled because they do not pass the mid-study evaluation as referred to in paragraph (1) if they cannot meet the passing criteria within the maximum study period limit.

E. LECTURES

1. Lectures each semester are held for 14 to 16 weeks, including examination and evaluation activities.
2. The duration of holding the lecture is 50 minutes per one credit per week.
3. Each Study Program can organize practicum or other activities according to the needs of the Study Program.
4. Every student is required to attend lectures and scheduled activities of at least 75% and practicum 100% of the activities carried out.

F. EVALUATION OF STUDY RESULTS

Learning evaluation for all subjects in the PSMK curriculum is carried out based on the following stages:

1. Evaluation of each course based on the achievement of the CPMK;
2. Evaluation for each student is carried out every semester
3. Evaluation for each student is also carried out in the middle of the study period,
4. Evaluation of the deadline for student study is adjusted to SN DIKTI,
5. The study program conducts a final evaluation of each student through a closed theory judicium;
6. The study program conducts a final graduation study for students.

Assessment of learning outcomes

Activities and student learning progress are carried out periodically in the form of examinations, assignments and observations.

a. Exams are held through midterm exams (UTS) and final semester exams (UAS).

b. To be eligible for the UTS and UAS, students must meet the following requirements:
   1) Meeting attendance at 75% of those held.
   2) Paying the second installment tuition fee for odd semesters and fourth installments for even semesters.
   3) Take an exam card in the academic administration section of each faculty.
   4) Ratify the exam card in the academic administration section of each faculty by showing proof of tuition payment.

c. The implementation of assignments given by the lecturer to students can be in the form of reports on reading books, evaluating cases, comments on articles / news, making papers or other forms of activities determined by the lecturer.

d. The implementation of assignments for each subject is given by the lecturer at least 2 (two) times in one semester.

- Observations are observations made by the lecturer on lecture attendance and student activity in the teaching and learning process
- Assessment of learning outcomes is expressed in letters, each of which has the following digits:

No.	Score	weight	Minimum Score	Score Range
1.	A	4.00	80.00	80.00 – 100
2.	A-	3.75	77.50	77.50 – 79.99
3.	A/B	3.50	75.00	75.00 – 77.49
4.	B+	3.25	72.50	72.50 – 74.99
5.	B	3.00	70.00	70.00 – 72.49
6.	B-	2.75	67.50	67.50 – 69.99
7.	B/C	2.50	65.00	65.00 – 67.49
8.	C+	2.25	62.50	62.50 – 64.99
9.	C	2.00	60.00	60.00 – 62.49
10.	C-	1.75	55.00	55.00 – 59.99
11.	C/D	1.50	50.00	50.00 – 54.99
12.	D+	1.25	45.00	45.00 – 49.99
13.	D	1.00	40.00	40.00 – 44.99
14.	E and F	0	00.00	< 40.00

Students have the right to ask details of the assessment components from the course lecturer and if necessary can convey dissatisfaction through the procedures determined by the Academic Division.

I. JUDISIUM CLOSED THEORY

Graduation in the theory closed judicium is one of the requirements that must be met for a student who will carry out a thesis awareness exam. A student is declared to have passed the theory close judicium if it meets the following conditions:

1. Have taken a minimum of 42 credits with conditions.
   a. Compulsory 36 credits, including thesis
   b. Minimum Elective Subject is 6 credits.

1. There are no subjects that have the value of E, F or K.
2. Minimum GPA of 3.0.

J. IMPLEMENTATION OF THESES

• When registering a thesis, students must have taken a minimum of 30 credits.
• Students must have taken the Research Methodology course with a minimum grade of C.
• The thesis is more fully regulated in the Thesis Guide.

K. THESIS TRIAL

Thesis awareness can be done with the following conditions:

a. Have taken a minimum of 42 credits with the provisions for compulsory courses of 36 credits and a minimum of 6 credits of elective courses.
b. Has passed the graduation close theory.
c. Submitting a thesis that has been approved by Supervisor 1 and Supervisor 2, with regular binding without hard cover.
d. Has paid the cost of guidance and education in accordance with the Dean's Decree or applicable regulations.

L. YUDISIUM STUDY END

Before graduation, students must pass the Final Study Judiciary with the following requirements:

a. Has passed the graduation close theory.
b. Have taken a minimum of 42 credits with the provisions for compulsory courses of 36 credits and 6 credits of minimum elective courses.
c. Minimum GPA of 3.0.
d. Submit a photocopy of the CEPT 450 test certificate.
e. Proof of submission of the Thesis manuscript in the form of hard cover (1) which has been signed by all examiners and approved by the Dean to Supervisor 1 and Supervisor 2, as well as the Faculty library.
f. Proof of loan-free library books for the Faculty of Mathematics and Natural Sciences and the Central Library.
g. Proof of free laboratory administration inside and outside UII.
h. Certificate of free of Faculty financial administration.
i. Abstract (in English) and extracts accompanied by title and signed by the supervisor.
j. Latest Study Result Card (KHS)
k. Proof of submission of the thesis manuscript on CD to the library.
l. Submit a paper / thesis summary (hard copy and CD) in the format of a scientific article with one space, at least 10 pages that are validated by the first supervisor and the supervising lecturer 2. The rules and writing format are regulated in more detail in the Thesis Guidebook.
m. Show evidence of 1 paper published in an international reputable journal.

CHAPTER IV
CURRICULUM OF MASTER OF CHEMISTRY STUDY PROGRAM

A. LEGALITY REFERENCE

PSMK already has a curriculum design prepared for the establishment of PSMK. So far, the curriculum design is based on studies based on the results of a comparative study to several master of chemistry Study Programs in several universities among others, PS Masters in Chemistry, Sepuluh Nopember Institute of Technology (ITS) Surabaya, PS Masters in Chemistry at the Bandung Institute of Technology (ITB), PS Masters in Chemistry from Brawijaya University, Malang, and PS Masters in Chemistry from Gadjah Mada University (UGM). In addition, curriculum design is carried out through a Curriculum Preparation Team consisting of lecturers by paying attention to the study of opportunities and challenges for future Master of Chemistry learning.

In order to ensure the quality of learning and the resulting graduates, PSMK plans a comprehensive curriculum review. The basis for the future curriculum will be based on several regulations:

1. Law of the Republic of Indonesia Number 20 Year 2003 concerning the National Education System (State Gazette of the Republic of Indonesia year 2003 Number 78, Supplement to the State Institution of the Republic of Indonesia Number 4301);
2. Law of the Republic of Indonesia Number 12 year 2012 concerning Universities (State Gazette of the Republic of Indonesia year 2012 Number 158, Supplement to the State Institution of the Republic of Indonesia Number 5336);
3. Government Regulation of the Republic of Indonesia Number 4 year 2014 concerning Implementation of universities and Management of Universities (State Institute of the Republic of Indonesia year 2014 Number 41, Supplement to State Institutions of the Republic of Indonesia Number 5500);
4. Presidential Regulation Number 8 year 2012 concerning the Indonesian National Qualifications Framework;
5. Regulation of the Minister of Education and Culture Number 73 year 2013 concerning Application of the Indonesian National Qualifications Framework in the Field of universities;
6. Regulation of the Minister of Research, Technology and Universities of the Republic of Indonesia Number 44 year 2015 concerning National Universities Standards, State Gazette of the Republic of Indonesia year 2015 Number 1952;
7. Decree of the Trustees of the Universitas Islam Indonesia Waqf Foundation Number VI / TAP / PBN / IX / 2017 concerning Ratification of the Statute of the Universitas Islam Indonesia in 2017;
8. Universitas Islam Indonesia Regulation Number 2 year 2017 concerning the Education and Learning Process at the Universitas Islam Indonesia.
9. Rector's Regulation Number 11 year 2017 concerning Learning Outcomes of University Graduates and University Compulsory Courses;

10. Rector Regulation number 12 year 2017 concerning Guidelines for Preparation of Learning Planning Documents in the Universitas Islam Indonesia;
11. Chancellor Regulation Number 7 year 2018 concerning Amendments to Chancellor Regulation Number 11 year 2017 concerning University Lulu and University Compulsory Subjects;
12. UII Chancellor's Regulation No. 02 / PR / REK / BPA / VI / 2015 concerning Guidelines for Curriculum Development in the Universitas Islam Indonesia;
13. Ulil Albab Comprehensive Curriculum Documents, 2017.

The preparation and ratification of the curriculum including documents covering graduate learning outcomes (CPL) which refer to the Indonesian National Qualifications Framework (KKNI) is needed. The preparation refers to the provisions of professional organizations, in this case the Indonesian Chemists Association (HKI), Islamic and Islamic values as well as competitive advantage are needed. In accordance with the ideal conditions in the implementation of the curriculum, the teaching and learning process is carried out based on the course learning outcomes (CPMK) which are determined as the CPL embodiment of the study program.

There is a learning level that is different from S1, and the importance of curriculum, teaching materials, learning systems and learning evaluation tools, curriculum studies and these things really need to be done.

B. COMPETENCY OF GRADUATES

PSMK graduates are personnel in the field of chemistry who have the knowledge, skills and abilities to plan, implement and develop educational, industrial, environmental, research and service activities related to chemical expertise. PSMK graduates are predicated experts in the field of chemistry in charge of planning, organizing, implementing, monitoring, controlling, supervising and assessing development and environmental sustainability in line with the basic principles of sustainability and green chemistry, based on basic knowledge of chemistry and the main focus of research development, namely the development of essential oils, materials and electrochemicals for energy and the environment and non-essential for health and food.

The basic profile of all PSMK graduates is to have a character of knowledge and practice and scientific practice based on Al-Qurán and hadith so that they have the values of integrity, academic ethics, professionalism, and independence. Descriptions of the profiles of PSMK graduates can be seen in Table 4.1.

Table 4.1. PSMK graduate description

Graduate profile	Description
Researcher	The research profile of PSMK has the characteristics of being able to apply scientific knowledge that is mastered as a reference for solving concrete problems and scientific development include

	ability to analyze and interpret sophisticated chemical instrumentation data, able to develop ideas, design and carry out research with outputs that are beneficial to society, especially those related to the development of essential oils, materials and electrochemistry for energy and the environment as well as the development of non-essential natural materials for health and food.
Experts / Consultants	The Expert Profile produced from the PSMK is appropriate and refers to the level 8 Indonesian National Qualification Framework (KKNI) standard, which is capable of master and apply knowledge, technology in the field of chemistry, able to solve problems, especially those related to the developing chemical field in society, have technical skills (technical know-how) and managerial skills (managerial know-how) in their professional performance, as well as having character of flexibility in professional development and upholding ethics according to the teachings of the Qur'an and Hadith.
Educator (teacher / lecturer)	Able to increase the effectiveness of learning, especially in the field chemistry, and focus on mastering the basic content of science with a future view (science in progress).
Technopreuner	Able to carry out innovation, creation, planning and business management based on skills and knowledge, especially in the field of chemistry which focuses on job creation.

C. Graduate Learning Outcomes

The formulation of Graduate Learning Outcomes (CPL) from PSMK is prepared by taking into account the formulation of CPL general attitudes and skills contained in the attachment of Permenristekdikti No. 44/2015 concerning National Universities Standards.

Based on several considerations, including the CPL set by the Indonesian Chemical Association (HKI) (http://kkni-kemenristekdikti.org/pend Pendidikan/description), the key requirements of the Royal Society of Chemistry (RSC) curriculum standards, and the vision, mission, objectives and PSMK's own targets.

The mechanism for compiling the learning outcomes of the study program according to level 8 (eight) of the KKNI and SN-Dikti and the parties involved. The scheme for preparing learning outcomes in the Master of Chemistry Study Program is shown in Figure 4.1.

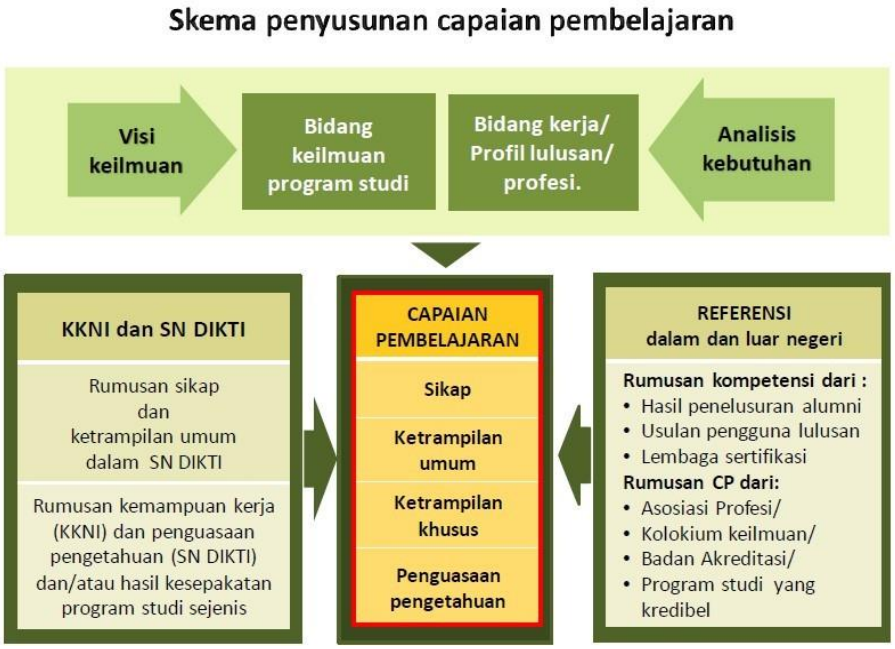


Figure 4.1. Learning Outcomes Compilation Scheme

Descriptions of the CPL defined by the IPR and CPL PSMK are presented in Table 4.2.

Table 4.2. PSMK CPL formulation

Short Description	CPL Code	Formulation of CPL	Learning Outcome Description
ATTITUDE: ISLAMIC PERSONALITY			
Have an attitude piety to Allah SWT, knowledgeable practice and scientific charity as well shows the value-Islamic value on life social, nation and patriotic	CPL 1	Be able to show attitude devotion to God Yang The One and Only by exercising His law in daily life day and uphold Islamic morals and universal ethics	Having an ability to demonstrate piety attitude toward God Almighty by carrying out His law in daily life and upholding Islamic morals and universal ethics.
	CPL 2	Be able to show views live inclusive and get along on global society by staying maintain identity Islamic and Indonesian	Having an ability to show an inclusive view of life and to get along in a global society while maintaining an Islamic and Indonesian identity.
	CPL 3	Contribute to the improvement quality of social life, nation, state and civilization based progress Pancasila.	Contributing to an improvement of the quality of life in a society, nation, state and the advancement of civilization based on Pancasila.

	CPL 4	Acting as citizens who are proud and love the country, have nationalism and a sense of responsibility to the state and nation.	Having a role as a proud and loving citizen of the country, having nationalism and a sense of responsibility to the country and nation.
	CPL 5	Appreciate the diversity of cultures, views, religions and beliefs, as well as other people's original opinions or findings.	Respecting the diversity of cultures, views, religions, and beliefs, as well as other people's opinions or original findings.
	CPL 6	Work together and have social sensitivity and concern for the community and environment.	Having an ability to work in a team, social sensitivity and care for the community and the environment.
	CPL 7	Obey the law and discipline in social life and patriotic.	Obeying the law and having discipline attitude in social and state life.
	CPL 8	Internalizing academic values, norms and ethics.	Internalizing academic values, norms and ethics.
GENERAL SKILLS: PROFETIC LEADERSHIP			
Have skills that are based on knowledge, theoretical concepts in the field of chemistry	CPL 9	Demonstrate an attitude of responsibility for work in their field of expertise independently.	Demonstrating responsibility for work in theie area of expertise independently.
	CPL10	Internalizing the spirit of independence, struggle, and entrepreneurship.	Internalizing the spirit of independence, struggle, and entrepreneurship.
	CPL11	Able to master and apply the concepts and theories of structure and properties, energetics, kinetics, analysis and micro synthesis and macromolecules in Indonesian natural materials	Having an ability to master and apply concepts and theories of structure and properties, energetics, kinetics, analysis and synthesis of micro and macromolecules in the field of Indonesian natural products.
SPECIAL SKILLS: TRANSFORMATIVE SKILLS			
Mastering the principles and theoretical mastery of chemical science to contribute to scientific development for the wider community	CPL12	Able to master theoretical concepts about the functions of the latest instruments in the chemical field and how to operate them, as well as mastering the application of Indonesian natural material management technology	Having an ability to master theoretical concepts about the function of the latest instruments in the field of chemistry and how to operate it, as well as to master the application of technologies for Indonesian natural products management.

	CPL13	Able to master and apply the latest principles, procedures and handling techniques to the impact of the use of Indonesian natural chemicals on people's lives, the environment,	Having an ability to master and apply the latest principles, procedures, and handling techniques to the impact of the use of Indonesian natural chemicals on people's life, environment, social and economy.

KNOWLEDGE: INTEGRATIVE KNOWLEDGE

Have critical, systematic and creative scientific development skills to apply them to specific professional fields in the field of chemistry	CPL14	Able to develop logical, critical, systematic, and creative thinking through scientific research, theses and scientific publications, creation of designs in the field of science and technology that pay attention to and apply the values of the humanities in accordance with their field of expertise, compile scientific conceptions and the results of their studies based on rules, regulations way, and scientific ethics.	Having an ability to develop logical, critical, systematic, and creative thinking through scientific research, thesis and scientific publications, the creation of designs in the fields of science and technology that consider and apply humanities value in accordance with their fields of expertise, and to compile scientific conceptions and the results of their studies based on rules, procedures and scientific ethics.
	CPL15	Able to carry out validation and studies according to their area of expertise in solving problems in society or industry ones relevant through the development of knowledge and expertise.	Having an ability to carry out validation and study in accordance with their expertise to solve problems in the relevant community or industry through the development of their knowledge and expertise.
	CPL16	Able to compile ideas, thoughts, and scientific arguments responsibly and based on academic ethics, and communicate it through the media to the public academics and society at large	Having an ability to arrange ideas, results of thought, and scientific arguments responsibly and based on academic ethics, as well as communicate them through the media to the academic and the wider communities.
	CPL17	Able to identify the scientific field that is the object of his research and position into a research map developed through an interdisciplinary or multidisciplinary approach Indonesian natural materials sector	Having an ability to identify scientific field as the objects of the research and position it into a research map developed through an interdisciplinary or multidisciplinary approach in the field of Indonesian natural products.
	CPL18	Able to make decisions in the context of solving problems in the development of science and technology that pay attention and applying humanities values based on analytical or experimental studies to information and data	Having an ability to make decisions in the context of solving problems in developing science and technology that consider and apply humanities value based on analytical or experimental studies of information and data.

	CPL19	Able to manage, develop and maintain networks with colleagues, peers within the wider research institution and community	Having an ability to manage, develop and maintain a network of colleagues, colleagues within the institution and the wider research community.

	CPL20	Able to increase learning capacity independently	Having an ability to increase the learning capacity independently.
	CPL21	Able to document, store, secure, and recover research data in order to guarantee validity and prevents plagiarism.	Having an ability to document, store, secure, and rediscover research data in order to ensure validity and prevent plagiarism.
	CPL22	Able to deepen or expand chemical or applied chemistry science by producing accurate, tested models / methods / theory development, and innovative in the fields of essential oils or materials and electrochemistry for energy and the environment and the synthesis of natural materials for health and food.	Having an ability to deepen or expand scientific or applied chemistry by producing accurate, tested and innovative models / methods / theory development in the field of essential oils or materials and alectrochemistry for energy and the environment and the development of natural products for health and food.
	CPL23	Able to solve science and technology problems related to the structure, properties, and chemical changes at the micro- and macromolecular level, through experimental approaches, theoretical deduction or computation / simulation, and inter- or multidisciplinary approaches, characterized by the production of work that has the potential to be applied in solving the iptext problem.	Having an ability to solve science and technology problems related to the structure, properties, and chemical changes at the micro- or macromolecular level, through experimental approaches, theoretical deduction or computation / simulation, and inter- or multidisciplinary approaches, characterized by the production of work that has the potential to be applied in solving the problems.

The continuity between VMTS Faculties, VMTS PSMK and CPL is presented in Figure 4.2

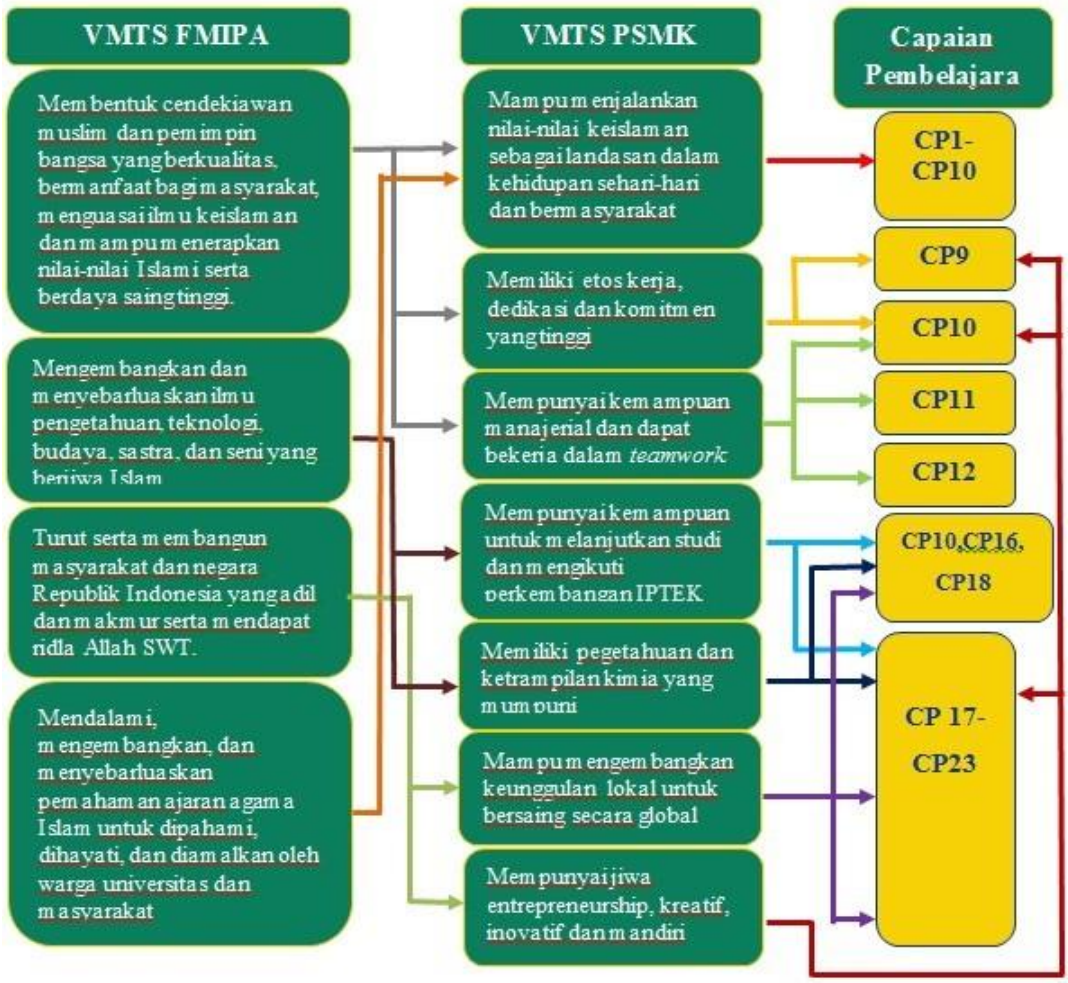


Figure 4.2. Sustainability scheme of Faculty VMTS, VMTS PSMK and Graduate Learning Outcomes

D. Development of Study Materials

PSMK Graduate Learning Outcomes (CPL) are compiled based on an evaluation of the latest scientific developments, market needs, input from the Indonesian Chemists Association (HKI) and input from experts outside the university. The study material in the curriculum is adjusted to the vision, mission, goals and objectives of PSMK and is realized based on the direction of research development (Research Excellencies/ RE) as presented in Figure 4.3. Deepening and exploratory core chemistry consisting of Organic Chemistry, Inorganic Chemistry, Analytical Chemistry, Physical Chemistry and Biochemistry is carried out based on specific topics from RE. The development of study materials and their mapping in the CPL is presented in Table 4.3. and CPL mapping based on the subjects arranged is presented in Table 4.4.

Figure 4.3. Relationship research excellencies and areas of expertise

Table 4.3. Mapping of CPL PSMK in study materials

Study Materials	CPL																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Internalization of Islamic values	√	√	√																				
UII values	√	√	√	√	√	√	√	√	√														
The values of tolerance, nationalism, integrity and ethics	√	√	√	√	√	√	√	√	√	√													
Independence and technopreneurship				√		√			√	√		√	√	√	√	√	√	√					
Essential Oil Development									√	√	√	√		√		√		√	√	√	√	√	√
Development of materials for energy and the environment									√	√	√	√	√	√	√	√	√	√			√	√	√
Renewable energy				√		√						√	√	√	√	√	√	√	√	√	√	√	√
Advanced instrumentation												√	√	√	√	√	√	√	√	√	√	√	√
Development of electrochemistry and electrochemistry for energy and the environment									√	√	√	√	√	√	√	√	√	√			√	√	√
Chemistry and sustainability				√		√			√	√	√	√	√	√	√	√	√	√			√	√	√
Food and health chemistry				√		√			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

Table 4.4. CPL mapping per course

Courses	Code		Trait	Smt	Cluster	CPL																			
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Islam Ulil Albab	IUA	MKWU01	Compulsory	3	Universitas	■	■	■	■	■	■	■	■	■	■													
Synthesis of Organic and Inorganic Chemistry	SOA	MK1101	Compulsory	1	Inorganic											■	■	■	■	■	■	■	■		■	■	■	■
Advanced Materials	MMA	MK2102	Compulsory	1	Inorganic												■											■
Essential Oil Synthesis and Derivatives	SMA	MK1201	Compulsory	1	Organic												■									■		■
Natural Material Synthesis	SBA	MK1202	Compulsory	1	Organic											■			■					■		■		
Essential Oil Characterization	KMA	MK1203	Compulsory	1	Organic											■			■									
Elucidation of Organic Compounds and Inorganic	EOA	MK2206	Compulsory	2	Organic																		■			■		■
Perfume, Flavor and Aroma Therapy	PFA	MK2207	Elective	2	Organic														■					■		■		
Organic reaction mechanism	MRO	MK2204	Compulsory	1	Organic											■	■	■	■	■	■	■	■		■	■	■	■
Quantum and Computational Chemistry	KKK	MK1301	Compulsory	1	Chemistry Physics																						■	■
Instrument Chemistry	KIN	MK1401	Compulsory	1	Analytical Chemistry												■						■					■
Chemical Separation and Purification	KPP	MK1402	Compulsory	1	Analytical Chemistry																						■	■
Electrochemical Analysis	AEL	MK2404	Compulsory	1	Analytical Chemistry												■	■										
Pharmacology and Toxicology	FTO	MK1501	Compulsory	1	Biochemistry											■			■									
Ecology and Environmental Chemistry	EKL	MK1601	Compulsory	1	Study program											■	■	■	■	■	■	■	■		■	■	■	■
Research and Publication Design	**DRP**	**MK2602**	**Compulsory**	**2**	Study program	■	■	■	■	■	■	■	■	■	■				■		■				■	■	■	
Proposal and Research preliminary	PPP	MK2603	Compulsory	2	Study program	■	■	■	■	■	■	■	■	■	■									■				
Thesis Research	PTH	MK3604	Compulsory	3	Study program	■	■	■	■	■	■	■	■	■	■									■				
International Scientific Works	KII	MK3605	Compulsory	3	Study program	■	■	■	■	■														■				

Thesis	THE	MK4606	Compulsory	4	Study program																								
Inorganic reaction mechanism	MRA	MK2103	Elective	2	Inorganic																								
Functional Materials	**MFU**	**MK2104**	**Elective**	**2**	**Inorganic**																								

Matakuliah	Kode		Trait	Smt	Cluster	CPL																				
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Essential Oil Industry Process	PIM	MK2205	Elective	2	Organic											■	■	■	■	■	■	■	■		■	■	■	■
Essential oil bioactivity	**BAA**	**MK2208**	**Elective**	**2**	**Organic**											■				■				■		■		
Essential Oil for edible coating	**MAE**	**MK2209**	**Elective**	**2**	**Organic**											■	■	■	■	■	■	■	■		■	■	■	■
Essential Oil for pesticide control	**MAP**	**MK2210**	**Elective**	**2**	**Organic**											■	■	■	■	■	■	■	■		■	■	■	■
Catalyst Chemistry	KKA	MK2302	Elective	2	Chemistry Physics											■	■	■	■	■	■	■	■		■	■	■	■
Sensor dan Biosensor	**SDB**	**MK2303**	**Elective**	**2**	Chemistry Physics												■											■
Energy Conservation	**MEN**	**MK2304**	**Elective**	**2**	Chemistry Physics												■											■
Enzimology	ENZ	MK2502	Elective	2	Biochemistry											■			■									
Enzyme Synthesis Technique	TSE	MK2503	Elective	2	Biochemistry											■			■									
Functional Food Chemistry	**KPF**	**MK2504**	**Elective**	**2**	**Biochemistry**											■	■	■	■	■	■	■	■		■	■	■	■
Bioactivity of Natural Materials	**BBA**	**MK2505**	**Elective**	**2**	**Biochemistry**											■	■	■	■	■	■	■	■		■	■	■	■
Bioenergy	**BIO**	**MK2506**	**Elective**	**2**	**Biochemistry**											■	■	■	■	■	■	■	■		■	■	■	■
Adsorption Technology			**Elective**	**2**	Study program														■		■				■	■	■	■
Green and Sustainable Chemistry			**Elective**	**2**	Study program	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■		■	■	■	■
Waste Treatment Technology			**Elective**	**2**	Study program																							■

E. LIST OF MATAKULIAH PER SEMESTER

Table 4.5. Distribution of courses per semester

SEMESTER 1						
	DEVELOPMENT CONCENTRATION ESSENTIAL OIL AND PRODUCT DERIVATIVES	SKS	CONCENTRATION OF MATERIALS AND ELECTROCHEMISTRY FOR ENERGY AND THE ENVIRONMENT	SKS	CONCENTRATION OF NON-ESSENTIAL ISOLATION AND SYNTHESIS FOR HEALTH AND FOOD	SKS
1.	Instrument Chemistry	3	Instrument Chemistry	3	Instrument Chemistry	3
2.	Separation and Purification Chemistry	3	Separation and Purification Chemistry	3	Separation and Purification Chemistry	3
3.	Synthesis of Essential Oils and Their Derivatives	3	Quantum and Computational Chemistry	3	Natural Material Synthesis	3
4.	Synthesis of Organic and Inorganic Chemistry	3	Synthesis of Organic and Inorganic Chemistry	3	Synthesis of Organic and Inorganic Chemistry	3
5.	Essential Oil Characterization	3	Electrochemical Analysis	3	Pharmacology and Toxicology	3
6.	Ecology and Environmental Chemistry	2	Ecology and Environmental Chemistry	2	Ecology and Environmental Chemistry	2
7.	Organic reaction mechanism	2	Advanced Materials	2	Organic reaction mechanism	2
TOTAL CREDITS		19		19		19
SEMESTER 2						
	DEVELOPMENT CONCENTRATION ESSENTIAL OIL AND PRODUCT DERIVATIVES	SKS	CONCENTRATION OF MATERIALS AND ELECTROCHEMISTRY FOR ENERGY AND THE ENVIRONMENT	SKS	CONCENTRATION OF NON-ESSENTIAL ISOLATION AND SYNTHESIS FOR HEALTH AND FOOD	SKS
1.	Research and publication design	2	Research and publication design	2	Research and publication design	2
2.	Proposal and Preliminary Research	2	Proposal and Preliminary Research	2	Proposal and Preliminary Research	2
3.	Elucidation of Organic and inorganic compounds	2	Elucidation of Organic and inorganic compounds	2	Elucidation of Organic and inorganic compounds	2
4.	Elective courses	2	Elective courses	2	Elective courses	2
5.	Elective courses	2	Elective courses	2	Elective courses	2

6.	Elective courses	2	Elective courses	2	Elective courses	2
TOTAL CREDITS		**12**		**12**		**12**
Elective courses						
1.	Essential Oil Industry Process	2	Catalyst Chemistry	2	Functional Food Chemistry	2

2.	Perfume, Flavor, Aromatherapy	2	Inorganic reaction mechanism	2	Enzimology	2
3.	Oil bioactivity essential	2	Sensors and Biosensors	2	Synthesis Technique Enzymatic	2
4.	Essential oil for edible coating	2	Functional materials	2	Bioactivity of natural ingredients	2
5.	Essential oil for pest control	2	Energy Conservation	2	Bioenergy	2
6.	Green and Sustainable Chemistry	2	Green and Sustainable Chemistry	2	Green and Sustainable Chemistry	2
7.	Adsorption Technology	2	Adsorption Technology	2	Adsorption Technology	2
8.	Waste Treatment Technology	2	Waste Treatment Technology	2	Waste Treatment Technology	2
SEMESTER 3						
	DEVELOPMENT CONCENTRATION ESSENTIAL OIL AND PRODUCT DERIVATIVES	**SKS**	**CONCENTRATION OF MATERIALS AND ELECTROCHEMISTRY FOR ENERGY AND THE ENVIRONMENT**	**SKS**	**CONCENTRATION OF NON-ESSENTIAL ISOLATION AND SYNTHESIS FOR HEALTH AND FOOD**	**SKS**
1.	Islam Ulil Albab	2	Islam Ulil Albab	2	Islam Ulil Albab	2
2.	Thesis Research	5	Thesis Research	5	Thesis Research	5
3.	Islam Rahmatan Lil Alamin	1	Islam Rahmatan Lil Alamin	1	Islam Rahmatan Lil Alamin	1
4.	Scientific work International	1	Scientific work International	1	Scientific work International	1
TOTAL CREDITS		**9**		**9**		**9**
SEMESTER 4						
	DEVELOPMENT CONCENTRATION ESSENTIAL OIL AND PRODUCT DERIVATIVES	**SKS**	**CONCENTRATION OF MATERIALS AND ELECTROCHEMISTRY FOR ENERGY AND THE ENVIRONMENT**	**SKS**	**CONCENTRATION OF NON-ESSENTIAL ISOLATION AND SYNTHESIS FOR HEALTH AND FOOD**	**SKS**
1.	Thesis	2	Thesis	2	Thesis	2
TOTAL CREDITS		**2**		**2**		**2**

Table 4.6. Mandatory student activity

Code	Name of learning activity	Translation in English	Shape Learning	Weight skp

S11	Intensive Study of the Quran	Intensive Study of the Quran	Workshop; Student centered-learning	5

S12	Islam in the discipline of chemistry	Islam in the discipline of chemistry	Workshop; Laboratory based learning	3
S21	Ethics in the chemist profession	Ethics in the chemist profession	Workshop; Student centered-learning	2
S22	Scientific Writing / Activity Workshop Publication	Scientific Writing / Activity Workshop Publication	Workshop; Student centered-learning	2
				12 skp

F. STUDENT ACTIVITY EXPENSES IN PARTICIPATION CREDIT UNIT (SKP)

The PSMK curriculum is prepared based on the defined CPL, which is 23 CPL. Academic activities consist of compulsory courses, elective courses, compulsory workshop activities consisting of a minimum of 36 semester credit units (SKS) and 12 participation credit units (SKP). Subjects consist of University Compulsory Subjects (MKWU), Compulsory Study Program Subjects (Compulsory Study Programs), Compulsory Concentration Subjects (Compulsory) and Elective Subjects.
The list of subjects is presented in Table 4.7.

Tabel 4.7. List of PSMK courses

No	Name of Course	COURSE	ABBREVIATION	Code of Course	STATUS	SKS
1.	Islam Ulil Albab	Islam for Scholar	IUA	MKWU01	Compulsory MKWU	2
2.	Sintesis Kimia Organik dan Anorganik	Synthesis of Organic and Inorganic Chemistry	SOA	MK1101	Compulsory STUDY PROGRAM	3
3.	Elusidasi Senyawa Organik dan Anorganik	Elucidation of Organic and Inorganic Compounds	EOA	MK2206	Compulsory STUDY PROGRAM	3
4.	Ekologi dan Kimia Lingkungan	Ecology and Environmental Chemistry	EKL	MK1601	Compulsory STUDY PROGRAM	2
5.	Kimia Pemisahan dan Pemurnian	Chemical Separation and Purification	KPP	MK1402	Compulsory STUDY PROGRAM	3

6.	Kimia Instrumen	Instrumental chemistry	KIN	MK1401	Compulsory STUDY PROGRAM	3

No	Name of Course	COURSE	ABBREVIATION	Code of Course	STATUS	SKS
7.	Desain Riset dan Publikasi	Research Design and Publication	DRP	MK2602	Compulsory STUDY PROGRAM	2
8.	Proposal dan Penelitian Pendahuluan	Proposal and Preliminary Research	PPP	MK2603	Compulsory STUDY PROGRAM	2
9.	Penelitian Thesis	Research for Thesis	PTH	MK3604	Compulsory STUDY PROGRAM	5
10.	Karya Ilmiah Internasional	International Scientific Work	KII	MK3605	Compulsory STUDY PROGRAM	2*
11.	Thesis	Thesis	THE	MK4606	Compulsory STUDY PROGRAM	2
Essential Oil Concentration						
12	Sintesis Minyak Atsiri dan Turunannya	Synthesis of Essential Oils and Derivatives	SMA	MK1201	Compulsory	3
13	Mekanisme reaksi organik* Bersama dengan konsentrasi Pengembangan Bahan alam untuk kesehatan dan pangan	Organic reaction mechanism * Together with the concentration of Development of Natural Resources for health and food	MRO	MK2204	Compulsory	2
14	Karakterisasi Minyak Atsiri	Characterization of Essential Oils	KMA	MK1203	Compulsory	3
Concentration of Materials and Electrochemicals for Energy and the Environment						
15	Material Maju	Advanced Material	MMA	MK2102	Compulsory	2
16	Kimia Kuantum dan Komputasi	Quantum and Computational Chemistry	KKK	MK1301	Compulsory	3
17	Analisis Elektrokimia	Electrochemical Analysis	AEL	MK2404	Compulsory	3
Concentration of Natural Material Development for Food and Health						
18	Sintesis Bahan Alam	Synthesis of natural product	SBA	MK1202	Compulsory	3
19	Farmakologi dan Toksikologi	Farmakologi dan Toksikologi	FTO	MK1501	Compulsory	3

13	Mekanisme reaksi organik	Organic reaction mechanism	MRO	MK2204	Compulsory	2

No	Name of course	COURSE	ABBREVIATION	Code of Course	STATUS	SKS
ELECTIVE COURSES (ALL STUDENTS MAY BE TAKEN APPROPRIATE RESEARCH NEEDS)						
20	Mekanisme reaksi anorganik	Inorganic reaction mechanism	MRA	MK2103	Elective	2
21	Material Fungsional	Functional Materials	MFU	MK2104	Elective	3
22	Proses Industri Minyak Atsiri	Process of the Essential Oil Industry	PIM	MK2205	Elective	2
23	Parfum, Flavor dan Aroma Terapi	Perfume, Flavor and Aroma Therapy	PFA	MK2207	Elective	2
24	Bioaktivitas minyak atsiri	Bioactivity of essential oils	BAA	MK2208	Elective	2
25	Minyak Atsiri untuk edible coating	Essential oils for edible coatings	MAE	MK2209	Elective	2
26	Minyak Atsiri untuk pengendalian hama	Essential oils for pest control	MAP	MK2210	Elective	2
27	Kimia Katalis	Chemical catalyst	KKA	MK2302	Elective	2
28	Sensor dan Biosensor	Sensor dan Biosensor	SDB	MK2303	Elective	2
29	Konservasi Energi	Energy Conservation	MEN	MK2304	Elective	2
30	Enzimologi	Enzymology	ENZ	MK2502	Elective	2
31	Teknik Sintesis Enzim	Techniques of Enzyme Synthesis	TSE	MK2503	Elective	2
32	Kimia Pangan Fungsional	Functional Food Chemistry	KPF	MK2504	Elective	2
33	Bioaktivitas Bahan Alam	Bioactivity of Natural Product	BBA	MK2505	Elective	2
34	Bioenergi	Bioenergy	BIO	MK2506	Elective	2
35	Kimia Hijau dan Lestari	Green and Sustainable Chemistry	KHL	MK2607	Elective	2
36	Teknologi Adsorpsi	Adsorption Technology	TAD	MK2608	Elective	2
37	Teknologi Pengolahan	Waste Management	TPL	MK2609	Elective	2

No	NAMA MATA KULIAH	COURSE	SINGKATAN	KODE MATKUL	STATUS	SKS
	Limbah	Technology				

* minimum requirements: acceptance letter indexed international proceedings that are recognized by DIKTI (SCOPUS, WoS)

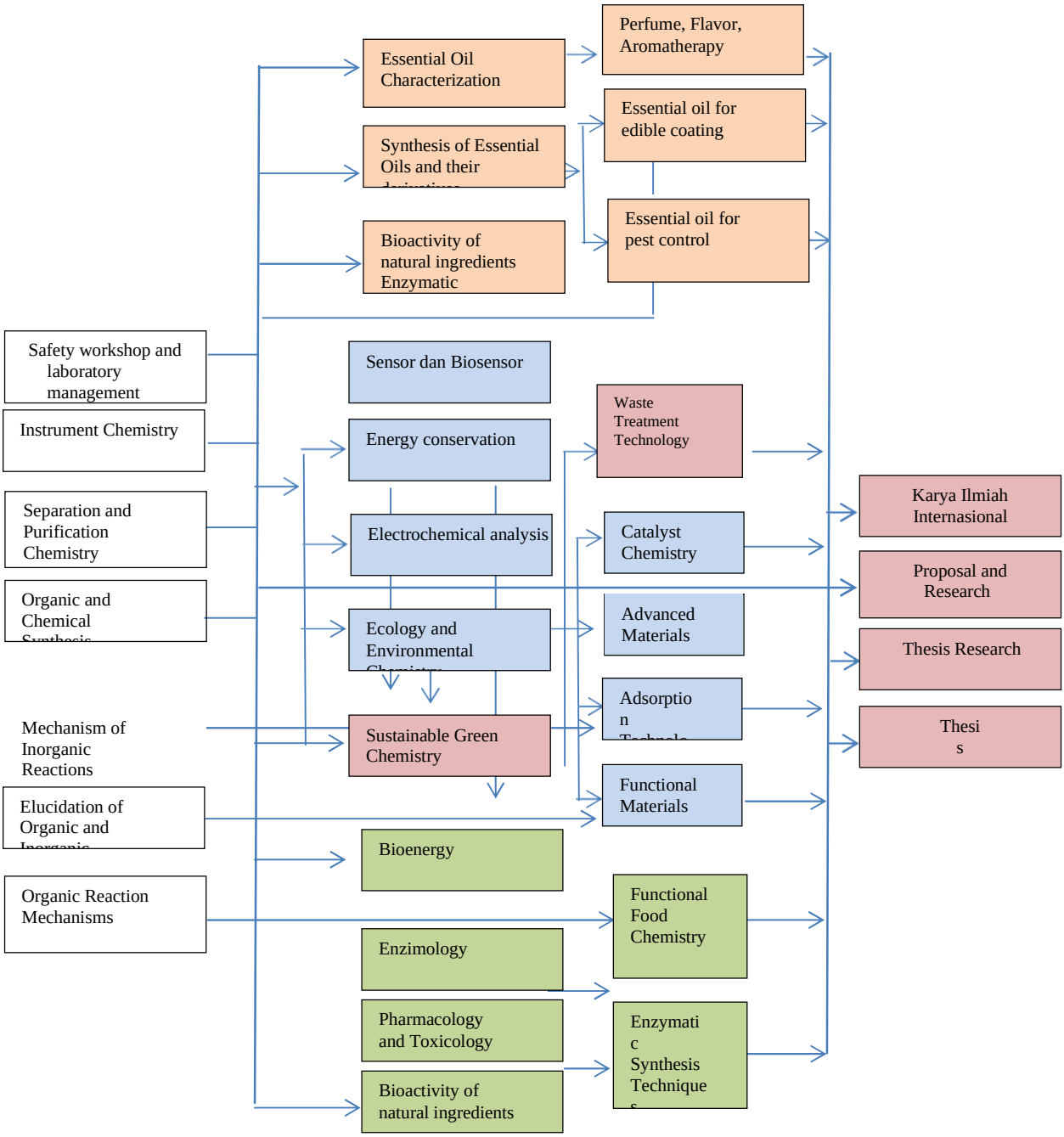
Recapitulation of student learning load during lecture is presented in Table 4.8.

Table 4.8. Recapitulation of student learning load during lectures

Compulsory courses	36 sks	Total 42 sks
Elective courses	6 sks	
Intensive Study of the Quran	5 skp	Total 12 skp
Islam in the discipline of chemistry	3 skp	
Ethics in the chemist profession	2 skp	
Scientific Writing / Activity Workshop Publication	2 skp	

The distribution of subjects per semester is presented in Table 4.5, and the compulsory student activities are presented in Table 4.6.

G. MAP OF THE MATAKULIAH TAKING FLOW



H. STANDARDISADI COURSE CODE / BLOCK

Based on the circular BPA UII standardization course / block codes are:

X	X	X	-	1	2	3

Course Coding Provisions:

- **Letter digits XXX: Code 3 Letter for the course organizing unit**
  a. University course code : UNI
  b. Study program course code:
     X First = Nama Prodi : Chemistry (code: C)
     X Second = Expertise Group:
     1. General Group : General (code: G)
     2. Organic Chemistry Research Group : Organic (code: O)
     3. Inorganic Chemistry Research Group : Inorganic (code: I)
     4. Physical Chemistry Research Group : Physic (code: P)
     5. Biochemistry Research Group : Biochemistry (code: B)
     6. Analytical Chemistry Research Group : Analytical (code: A)

     X third = Education Strata Level:
     1. Strata 1 : Bachelor (code: B)
     2. Strata 2 : Master (code: M)
     3. Strata 3 : Doctor (code: D)
- **Digit number 1:**
  a. Semester Position : 1-8
  b. Elective courses 9
- **Digits 2 and 3: course serial number : 01 and so on (course sequence)** based on Semester and elective courses.

I. LEARNING METHODS

The learning process used in the delivery of courses is adjusted to course learning outcomes (CPMK) as a derivative of graduate learning outcomes (CPL). The learning methods used include workshops, student activity-based learning, collaborative learning, problem-based learning, exploration-based learning and project-based learning. In a structured manner, it is expected that all courses will be implemented using a combination method outside the network (offline) and online. The strategic approach and learning techniques are presented in Table 4.9.

Table 4.9. Strategic approaches and learning techniques in each CPL

CPL	Learning approaches / strategies / methods / techniques								
	Workshop	Student Activity based	Collaborative	Project based	Problem based	Independently	Laboratory	Exploration of knowledge	Online
CPL1	√	√	√			√		√	
CPL2	√	√	√			√		√	
CPL3	√	√	√			√		√	
CPL4	√	√	√			√		√	
CPL5	√	√	√			√		√	
CPL6	√	√	√			√		√	
CPL7	√	√	√			√		√	
CPL8	√	√	√			√		√	
CPL9		√	√	√	√	√		√	√
CPL10		√	√	√	√	√		√	√
CPL11		√	√	√	√	√		√	√
CPL12		√	√	√	√	√		√	√
CPL13		√	√	√	√	√		√	√
CPL14		√	√	√	√	√	√	√	√
CPL15		√	√	√	√	√		√	√
CPL16		√	√	√	√	√		√	√
CPL17		√	√	√	√	√		√	√
CPL18		√	√	√	√	√		√	√
CPL19		√	√	√	√	√	√	√	√
CPL20		√	√	√	√	√		√	√
CPL21		√	√	√	√	√		√	√
CPL22		√	√	√	√	√	√	√	√
CPL23		√	√	√	√	√	√	√	√

J. Learning Outcomes Measurement Design

Measurement of CPL fulfillment will be carried out by the Study Program in order to ensure the achievement of learning objectives in the entire curriculum. The method of measuring CPL is done by adjusting the learning model according to the CPMK. This determines the assessment instrument. The accumulation of the CPMK evaluation for each course will be mapped for the overall CPL evaluation.

The measurement model for CPL achievement based on measurement objects is all students, and for subjects that use an output basis, the assessment instrument also adjusts the type of research output.

Table 1 Design of the CPL Measurement Method

Formulation of the CPL	Measurement method	Subject / learning stage that is measured	Assessment instrument
Able to show devotion to God Almighty by carrying out His shari'a in daily life. Uphold Islamic morals and universal ethics	Interview, Response, Visual observation visual	Workshop	Questionnaire
Able to show an inclusive view of life and be able to get along in the global community while maintaining an identity Islamic and Indonesian	Interview, Response, Visual observation visual	Workshop	Questionnaire
Contributing to improving the quality of life in society, nation, state and progress of civilization based on Pancasila.	Interview, Response, Visual observation visual	Workshop	Questionnaire
Acting as citizens who are proud and love the country, have nationalism and a sense of responsibility to the state and nation.	Interview, Response, Visual observation visual	Workshop	Questionnaire
Respect the diversity of cultures, views, religions and beliefs, as well as opinions or other people's original findings.	Interview, Response, Visual observation visual	Workshop	Questionnaire
Work together and have social sensitivity and concern for the community and environment.	Interview, Response, Visual observation visual	Workshop	Questionnaire
Obey the law and discipline in social life and patriotic.	Interview, Response, Visual observation visual	Workshop	Questionnaire
Internalizing academic values, norms and ethics.	Interview, Response, Visual observation visual	Workshop	Questionnaire
Demonstrate an attitude of responsibility for work in their field of expertise independently.	Interview, Response, Visual observation visual	Workshop	Questionnaire

Formulation of the CPL	Measurement method	Subject / learning stage that is measured	Assessment instrument
Internalizing the spirit of independence, struggle, and entrepreneurship.		Based learning the output	
Able to master and apply the concepts and theories of structure and properties, energetics, kinetics, analysis and micro synthesis and macromolecules in Indonesian natural materials	Written / Presentation / Laboratory / Project Assignment	Courses with CPL 14-CPL 23	Assignment sheet, Project
Able to master theoretical concepts about the functions of the latest instruments in the chemical field and how to operate them, and master the application of management technology Indonesian natural ingredients	Written / Presentation / Laboratory / Project Assignment	Courses with CPL 14-CPL 23	Assignment sheet, Project
Able to master and apply the latest principles, procedures, and handling techniques to the impact of the use of Indonesian natural chemicals on people's lives, environment, social and economy.	Written / Presentation / Laboratory / Project Assignment	Courses with CPL 14-CPL 23	Assignment sheet, Project
Able to develop logical, critical, systematic, and creative thinking through scientific research, scientific theses and publications, design creation in the fields of science and technology that pay attention and applying humanities values in accordance with their fields of expertise, compiling scientific conceptions and the results of their studies based on scientific principles, procedures and ethics.	Written / Presentation / Laboratory / Project Assignment	Courses with CPL 14-CPL 23	Assignment sheet, Project
Able to carry out validation and studies according to their area of expertise in solving problems in the relevant community or industry through the development of their knowledge and expertise.	Written / Presentation / Laboratory / Project Assignment	Courses with CPL 14-CPL 23	Assignment sheet, Project
Able to compile ideas, thoughts, and scientific arguments responsibly and based on academic ethics, as well communicate through the media to the public academics and society at large	Written / Presentation / Laboratory / Project Assignment	Courses with CPL 14-CPL 23	Assignment sheet, Project

Formulation of the CPL	Measurement method	Subject / learning stage that is measured	Assessment instrument
Be able to identify the scientific field that is the object of his research and position it on a research map developed through an interdisciplinary or multidisciplinary approach in the field of Indonesian natural materials.	Written / Presentation / Laboratory / Project Assignment	Courses with CPL 14-CPL 23	Assignment sheet, Project
Able to make decisions in the context of solving problems in the development of science and technology that pay attention to and apply humanities values based on analytical or experimental studies information and data	Written / Presentation / Laboratory / Project Assignment	Courses with CPL 14-CPL 23	Assignment sheet, Project
Able to manage, develop and maintain networks with colleagues, colleagues within the wider research institution and community	Written / Presentation / Laboratory / Project Assignment	Courses with CPL 14-CPL 23	Assignment sheet, Project
Able to increase learning capacity independently	Written / Presentation / Laboratory / Project Assignment	Courses with CPL 14-CPL 23	Assignment sheet, Project
Able to document, store, secure, and recover research data in order to guarantee validity and prevents plagiarism.	Written / Presentation / Laboratory / Project Assignment	Courses with CPL 14-CPL 23	Assignment sheet, Project
Able to deepen or expand chemical or applied chemistry science by producing accurate, tested, and innovative models / methods / theory development in the field of essential oils or materials and electrochemistry for energy and the environment and synthesis. non-essential for health and food.	Written / Presentation / Laboratory / Project Assignment	Courses with CPL 14-CPL 23	Assignment sheet, Project
Able to solve science and technology problems related to the structure, properties, and chemical changes at the level micro- and macromolecules, through an experimental approach,	Written / Presentation / Laboratory / Project Assignment	Courses with CPL 14-CPL 23	Assignment sheet, Project

Formulation of the CPL	Measurement method	Subject / learning stage that is measured	Assessment instrument
theoretical deduction or computation /simulation, and inter- or multidisciplinary approaches, characterized by the production of work that has the potential to be applied in solving the iptext problem.			

K. Learning Evaluation Design

Learning evaluation for all subjects in the PSMK curriculum is carried out based on the following stages:

- Evaluation in each course based on the achievement of CPMK;
- Evaluation for each student is carried out every semester
- Evaluation for each student is also carried out in the middle of the study period,
- Evaluation of the deadline for student study is adjusted to SN DIKTI,
- The study program conducts a final evaluation of each student through a closed theory judicium;
- The study program conducts final graduation studies for students.

Thesis Implementation

- When registering a thesis, students must have taken a minimum of 30 credits.
- Students must have taken the Research Methodology course with a minimum grade of C.
- The thesis is more fully regulated in the Thesis Guide.

Thesis trial

Thesis trial can be done with the following conditions:

a. Have taken a minimum of 42 credits with the provisions for compulsory courses of 36 credits and a minimum of 6 credits of elective courses.
b. Has passed the graduation close theory.
c. Submitting a thesis that has been approved by Supervisor 1 and Supervisor 2, with regular binding without hard cover.
d. Has paid the cost of guidance and education in accordance with the Dean's Decree or applicable regulations.

Judicium Close Theory

Graduation in the theory closed judicium is one of the requirements that must be met for a student who will carry out a thesis awareness exam. A student is declared to have passed the theory close judicium if it meets the following conditions:

1. Have taken a minimum of 42 credits with conditions.
   a. Compulsory 36 credits, including thesis
   b. Minimum Elective Subject is 6 credits.
2. **There are no subjects that have the value of E, F or K.**
3. **Minimum GPA of 3.0.**

Final Study Judicium

Before graduation, students must pass the Final Study Judiciary with the following requirements:

a. Has passed the graduation close theory.
b. Have taken a minimum of 42 credits with the provisions for compulsory courses of 33 credits and 9 credits of minimum elective courses.
c. Minimum GPA of 3.0.
d. Submit a photocopy of the CEPT 450 test certificate.
e. Proof of submission of the Thesis manuscript in the form of hard cover (1) which has been signed by all examiners and approved by the Dean to Supervisor 1 and Supervisor 2, as well as the Faculty library.
f. Proof of loan-free library books for the Faculty of Mathematics and Natural Sciences and the Central Library.
g. Proof of free laboratory administration inside and outside UII.
h. Certificate of free of Faculty financial administration.
i. Abstract (in English) and digest, accompanied by a title and signed by the supervisor.
j. Latest Study Result Card (KHS).
k. Proof of submission of the thesis manuscript on CD to the library.
l. Submit a paper / thesis summary (hard copy and CD) in the format of a scientific article with one space, at least 10 pages that are validated by the first supervisor and the supervising lecturer 2. The rules and writing format are regulated in more detail in the Thesis Guidebook.
m. Show evidence of 1 paper published in an international reputable journal.

L. Educational Quality Assurance Design

Education quality assurance is carried out by PSMK to ensure the quality of graduates according to the scheme in Figure 11.1. The syllabus for each subject in the curriculum is translated into a Semester Learning Plan (RPS) by the teaching lecturer along with learning methods and learning evaluation instruments based on CPMK. The learning evaluation instrument is carried out through the preparation of an assessment rubric by the lecturer who is approved by the Head of the Study Program. Evaluation of the achievement of CPMK is carried out by each lecturer for each student in each subject through Mid-Semester Assessment (PTS) and Final Semester Assessment (PAS). Lecturers strive to guarantee the minimum CPMK achievement for each student through assignments throughout the semester. The realization of the RPS implementation is evaluated by the Head of the Study Program at the middle and end of the semester, and it is possible that the input from students can also be used as a reference for improving the learning process.

The final evaluation of learning by the Head of the Study Program is carried out by

taking into account the following points:

a. Realization of lecturer meetings / attendance
b. Material conformity with RPS
c. Validation of learning evaluation instruments
d. CPMK and CPL measurements for each subject;
e. A general evaluation of learning includes any necessary improvements

The Plan, DO, Check and Action (PDCA) stages of learning quality assurance at PSMK are presented through the scheme in Figure 4.4.

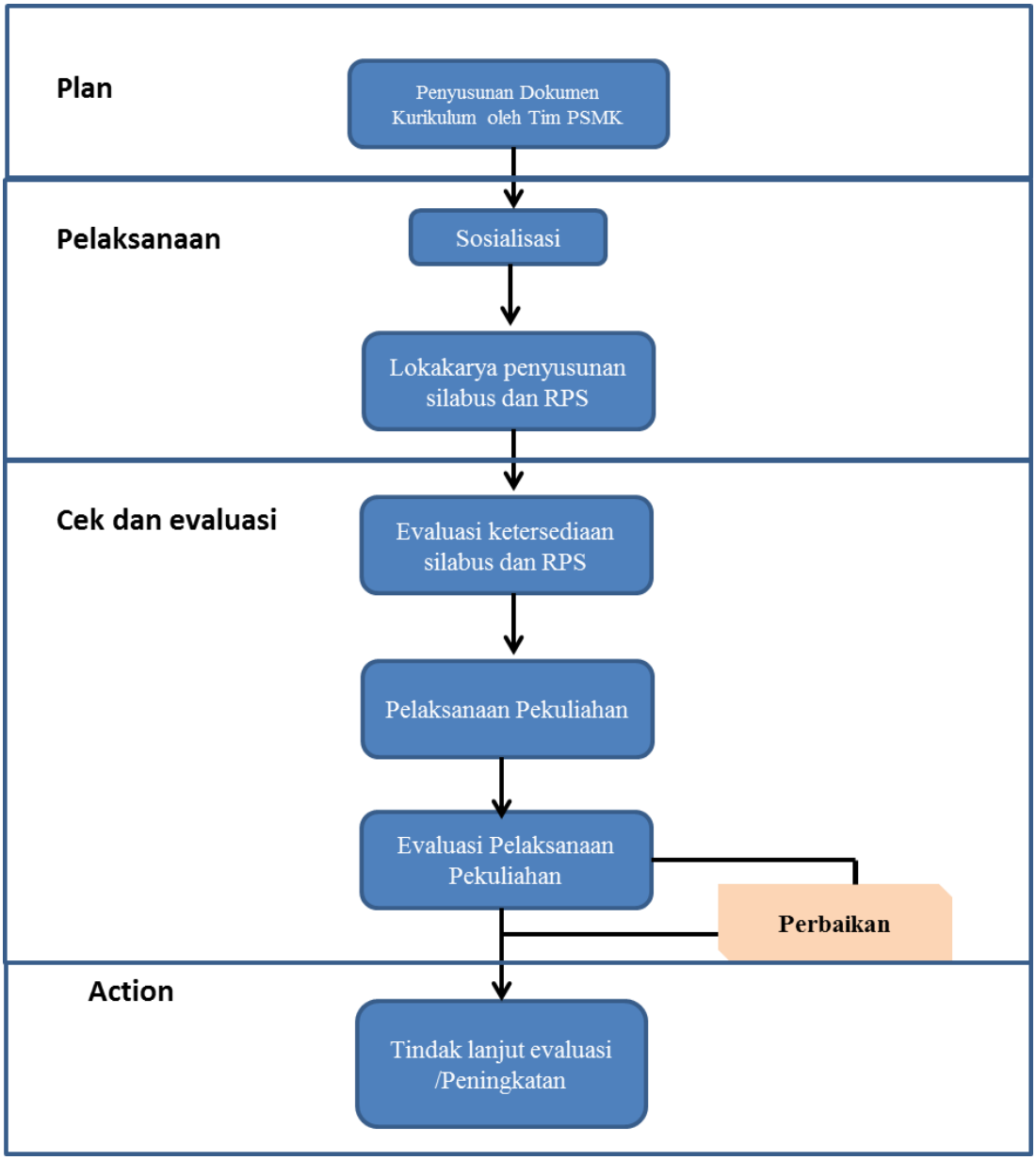


Figure 4.4. Plan, DO, Check and Action (PDCA) stages of quality assurance learning at PSMK

CHEMISTRY MASTER COURSE SYLABUS

SEMESTER 1

ALL CONCENTRATION

Instrument Chemistry

Study Materials

The lecture on Instrument Chemistry includes a discussion of the basic theory of selected spectroscopy, the principles of various selected spectrometric analysis methods, and particle-surface analysis methods. Discussion of the advantages and disadvantages between methods, the use of tool components, working principles, sample preparation and qualitative identification methods for inorganic and organic samples with various selected spectrometers. Selected spectrometers include IR-Raman, NMR, ICP AES / EOS, XRF, XPS, AES, NAA as well as the PSA / PSD and AFM particle-surface analysis instruments.

Abbreviation:

Infra red (IR), *nuclear magnetic resonance* (NMR), *induced coupled plasma atomic emission spectroscopy* (ICP-AES), *emission optic spectroscopy* EOS), *X-ray fluorescence* (XRF), *X-ray photoelectron spectroscopy* (XPS), *Auger electron spectroscopy* (AES), *neutron activation analysis* (NAA), *particle size analyzer* (PSA), *particle size distribution* (PSD) dan *atomic force microscopy* (AFM).

Reference

1. Vandenabeele, Peter (2013). *Practical Raman spectroscopy: An Introduction.* Wiley. ISBN 978-0470683194
2. J. Keeler (2005). *Understanding NMR Spectroscopy*. John Wiley & Sons. ISBN 978-0-470-01786-9.
3. Principle of ICP Optical Emission Spectrometry (ICP-OES) : Hitachi High-Technologies GLOBAL, www.hitachi
4. Beckhoff, B., Kanngießer, B., Langhoff, N., Wedell, R., Wolff, H.(2006), *Handbook of Practical X-Ray Fluorescence Analysis*, Springer. ISBN 3-540-28603-9
5. J.F.Watts, J.Wolstenholme (2003). *An Introduction to Surface Analysis by XPS and AES*, , published by Wiley & Sons, Chichester, UK, ISBN 978-0-470-84713-8.
6. P. Bode: *Instrumental and organizational aspects of a neutron activation analysis laboratory*. Reactor Institute Delft, Nederland.

Separation and Purification Chemistry

Study Materials

Classification methods on the basis of separation; Extraction techniques include the theory and application of liquid-liquid, liquid-solid extraction techniques, micro-solid phase extraction, comparison of the efficiency of several techniques and the development of extraction techniques. Chromatography includes the general theory of chromatography, separation mechanisms, column efficiency, resolution, and applications of TLC chromatography, HPLC includes NPC, RPC, IC, SEC, GC, GC-MS and various detectors (ECD, FID, NPD, PID). Electrophoresis, theory and application, various separation techniques PNC PAGE, SDS PAGE, CE; separation of element / molecule speciation.

Reference

1. Quantitative Chemical Analysis, Daniel C. Harris, 8th edition,2010, W. H. Freeman & Co., New

York, ISBN: 9781429218153
2. Modern Analytical Chemistry, David Harvey, McGraw-Hill, 1st ed, 2000, ISBN: 0–07–237547–7 2.
3. Chemical Analysis: Modern Instrumentation Methods and Techniques, Francis Rouessac, AnnickRouessac, John Wiley & Sons, 2nd ed, 2007.ISBN: 0470859040, 9780470859049
4. Principles of Instrumental Analysis", D. A. Skoog, F. J. Holler, S.R. Crouch, Brooks Cole; 6th edition (Dec 6 2006) , ISBN: 0495012017 , 978-0495012016

Synthesis of Organic and Inorganic Chemistry

Study Materials

Synthesis and analysis; waste management and current topics in chemistry; all the material in the related subjects in the Master of Chemistry

Reference

1. Warren, S., 1982, Organic Synthesis: The Disconnection Approach, John Wiley & Sons Ltd., Chichester.
2. Smith, M.B., 1994, Organic Synthesis, McGraw-Hill, Inc., New York.

Ecology and Environmental Chemistry

Study Materials

1. Ecological succession: Effects of agricultural land clearing on soil nitrogen availability, the linkage of land cover to crop types and agricultural land cover on water salinity.
2. Budget of chemical compounds in forest ecosystems: Nutrient cycles, effects of deforestation on soil nutrient availability and nutrient elution from soil.
3. Energy and matter flux in the ecosystem: Relation of physico-chemical and community factors, inequality of primary productivity, inefficient transfer of energy, flow of energy and matter from decomposition to consumer, decomposition of energy-rich molecules to carbon dioxide, water and inorganic nutrients.
4. Nutrient budget: budget in terrestrial ecosystem, budget in aquatic community and cycle of phosphorus, nitrogen, sulfur and carbon.
5. Acidic properties: atmosphere, deposition and weathering.
6. Amosphere and water interaction: Gas-water balance in open and closed systems, transports gas across air-water boundaries
7. Circulation system: Temperature and salinity profile, redox energy, speciation and redox cycle
8. Production and destruction of organic materials: Assimilation, aerobic digestion and oxygen consumption
9. Water system carbon biogeochemistry: Formation of calcium carbonate, solubility and speciation of calcium carbonate, vertical and horizontal segregation
10. Diagenesis: Definition, trace metal sources in sediments, input from rivers and the atmosphere, remobilization due to diagenesis
11. Equilibrium at the environmental interface, chemical exchange between water and air: Desorption of gases and liquids from aeration basins and rivers, exchange of chemicals across the air-water interface of lakes and oceans, transfer of heat across the air-water interface
12. Chemical transportation: Chemical movement in the lower part of flowing rivers, chemical movement under ponds, lakes and still water bodies, chemical movements in the bottom of estuaries and oceans
13. Chemical exchange between water and soil: The rate of chemical flux through the lower layers of the atmosphere, the upper layers of clayey materials.
14. Chemical transport between phases and fate: On the surface of the water, the atmosphere, and the soil medium.

15. Studies on the nature, effects and detection of toxic substances in the environment and in any species exposed to the environment including humans.
16. General understanding of toxicology related to the environment.

17. The basic concept of tocology: Basic understanding and types of hazardous substances, dose-response relationship (endogenous and exogenous, acute and chronic effects, reversible and irreversible effects, independent and additive effects), the concept of toxicokinetics and toxicity mechanisms (exposure, uptake, distribution and elimination, blocking and inhibition of enzymes, ATP and macromolecular biology, mutagenesis, carcinogenesis, tetratgenesis)

Reference

1. Townsend, C.R., Begon, M and Harper, J.L., 2008, Essensial of Ecology, 3rd Ed., Balckwell Pubs. Malden
2. Bashkin, V.N, 2006, Modern Biogeokimia: Environmental Rsik Assessment, 2nd, Springer, Dordrech
3. Thibodeaux, L.J., 1996, Environmental Chemodynamic, John Wiley & Sons, New York
4. Andreas Luch, 2012, Molecular, Clinical and Environmental Toxicology, 3rd Volume, Springer
5. Ira S. Richards, 2009, Principles and Practice of Toxicology in Publich Khealth, Jones & Bartlett Pubs.
6. Manahan S.E., 1992, Toxicological Chemsitry, 2nd Ed., Lewis Publisher, New York.

CONCENTRATION OF ESSENTIAL OIL DEVELOPMENT AND ITS DERIVATIVED PRODUCTS

Synthesis of Essential Oils and Their Derivatives

Study Material

Synthesis and analysis; waste management and current topics in chemistry; all the material in the related subjects in chemistry master's degree; Essential oil, materials, electrochemical, non-essential, energy, environment.

Reference

1. Warren, S., 1982, Organic Synthesis: The Disconnection Approach, John Wiley & Sons Ltd., Chichester.
2. Smith, M.B., 1994, Organic Synthesis, McGraw-Hill, Inc., New York.
3. Sastrohamidjojo, H., 2004, Kimia Minyak Atsiri, cetakan pertama, Gadjah Mada University Press, Jogjakarta
4. Baser, K.H.C. and Buchbauer, G., 2010, Handbook of essential oils : science, technology, and applications, CRC Press, Taylor & Francis Group

Essential Oil Characterization

Study Material

Synthesis and analysis; waste management and current topics in chemistry; all the material in the related subjects in chemistry master's degree; Essential oil, materials, electrochemical, non-essential oil, energy, environment

Reference

1. Hermann, A., 2010, The Chemistry and Biology of Volatiles, John Wiley & Sons Ltd., Chichester.
2. Baser, K.H.C. and Buchbauer, G., 2010, Handbook of essential oils : science, technology, and applications, CRC Press, Taylor & Francis Group

Organic reaction mechanism

Study Material

Synthesis and analysis; waste management and current topics in chemistry; all the material in the related subjects in chemistry master's degree; Essential oil, materials, electrochemical, non-essential oil, energy, environment

Reference

1. *Sykes, P.*, 1985, Guide Book to Orgnnnanic Chemistry Mechanism, Longman Scientific & Techincal, Cambridge.

2. Grossman, R.B., 2003, The Art of Writing Reasonable Organic Reaction Mechanisms, Second Edition, Springer.

CONCENTRATION OF MATERIALS AND ELECTROCHEMISTRY FOR ENERGY AND THE ENVIRONMENT

Quantum and Computational Chemistry

Study Material

General theory in quantum includes operators and computational relations, quantum mechanical postulates and Schrödinger wave equations, free particles, particles in one, two and three dimensions, harmonic oscillators, rigid rotor and hydrogen atoms, quantum mechanics of chemical bonds, Born-Oppenheimer approximation, Huckel molecular orbital calculations, hybridization, symmetry, basics of molecular spectroscopy, computational chemistry methods: molecular mechanics methods, semi-empirical, ab initio, dft, post-scf.

Reference

1. Helvin W. Hanna, *Quantum Mechanics in Chemistry*, W.A. Benjamin, Inc, USA
2. Leach A.R., 1996, *Molecular Modeling*, Addison Wesley Longman Limited, England
3. Harno Dwi Pranowo, 2003, *Kimia Komputasi*, PKKIA
4. Ramachandran, K.I., Deepa, G., and Namboori, K., 2010, *Computational Chemistry and Molecular Modeling: Principles and Applications*, Springer Science, New York

Electrochemical Analysis

Study Material

Electrochemical Analysis

Reference

1. Bagotsky, V.S. 2006. *Fundamentals of electrochemistry*. New Jersey: John Wiley and Sons Inc.
2. Kissinger, P.T. & Heineman, W.R. 1996. *Laboratory techniques in electroanalytical chemistry. Second edition.* New York: Marcel Dekker. Inc.
3. Wang, J., 2006, *Analytical Electrochemistry*, 3rd Edition, Wiley VCH.
4. **Mikhelson**, Konstantin N., 2013, *Ion-Selective Electrodes*, Springer.
5. Florinel-Gabriel Banica, 2012, Chemical Sensors and Biosensors: Fundamentals and Applications 1st Edition, Wiley.
6. Michael Dornbusch, 2018, Corrosion Analysis, RC Press, Published.
7. Reiner Westermeier, 1993, Electrophoresis in Practice: A Guide to Methods and Applications of DNA and Protein Separations.

Advanced Materials

Study Material

Classification of materials based on electronic, magnetic, basic building blocks of materials, molecular size, ceramics, and polymers. Nanomaterials include nanoparticles, nanostructures and the principles of their application to the environment, catalysis, health and energy. The basic concepts of advanced material synthesis include the synthesis of nanomaterials (nanotubes, graphene, molecular organic framework, nanomembrane) as well as the basic concepts of reactions for various applications including adsorption, desorption, catalysis, photocatalysis, sonocatalysis (cavitation), and other surface reactions.

Reference

1. Robert, Vajtai, 2012, Handbook of Nanomaterials, Springer Press.
2. Hussein, 2018, Handbook of Nanomaterials for Industrial Applications, Elsevier Publ.

KONSENTRASI ISOLASI DAN SINTESIS NON ATSIRI UNTUK KESEHATAN DAN PANGAN

Natural Material Synthesis

Study Material

the concept of retons, Diels-Alder and reton aldol in the target molecule, the principles of advanced retrosynthesis (disconnection, chiral center material starting, reactive functional groups, the principle of symmetry), retrosynthetic analysis covering stereochemical aspects (identifying appropriate stereoselective strategies) such as enantio- and diastereoselectivity

Reference

1. Hsung, Richard P._ Huang, Peiqiang_ Yao, Zhu-Jun - Efficiency in natural product total synthesis (2018, John Wiley & Sons)
2. Nag, Ahindra - Asymmetric synthesis of drugs and natural products (2018, CRC Press)
3. Horace G. Cutler, Stephen J. Cutler - Biologically Active Natural Products_ Agrochemicals (1999, CRC Press)

Pharmacology and Toxicology

Study Material

1. The route of administration, absorption, distribution, elimination of drugs in the body and the factors that influence it,
2. pharmacodynamic-mechanism of action of the drug,
3. receptor and non-receptor theory,
4. signal transduction and second messengers,
5. the potency and effectiveness of drugs,
6. dose and response relationship,
7. agonists and antagonism, tolerance and tachypylaxis,
8. measurement of several pharmacological parameters,
9. the principle of toxicology and biochemical mechanisms of toxicity in mammalian and human species,
10. types of toxicants,
11. toxicogenomic,
12. toxic disposition,
13. pharmacogenomics and parmacogenetics

Reference

1. Terry Kenakin - A Pharmacology Primer, Third Edition_ Theory, Application and Methods-Academic Press (2009)
2. Miles Hacker, William S. Messer II, Kenneth A. Bachmann - Pharmacology Principles and Practice-Academic Press (2009)
3. John H. Duffus, Howard G. J. Worth - Fundamental toxicology-Royal Society of Chemistry (2006)

Organic reaction mechanism

Study Material

Synthesis and analysis; waste management and current topics in chemistry; all the material in the related subjects in chemistry master's degree; Essential oil, materials, electrochemical, non-essential oil, energy, environment

Reference

1. *Sykes, P.*, 1985, Guide Book to Orgnnnanic Chemistry Mechanism, Longman Scientific & Techincal, Cambridge.
2. Grossman, R.B., 2003, The Art of Writing Reasonable Organic Reaction Mechanisms, Second Edition, Springer.

SEMESTER 2

ALL CONCENTRATION

Research and publication design

Study Material

This course equips students to be able to analyze and design their needs in conducting research, writing research results, and research proposals. In addition, students are expected to be able to review articles (review) and make corrections to errors contained in the writing of the article to be published.

Referensi

1. Ranjit Kumar, 2011, Research Methodology: step-by-step for beginners, 3rd Ed., Sage, Los Angeles
2. C.R. Kothari, 2004, Research Methodology: methods & techniques, 2nd revised Ed., New Age International Publishers, New Delhi
3. Cargill, M. and O'Connor, P. ,2009, Writing Scientific Research Articles: Strategy and Steps, Chichester, West Sussex: John Wiley & Sons.

Proposal and Preliminary Research

Study Material

This course equips students to be able to analyze and design their needs in conducting research, writing research results, and research proposals. In addition, students are expected to be able to compile proposals and conduct pre-research and compile pre-research reports.

Reference

1. Ranjit Kumar, 2011, Research Methodology: step-by-step for beginners, 3rd Ed., Sage, Los Angeles
2. C.R. Kothari, 2004, Research Methodology: methods & techniques, 2nd revised Ed., New Age International Publishers, New Delhi
3. Cargill, M. and O'Connor, P. ,2009, Writing Scientific Research Articles: Strategy and Steps, Chichester, West Sussex: John Wiley & Sons.

Elucidation of Organic and inorganic compounds

Study Material

The basic principles of characterization / identification of materials, determine the principles of analysis methods and techniques commonly used for analysis (IR, XRD, DR-UV, TEM, SEM-EDX, thermal analysis (TGA, DTA), Surface Area Analyzer, XPS , PSA)

Reference

1. Anthony R. West, 1989, *Solid state chemistry and its applications*, John Willey and Sons, New York.
2. Jolly, W.L., 1991, *The Synthesis and Characterization of Inorganic Compounds*, Prentice Hall.
3. j.W. Niemansverdriet, 2000, *Sepectroscopy in Catalysis*, Willey-VCH, New York.

ELECTIVE COURSES

ELECTIVE COURSES
CONCENTRATION OF ESSENTIAL OIL DEVELOPMENT AND ITS DERIVATIVED PRODUCTS

Essential Oil Industry Process

Study Material

Synthesis and analysis; waste management and current topics in chemistry; all the material in the related subjects in chemistry master's degree; Essential oil, materials, electrochemical, non-essential oil, energy, environment

Reference

1. Baser, K.H.C. and Buchbauer, G., 2010, Handbook of essential oils : science, technology, and applications, CRC Press, Taylor & Francis Group
2. Shreve, N., 1964, Industrial Process Chemical, John Wiley & sons.

Perfume, Flavor, Aromatherapy

Study Material

Synthesis and analysis; waste management and current topics in chemistry; all the material in the related subjects in chemistry master's degree; Essential oil, materials, electrochemical, non-essential, energy, environment;

Reference

Jurnal-jurnal terbaru tentang parfum, flavor dan aromaterapi.

Essential oil bioactivity

Study Material

Properties and applications of essential oils for anti-bacterial, anti-viral, anti-cancer, anti-oxidant, anti-acne, anti-premature aging

Reference

Baser, K.H.C. and Buchbauer, G., 2010, Handbook of essential oils : science, technology, and applications, CRC Press, Taylor & Francis Group

Essential oil for edible coating

Study Material

Food coating technology, anti-microbial in food

Reference

1. Earle, M.; Earle, R.; Anderson, A. 2001, Food Product Development, Woodhead Publishing
2. Baser, K.H.C. and Buchbauer, G., 2010, Handbook of essential oils : science, technology, and applications, CRC Press, Taylor & Francis Group

Essential oil for pesticide control

Study Material

Natural pesticide formulations, repellents and attractants, anti-fungi of plantation plants

Reference

1. Milne, GWA, 1998, Handbook of Pesticides, CRC Press LLC, Florida
2. Mori, K. dan Tashiro, T, 2004, Useful Reactions in Modern Pheromone Synthesis, Curr. Org. Synth., 1, 11-29
3. Baser, K.H.C. and Buchbauer, G., 2010, Handbook of essential oils : science, technology, and applications, CRC Press, Taylor & Francis Group

Green and Sustainable Chemistry

Study Material

Twelve principles of green chemistry and sustainable development goals, several studies related to the principles of green chemistry including the atom economy, waste management, reduction of toxicological effects, green solvent, alternative energy and so on are associated with the role of laboratories, chemists, society, nation and state as well as religion. Development of the SDG concept in a structured evaluation of environmental changes and development.

Reference

1. Anastas, P., Warner, 2000, Green Chemistry: Theory and Practice, Oxford University Press
2. Anne E. Marteel-Parrish Martin A. Abraham, 2013, Green Chemistry and Engineering: A Pathway to Sustainability, American Institute of Chemical Engineers, Inc.

Adsorption Technology

Study Material

Basics of adsorption equilibrium, thermodynamics and adsorption kinetics, adsorption cycle and process, adsorption application system, adsorbent materials and their preparation design, adsorption application in various environmental fields and catalysis.

Reference

1. Barry Crittenden W John Thomas, 1998. Adsorption Technology and Design, Elsevier Pubisher
2. Douglas M. Ruthven, 1984. Principles of Adsorption and Adsorption Processes, John Wiley & Sons.

Waste Treatment Technology

Study Material

The Processing Technology course takes materials related to types of waste, waste recycling techniques, waste recycling (solid, liquid and gas), household waste recycling, loundry waste recycling, mining materials recycling, biomass and biogas, chrome waste recycling, plastic waste treatment and waste paper treatment, used oil, scrap metal, glass and others.

Reference

1. Skoog, D.A., West, D.M., James Holler, F., 2014, *Analytical Chemistry*, Saunder College Pubs, Philadelphia.
2. Maczulak, A.E., 2009, Waste Treatment (Green Technology), Facts On File Inc; 1 edition
3. Kreith, F., and Tchobanoglous, G., 2002, *Handbook of Solid Waste Management*,*2nd ed.*, McGraw-Hill Professional.

ELECTIVE COURSES
CONCENTRATION OF MATERIALS AND ELECTROCHEMISTRY FOR ENERGY AND THE ENVIRONMENT

Catalyst Chemistry

Study Material

Adsorption: thermodynamics and adsorption-desorption kinetics, surface reactions and other types of surface reaction kinetics. Homogeneous catalysts and their mechanisms, heterogeneous catalysts, and heterogeneous homogeneous catalysts. Principles of synthesis and characterization of several types of heterogeneous ketalists, enzyme catalysts, immobilized enzyme catalysts and their mechanisms.

Reference

1. Beller, Renken, van Santen, 2012, Catalysis from Principles to Applications, Wiley-VCH.
2. Hannefeld, Refferd, 2018, Catalysis: An Integrated Textbook for Students, Wiley-VCH.
3. Regalbuto, 2006, Catalyst Preparation: Science and Engineering, CRC Press.

Inorganic reaction mechanism

Study Material

Principles of inorganic compounds, in blocks d and f in complex compounds, organometallic and bioanorganic compounds, reaction mechanisms and the structure of complex macaromolecular inorganic compounds

Reference

1. Jordan, R.B., 2007, Reaction Mechanisms of Inorganic and Organometallic Systems, 3rd Ed., Oxford University Press, Oxford.
2. Katakis, D., and Gordon, G., 1987, Mechanisms of Inorganic Reactions, WileyInterscience Publication, New York.
3. Collman, v.J.P., Hegedus, L.G., Norton, J.R., and Finke, R.G., 1987, Principles and Applications of Organotransition Metal Chemistry, Oxford University Press, Oxford

Sensors and Biosensors

Study Material

The law of thermodynamics, the basics of energy conservation, energy change, management and renewable energy resources, alternative energy and increasing energy efficiency.

Reference

1. Florinel-Gabriel Banica. 2012. **Chemical Sensors and Biosensors: Fundamentals and Applications, John Wiley and Sons, New York**
2. Xueji Zhang, Huangxian Ju and Joseph Wang. 2008. **Electrochemical Sensors, Biosensors and their Biomedical Applications, Elsevier Publisher, Amsterdam.**

Functional materials

Study Material

Latest journals, technical journal writing and writing ethics and code of ethics

Reference

1. Jordan, R.B., 2007, Reaction Mechanisms of Inorganic and Organometallic Systems, 3rd Ed., Oxford University Press, Oxford.

2. Katakis, D., and Gordon, G., 1987, Mechanisms of Inorganic Reactions, WileyInterscience Publication, New York.

3. Collman, V.J.P., Hegedus, L.G., Norton, J.R., and Finke, R.G., 1987, Principles and Applications of Organotransition Metal Chemistry, Oxford University Press, Oxford

Energy Conservation

Study Material

The law of thermodynamics, the basics of energy conservation, energy change, management and renewable energy resources, alternative energy and increasing energy efficiency.

Reference

1. S. Thipse, 2013. ENERGY CONSERVATION AND MANAGEMENT, Technical Publication
2. Subhash L. Gadhave Mr. Pramod Mane Mr.Vishal Shitole, 2017. Energy Conservation and Management for GTU

Green and Sustainable Chemistry

Study Material

Twelve principles of green chemistry and sustainable development goals, several studies related to the principles of green chemistry including the atom economy, waste management, reduction of toxicological effects, green solvent, alternative energy and so on are associated with the role of laboratories, chemists, society, nation and state as well as religion. Development of the SDG concept in a structured evaluation of environmental changes and development.

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1. Anastas, P., Warner, 2000, Green Chemistry: Theory and Practice, Oxford University Press
2. Anne E. Marteel-Parrish Martin A. Abraham, 2013, Green Chemistry and Engineering: A Pathway to Sustainability, American Institute of Chemical Engineers, Inc.

Adsorption Technology

Study Material

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Reference

1. Barry Crittenden W John Thomas, 1998. Adsorption Technology and Design, Elsevier Pubisher
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Waste Treatment Technology

Study Material
The Processing Technology course takes materials related to types of waste, waste recycling techniques, waste recycling (solid, liquid and gas), household waste recycling, loundry waste recycling, mining waste recycling,

biomass and biogas, waste chromium recycling, plastic waste treatment and waste paper treatment, used oil, scrap metal, glass and others.

Reference

1. Skoog, D.A., West, D.M., James Holler, F., 2014, *Analytical Chemistry*, Saunder College Pubs, Philadelphia.
2. Maczulak, A.E., 2009, Waste Treatment (Green Technology), Facts On File Inc; 1 edition
3. Kreith, F., and Tchobanoglous, G., 2002, *Handbook of Solid Waste Management,2nd ed.,* McGraw-Hill Professional.

ELECTIVE COURSES
ISOLATION CONCENTRATION AND NON-essential SYNTHESIS FOR HEALTH AND FOOD

Functional Food Chemistry

Study Material

1. Definition of Functional Food
2. Antioxidants
3. Food Fiber
4. Prebiotics and Probiotics
5. Lipids and health
6. Minerals and vitamins
7. Sports Drinks
8. Food formula for babies
9. Soy products

Reference

1. Functional Foods – Principles and technology, Guo M. 2009, Woodhead Publishing Company, UK
2. (Food Analysis) S. Suzanne Nielsen (auth.), S. Suzanne Nielsen (eds.) - Food Analysis-Springer US (2010)
3. Semih Otles - Methods of Analysis of Food Components and Additives, Second Edition (Chemical & Functional Properties of Food Components) -CRC Press (2011)

Enzimology

Study Material

1. Preliminary studies of enzymes which include: Enzyme structure and properties (specificity, cofactor and prosthetic groups, enzyme classification, mechanism of enzyme action and free energy change, active site, covalent enzyme (acid-base) catalysis and metal ion catalysis)
2. Ezyme kinetics which includes: methods (steady state and continuous assay) to investigate enzyme-calcified reaction mechanisms, Henri-Michaelis-Menten and Briggs Haldane hypothesis, lineweaver plot, King Altman procedure for enzymatic reaction rate determination, enzyme inhibition, substrate inhibition and products, allosterism / allosteric enzymes and sigmoidal kinetics
3. Ezyme immobilization which includes: enzyme immobilization parameters, immobilization advantages, carrier (inorganic, organic and synthetic polymer) bonding methods (absorption, covalent binding, cross-linking and entrapment), microenvironmental effects, kinetics characterization of enzyme immobilization (Vmax and Kcat, Km and Ki)
4. Enzyme applications and trends in the future include: enzyme applications for food, medicine, medicine and diagnostics / biosensors. Antibiotic synthesis, chemical production, artificial enzymes

Reference

1. Andres Illanes, Enzyme Biocatalysis_ Principles and Applications-Springer (2008)
2. Daniel L. Purich, R. Donald Allison, The Enzyme Reference A Comprehensive Guidebook to Enzyme Nomenclature, Reactions, and Methods-Academic Press (2002)
3. Herbert Kirst, Wu-Kuang Yeh, Enzyme Technologies for Pharmaceutical and Biotechnological Applications-Marcel Dekker (2001)

4. Daniel L. Purich, Advances in Enzymology and Related Areas of Molecular Biology, Mechanism of Enzyme Action-Wiley-Interscience

Enzymatic Synthesis Techniques

Study Material

General types of enzymatic reactions which include the formation of C-O bonds, P-O bonds, C-N bonds, C-C bonds, oxidation-reduction reactions and isomerization, advanced principles related to their application in organic synthesis.

Reference

1. Richard B. Silverman, The Organic Chemistry of Enzyme-Catalyzed Reactions, Academic Press (2002)
2. Herbert Waldmann, Enzyme Catalysis in Organic Chemistry, Third Edition, Wiley-VCH Verlag (2012)

Bioactivity of natural ingredients

Study Material

Mechanisms of metabolic processes, Natural Materials Medicines, terpene biosynthesis, natural compounds with nitrogen atoms, chemical and biological natural antibiotics, and bioactivity of marine natural materials

Reference

1. P. M. Dewick, Medicinal Natural Products, A Biosynthetic Approach (2ª ed), Jonh Wiley and Sons, 2002
2. Colegate and Russell J. Molyneux, Bioactive Natural Products. Detection, Isolation, and Structural Determination. 2nd Edition. Edited by Steven M., CRC Press, Taylor and Francis Group, Boca Raton, 2008.3
3. Xiao-Tian Liang Wei-Shuo Fang, Medicinal Chemistry of Bioactive Natural Products, John Wiley & Sons, Inc. 2006.

Bioenergy

Study Material

1. Liquid biofuels (biodiesel, bioethanol; bioethanol; conversion of waste oil to biodiesel, and future biofuels including biofuels algae and microbial biofuels)
2. Solid biofuel (energy from wood and grass sources, pelletization)
3. biogas and bio-electricity
4. bioheat, biomass conversion technology to biofuel,
5. the relationship between biofuel / energy with environmental, economic and social issues

Reference

1. Ozcan Konur, Bioenergy and Biofuel, CRC Press, UK (2017)
2. R. Navanietha Krishnaraj, Jong-Sung Yu, Bioenergy: Opportunities and Challenges, 1st edition, Apple Academic Press (2015)
3. Kenneth L. Starcher, Vaughn Nelson, Introduction to Bioenergy, Elsevier (2016)

Green and Sustainable Chemistry

Study Material

Twelve principles of green chemistry and sustainable development goals, several studies related to the principles of green chemistry including the atom economy, waste management, reduction of toxicological effects, green solvent, alternative energy and so on are associated with the role of laboratories, chemists, society, nation and state as well as religion. Development of the SDG concept in a structured evaluation of environmental changes and development.

Reference

1. Anastas, P., Warner, 2000, Green Chemistry: Theory and Practice, Oxford University Press
2. Anne E. Marteel-Parrish Martin A. Abraham, 2013, Green Chemistry and Engineering: A Pathway to Sustainability, American Institute of Chemical Engineers, Inc.

Adsorption Technology

Study Material

Dasar-dasar kesetimbangan adsorpsi, Termodinamika dan kinetika adsorpsi, proses dan siklus adsorpsi, sistem aplikasi adsorpsi, material adsorben dan desain preparasinya, aplikasi adsorpsi pada berbagai bidang lingkungan dan katalisis.

Reference

1. Barry Crittenden W John Thomas, 1998. Adsorption Technology and Design, Elsevier Pubisher
2. Douglas M. Ruthven, 1984. Principles of Adsorption and Adsorption Processes, John Wiley & Sons.

Waste Treatment Technology

Study Material

The Processing Technology course takes materials related to types of waste, waste recycling techniques, waste recycling (solid, liquid and gas), household waste recycling, loundry waste recycling, mining materials recycling, biomass and biogas, chrome waste recycling, plastic waste treatment and waste paper treatment, used oil, scrap metal, glass and others.

Reference

1. Skoog, D.A., West, D.M., James Holler, F., 2014, *Analytical Chemistry*, Saunder College Pubs, Philadelphia.
2. Maczulak, A.E., 2009, Waste Treatment (Green Technology), Facts On File Inc; 1 edition
3. Kreith, F., and Tchobanoglous, G., 2002, *Handbook of Solid Waste Management,2nd ed.*, McGraw-Hill Professional.

SEMESTER 3

ALL CONCENTRATION

Islam Ulil Albab

Thesis Research

Study Material

Students conduct laboratory research and compile the results in the form of a thesis following the format determined by the Faculty. The assessment is carried out by the Thesis Advisor for the entire research process and thesis preparation

Reference

Mansfield, N., 2008, Your Chemical Science Thesis: An Introductory Guide to Writing Up Your Research Project,Royal Society of Chemistry, London.

International Scientific Works

Study Material

Recent journals, technical journal writing and writing ethics and codes of ethics

Reference

Rivera, M.M. Jr. and Rivera, R.V., 2007, Practical Guide to Thesis and Dissertation Writing, Katha Pub. Inc. Quezons City.

SEMESTER 4

ALL CONCENTRATION

Thesis

Study Material

Students are able to make good power points to communicate the research results provided by the testing team

Reference

Burton S., and Steane, P., 2004, Surviving Your Thesis, Routledge, London

REFERENCES

Direktorat Jendral Pembelajaran dan Kemahasiswaan. (2016). Panduan Penyusunan Kurikulum Pendidikan Tinggi. Direktorat Jendral Pembelajaran dan Kemahasiswaan (Belmawa) Kementerian Riset, Teknologi dan Pendidikan Tinggi.

Kementerian Riset, Teknologi, dan Pendidikan Tinggi. (2015). Peraturan Menteri Riset, Teknologi, dan Pendidikan Tinggi Nomor 44 Tahun 2015 Tentang Standar Nasional Pendidikan Tinggi. Kementerian Riset, Teknologi, dan Pendidikan Tinggi Republik Indonesia.

Majelis Akreditasi Badan Akreditasi Nasional Perguruan Tinggi. (2017). Peraturan Badan Akreditasi Nasional Perguruan Tinggi Nomor 4 Tahun 2017 tentang Kebijakan Penyusunan Instrumen Akreditasi. Badan Akreditasi Nasional Perguruan Tinggi.

Tim Kurikulum dan Pembelajaran. (2014). Buku Kurikulum Pendidikan Tinggi. Direktorat Jenderal Pendidikan Tinggi Kementerian Pendidikan dan Kebudayaan.

Tim Penyusun. (2014). Panduan Penyusunan Capaian Pembelajaran Program Studi. Direktorat Pembelajaran dan Kemahasiswaan Direktorat Jendral Pendidikan Tinggi Kementrian Pendidikan dan Kebudayaan.

Universitas Islam Indonesia. (2017). Peraturan Universitas Islam Indonesia Nomor 2 Tahun 2017 tentang Proses Pendidikan dan Pembelajaran, Universitas Islam Indonesia.

Universitas Islam Indonesia. (2017). Peraturan Rektor Universitas Islam Indonesia Nomor 12 Tahun 2017 tentang Dokumen Perencanaan Pembelajaran. Universitas Islam Indonesia.

Universitas Islam Indonesia. (2017). Peraturan Rektor Universitas Islam Indonesia Nomor 11 Tahun 2017 tentang Capaian Pembelajaran Lulusan Universitas dan Mata Kuliah Wajib Universitas. Universitas Islam Indonesia serta perubahannya seperti tercantum pada Peraturan Rektor Universitas Islam Indonesia Nomor 8 Tahun 2018.