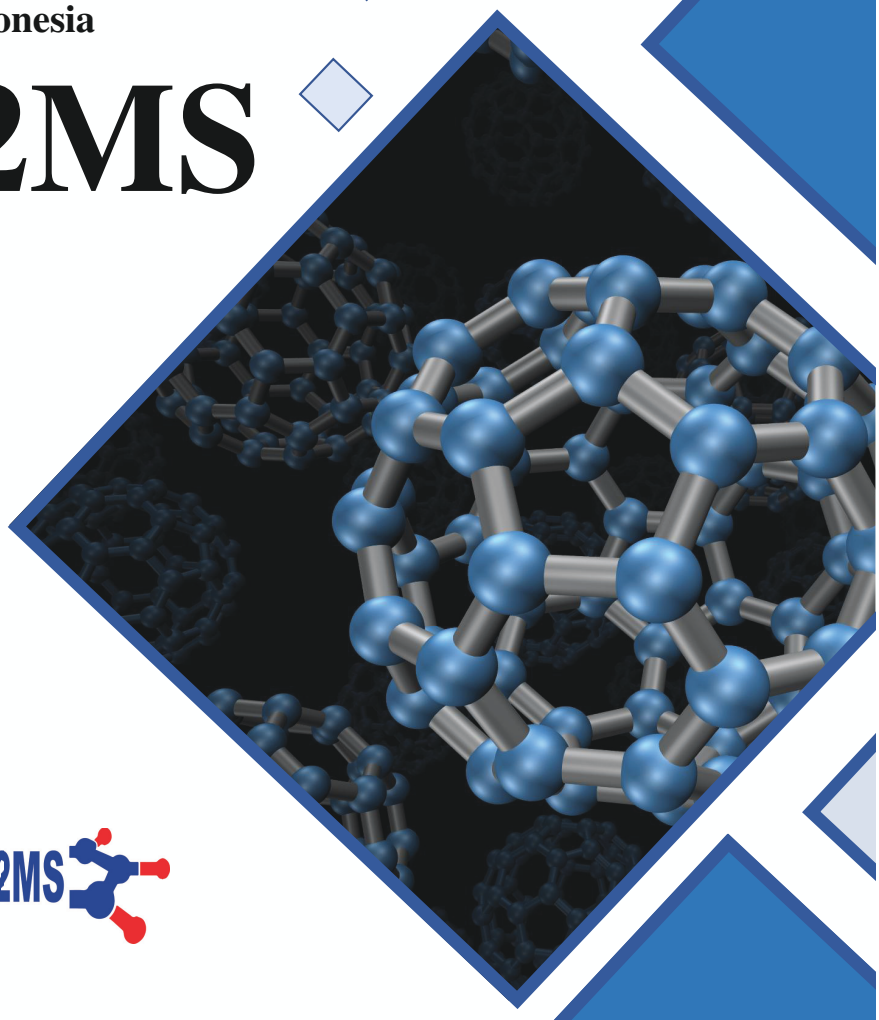
Preface

To cite this article: 2020 *IOP Conf. Ser.: Mater. Sci. Eng.* **833** 011001

2-3 November 2019
Malang, Indonesia

IC2MS



The 2nd International Conference on Chemistry and Material Science

PREFACE

Chemistry is often regarded as the central of science, while material science is considered as the mother of technology. The pair holds an important role in advancing the quality of life, environment, and welfare. The International Conference on Chemistry and Material Science (IC2MS) is organized to provide an international platform for promoting mutual exchange between scientists, discussing innovative ideas in scientific research, and as a building block for academicians to expand their global perspective and to initiate collaboration, and for government and industrial sectors to update their information with the newest research findings for their future research-based plans and policies.

This year, the conference is organized by the Department of Chemistry, Faculty of Science, Brawijaya University, in collaboration with Chemistry Departments of State University of Malang, Jember University, and Ma Chung University. The 2nd IC2MS was held on 2-3 November 2019 with a theme of "Advancing to the Frontier of Innovation in Chemistry and Material Science". The conference covers not only in chemistry area (Organic, Inorganic, Physical, Analytical, Biochemistry), but also promote papers in material science such as molecular science, functional material, material synthesis and characterisation, nanomaterials and nanodevices, as well as renewable energy and fuel cell.

This conference presents 4 plenary lectures by the keynote speakers, 16 parallel sessions (including invited speakers), and two poster sessions. In total, 220 titles were presented during this conference. The organising committee was also had to rejected some submitted abstracts due to the limited time and venue capacity. Participants were coming from seven different countries and more than 40 national and international universities/institutions (Figure 1). There are also 10 best and favourite (student) posters awarded in this event.

The organising committee of the 2nd IC2MS are greatly appreciating and thanking to all people involve in this event for their active participation and supports. To all keynote and invited speakers, thank you for sharing your research achievements. To the PPIKID of UB for the great financial commitment, and to the Department of Chemistry, Faculty of Mathematics and Natural Sciences (FMIPA), Brawijaya University, for every support given during this event. We also would like to acknowledge all co-host universities and the Savana Hotel of Malang, thank you for the cooperation and assistance. Thank you and may this event give benefits to all. See you in the 3rd IC2MS 2020.

Best Regards,

Dr. Yuniar Ponco Prananto, MSc
Chairman of the 2nd IC2MS 2019

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Official site: http://ic2ms.ub.ac.id

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List of Keynote Speakers

Keynote speaker 1 : Prof. Ibrahim bin Jantan (*Scopus docs = 176; h-index = 25*)
Taylor's University, Malaysia
Moderator: Dr. Elvina D. Iftitah, MSi

Keynote speaker 2 : Dr. David R. Turner (*Scopus docs = 119; h-index = 29*)
Monash University, Australia
Moderator: Dr. Yuniar Ponco Prananto, MSc

Keynote speaker 3 : Assoc. Prof. Kenji Mochizuki (*Scopus docs = 21; h-index = 9*)
Shinshu University, Japan
Moderator: Assoc. Prof. akhmad Sabarudin, Dr.Sc

Keynote speaker 4 : Akhmad Sabarudin, Dr.Sc (*Scopus docs = 59; h-index = 17*)
Brawijaya University, Indonesia
Moderator: Barlah Rumhayati, PhD

List of Invited Speakers

Invited speaker 1 : Dr. Hendra Gunosewoyo (*Scopus docs = 26; h-index = 11*)
Curtin Unversity, Australia

Invited speaker 2 : Dr. Mohamad Rafi (*Scopus docs = 19; h-index = 4*)
IPB University, Indonesia

Invited speaker 3 : Assoc. Prof. Lee Siew Ling (*Scopus docs = 91; h-index = 13*)
Universiti Teknologi Malaysia, Malaysia

Invited speaker 4 : Dr.rer.nat. Witri Wahyu Lestari (*Scopus docs = 27; h-index = 5*)
University of Sebelas Maret, Indonesia

Invited speaker 5 : Anugrah Ricky Wijaya, DSc (*Scopus docs = 13; h-index = 5*)
State University of Malang, Indonesia

Invited speaker 6 : Dr.rer.nat. Rachmat T. Tjahjanto (*Scopus docs = 12; h-index = 2*)
Brawijaya University, Indonesia

Link for Presented Papers

Oral presenters : 116 presenters
http://ic2ms.ub.ac.id/wp-content/uploads/2019/10/Oral-Session-Schedule.pdf

Poster presenters : 104 presenters
http://ic2ms.ub.ac.id/wp-content/uploads/2019/10/Poster-Session-Schedule.pdf

SELECTED PICTURES TAKEN FROM THE IC2MS-2019

Picture 1. Flags of the participants' country and logos of the participants' institution.

Picture 2. Opening remarks by the chairman of the 2nd IC2MS

Picture 3. Poster session and poster award winners.

Picture 4. One of the invited speaker's talk.

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Accepted papers received: 09 April 2020
Published online: 30 June 2020

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Chemistry

Crystallinity of nanocellulose isolated from the flower waste of pine tree (*Pinus merkusii*)

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Isolation, Identification, and Inhibition of Saponin Isolates from Pineapple (*Ananas comosus* L.) and Candlenut (*Aleurites moluccanus* L.) against Xanthine Oxidase by In Vitro Assay

Mimma Amalia, Mieke Alvionita, Subandi, Evi Susanti and Dian Nugraheni

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The potency of *Polylathia longifolia* from Indonesia and the Philippines as therapeutic agents on inflammatory bowel disease (IBD) in Rats *(Rattus norvegicus)* induced by Indomethacin

A Aulanni'am, T Z Anita, D S Nahari, I A Aluka, E I Agustine, T Novita, A A Pentaloka, D K Wuragil, W Riawan and M A G Beltran

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A molecular docking study of dehydroevodiamine as an inhibitor of epstein-barr virus protease

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The Potency of Antioxidant Perfume of Essential Oils to Reduce Free Radical Content in Air

Selena B Deshinta, F A D Cahyo, G D Aggreini, Edi P Utomo and I Tazi

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Q Fardiyah, Suprapto, F Kurniawan, T Ersam, A Slamet and Suyanta

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Physicochemical Properties and Antibacterial Activity of Castor Oil and Its Derivatives

M I Fitranda, Sutrisno and S Mariyah

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Experimental and Theoretical Study of Pinostrobin as Copper Corrosion Inhibitor at 1 M H_2SO_4 Medium

Saprizal Hadisaputra, Agus Abhi Purwoko, Aliefman Hakim, Rosita Wati, Dina Asnawati and Yuniar Ponco Prananto

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The Effect of CMC, Agar, and Konjac on the Characteristics of Durian Seed Starch Edible Film

Muhammad Husain Haekal and Lizda Johar Mawarani

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Antioxidant and Xanthine Oxidase Inhibitory Activities of Kecapi (*Sandoricum koetjape* (Burm.f) Merr.) Leaf Extract

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Antibacterial activity of *Achromobacter sp.* and *Bacillus sp.*, bacterial endophytes derived from Mangrove *Ceriops tagal* (Perr.) C.B.Robb

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Antifungal Activity of Red Dragon Peel (*Hylocereus polyrhizus*)

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The Reduction of Cadmium Concentration by *Oscillatoria* Microalgae in a Culture Media

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Luqi Khoiriyah Latif, Masruri Masruri and Barlah Rumhayati

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Acetylacetone as A Potential Chemosensor for Rapid Detection of Cu(II) in Aqueous Media

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Oxalic Acid from Corn Stalk for Photocatalytic Reduction of Cr(VI)

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Antifungal Activity from Co-Culture of a Local Fungus of Tropical Peat Swamp Soil, *Penicillium* sp. LBKURCC34 with Gram-Negative and Gram-Positive Bacteria

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Edible Coating Development of Durian Seeds Starch and Glucomannan with The Addition of Essential Oil As An Antimicrobial to Increase Shelf Life of Tomato and Cauliflower

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Carbon dioxide occupancies inside ice XVII structure from grand-canonical Monte Carlo simulation

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Preliminary Study on The Development of Preconcentration Method of Cu(II), Co(II), Ni(II), and Cr(III) Ions in Water Samples Using Nanomagnetite Coated by Carboxymethyl *kappa*-Carrageenan (CMKC)

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Anna Roosdiana, Analis Wisnu Wardhana and Tarsisius Handaru Cahyo Putro

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Mimi Salmawati, Prabasti Kusumoning Gati, Zubaidah Ningsih and Diah Mardiana

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The Effect of K_2O Concentration in K_2O/Al_2O_3 Catalyst on Methyl Ester (Biodiesel) Synthesis from CPO Off Grade with Ultrasonic Wave

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Development of Indirect Spectrophotometric Method for Mercury Determination Based on The Formation of Iron(III)-Thiocyanate Complex

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Indirect Spectrophotometry Method Based on the Formation of Chromium(VI)-Diphenylcarbazide Complex for Determination of Hydroquinone in Cosmetics

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Solvent Effect at Ibuprofen Adsorption Using Zinc Oxide Plate Rod-Like from Gelatine

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Viky Arina Zuhria, Arie Srihardyastutie, Anna Safitri and Sasangka Prasetyawan

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Muhammad Zulqurnain, M. Riza Ghulam Fahmi, Arif Fadlan and Mardi Santoso

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Faizinal Abidin, Abdul Hatta Gunawan Wibowo, Arya An Ambari and Sri Harjanto

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Voltammetric Determination of Paracetamol using Polyvinyl Alcohol (PVA)-Fe_3O_4 Modified Glassy Carbon Electrode

Robi'atul Andawiyah, Ani Mulyasuryani and Hermin Sulistyarti

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Combustion on Decolorisation of Organic Dye Molecules

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Preparation of *Cyperus diffusus* Vahl cellulose–polyanniline composite for dye removal

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The Effect of Zr Addition on Microstructures and Hardness Properties of Zn-Zr Alloys for Biodegradable Orthopaedic Implant Applications

Moh Waqyan Ghani Fahmi, Achmad Fauzi Trinanda, Rizki Yuni Pratiwi, Sotya Astutiningtyas and Ahmad Zakiyuddin

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Synthesis of ZnO-Ag Nanocomposites trough Ultrasonication-Microwave Combination Method with Clove Leaf Oil

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The Structural and Optical Band Gap Energy Evaluation of TiO_2-Fe_2O_3 Composite

Rendy Muhamad Iqbal, Dyah Ayu Pramoda Wardani, Luqman Hakim, Akhmad Damsyik, Riaa Safitri and Hamzah Fansuri

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Modification of Gunung Kidul Natural Zeolite and Its Application in the Corrosion Rate Reduction of Steel Plates in Acid Media

Mohammad Abdul Khalid, Aditya Pandu Wicaksono, Firstyananda Wahyu Andita and Asifa Ihya Nurdina

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C Y Leong, P W Koh, Y S Lo and S L Lee

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Green Synthesis of ZnO Nanoparticles by Using Banana Peel Extract as Capping agent and Its Bacterial Activity

Siti Marfu'ah, Santias Megasani Rohma, Faisal Fanani, Emi Nurul Hidayati, Diah Wahyu Nitasari, Thutug Rahardiant Primadi, Endang Ciptawati, Sumari Sumari and Fauziatul Fajaroh

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Synthesis of ZnO-Ag with Clove Oil Using Ultrasonication Method and Its Antibiofilm Activity Against *Klebsiella pneumoniae*

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The Effect of SrO Impregnation on The Characteristics of Cobalt Ferrite ($CoFe_2O_4$) Nanoparticles Synthesized by Coprecipitation

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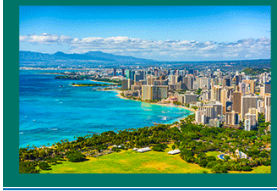

Synthesis of Copolymer of Chitosan with Acrylamide as an Adsorbent for Heavy Metal Waste Treatment

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Abstract. The aim of this research is to chemically modify chitosan to improve and enhance the ability as an adsorbent. Chitosan is a natural polymer produced from chitin deacetylation. The best performance of chitosan ~~is~~ as an adsorbent is in acidic solutions. Chemical modification was carried out by chitosan copolymerization with acrylamide. Copolymer synthesis was done by using microwave oven with the weight ratio of chitosan and acrylamide of 1: 4. The characterization of chitosan copolymer with acrylamide (chitosan-g-acrylamide copolymer) was conducted by FTIR spectroscopy and Scanning Electron Microscope (SEM). The analysis of the functional group by FTIR spectroscopy shows that the copolymer has been successfully synthesized. The surface analysis with SEM shows that the morphology of the copolymer surface is more homogeneous compared to that of chitosan.

1. Introduction

Chitosan is a biopolymer produced by the chitin deacetylation process. Chitin is a compound widely found in shrimp shells [1]. Chitosan is polycationic, so that it can be applied in various fields such as metal adsorbents, dyes, and cosmetics. Chitosan is biodegradable, biocompatible and non-toxic compound. Chitosan has biological and chemical properties. Chitosan has antimicrobial activity so it is widely used in biomedicine. Chitosan can interact very well with inorganic solutes (metal ions) and dyes, due to the presence of reactive groups such as -OH and -NH_2 [2].

However, chitosan has disadvantage of only dissolved in acidic solutions, insoluble in water and unstable in acidic solutions, so that their use is limited mainly as an adsorbent [3]. Therefore, researchers have done a chemical modification of chitosan [4,5]. Chemical modification of chitosan has been done to improve and enhance the ability of chitosan as an adsorbent, such as adding cross-linked material such as glyoxal, formaldehyde, and ethylene glycol [6]. Cross-linked material can stabilize chitosan in acidic solutions and improve its mechanical properties. Another method that has also been carried out by researchers to improve the ability of chitosan as an adsorbent is by copolymerization, namely grafting between chitosan with some vinyl monomers such as acrylic acid, methyl acrylate, acrylonitrile, vinyl chloride, acrylamide and others [7].

Copolymerization of the graft into chitosan is one of the most effective method to improve the performance of chitosan. Graft copolymers are used to improve the physical and chemical properties of natural and synthetic polymers for agricultural, biomedicine and other fields. There have been many studies on the graft copolymerization including copolymerization of chitosan with acrylonitrile, acrylamide, acrylic acid using cerium ammonium nitrate as an initiator, methyl acrylate using the initiator of potassium periodatcuprate(III) [3]. Copolymerization of chitosan with acrylamide has also

been carried out by previous researchers, among others using the initiator of ammonium persulfate [9], and copolymerization of chitosan with acrylamide using gamma rays for the adsorption of Cu and Ni metals [8].

In this research, copolymerization of chitosan graft has been carried out into acrylamide, where copolymerization is conducted using the ammonium persulfate initiator. The copolymerization process is done by using microwave radiation heating using a microwave oven which is commonly used at home. Polymer synthesis using microwave has the advantage of short reaction time compared to the conventional heating. The results of chitosan graft copolymerization with acrylamide will later be applied for treatment of heavy metal waste, such as Pb metal, which is not included in this paper.

2. Materials and Methods

2.1. Materials

The materials used in this research are chitosan with 87.5% deacetylation degree obtained from the local market, acrylamide (Merck, Germany), ammonium persulfate (AR, China), 2% acetic acid, technical methanol obtained from local market in Indonesia and distilled water. All chemicals are used directly without further purification.

2.2. Synthesis of copolymers

The study was conducted with a weight ratio between chitosan and acrylamide of 1: 4. A 0.5-gram chitosan was placed into 2% acetic acid solution and stirred with magnetic stirrer until dissolved for 20 minutes in a Teflon container. Then, 2 grams of acrylamide were dissolved in 10 ml of distilled water, then poured into a Teflon container containing chitosan and stirred until the mixture was homogeneous. After that, 5% ammonium persulfate was added from the total weight of the sample and the mixture was stirred until homogeneous. Then, the Teflon container was placed into microwave oven by adjusting the microwave power that is 30%, 50%, and 70% by adjusting the reaction time every 2 minutes until the gel was formed. The time of gel formation was noted. After the reaction was complete, the formed gel was poured into a container containing excessive methanol to precipitate the product while stirring. The precipitate that has been obtained was washed with methanol for several times to remove the formed homopolymer. The precipitate was filtered, placed into a petri dish and then dried in a vacuum oven at 40 °C to a constant weight. Copolymers were then characterized using FTIR and SEM, while the percentage of grafting can be determined by equations (1) and (2), where W_0, W_1 and W_2 are initial mass of chitosan, mass of copolymer, and mass of acrylamide, respectively [11]:

$$\%G = (W_1 - W_0) / W_0 \times 100\% \quad (1)$$

$$\%E = (W_1 - W_0) / W_2 \times 100\% \quad (2)$$

2.3. Characterization

2.3.1. Fourier transformation infrared (FTIR) spectroscopy. FTIR analysis was performed on samples of chitosan, acrylamide and chitosan copolymers with acrylamide in the form of KBr pellets and measured at wavelengths of 400 - 4000 cm using FTIR SHIMADZU-8400.

2.3.2. Scanning electron microscopy (SEM). Scanning Electron Microscope (SEM) analysis was also performed on samples namely chitosan, acrylamide and chitosan copolymers with acrylamide using SEM JEOL JSM 6510 LA. Samples were measured in a powder form.

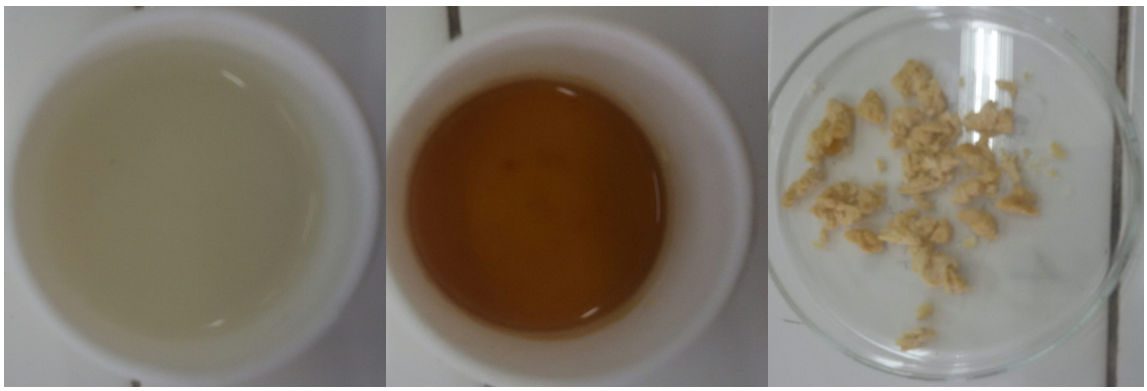
3. Result and Discussion

3.1. Synthesis of copolymer

Synthesis of chitosan copolymers with acrylamide was carried out using a microwave oven commonly used at home. Chitosan used in this work was originated from shrimp shells with deacetylation degree

of 87.5% that obtained from the local market. Copolymers were synthesized with a ratio of chitosan and acrylamide of 1:4. The initiator used for the synthesis of chitosan and acrylamide copolymers was ammonium persulfate. Copolymer synthesis was carried out with variations of power namely 30%, 50%, and 70%. The reaction is stopped until the solution is thickened or form a gel. This indicates that the copolymer has been formed. The initially white solution turns into a thick yellow solution. To stop the reaction, the gel obtained is poured into excessive methanol to form a precipitate. The precipitate formed were dried in a vacuum oven at a temperature of 40 °C until constant weight is obtained.

The time needed to form copolymers on various microwave power was varied. The average time required for the formation of the copolymer in microwave with 30%, 50% and 70% power, respectively were 24, 12, and 8 minutes. The greater the microwave power used, the faster the formation of copolymers. Due to greater power, the radicals were formed faster, so that of the copolymer. With the greater power, the reaction rate will be greater so that the time needed for the formation of copolymers is faster. Energy transfer is faster with the increasing of microwave power. In addition, the higher power microwave radiation indicates a higher temperature. Observations of the sample during the reaction show that with the increasing of microwave power, the time taken for the sample to boil is also faster. The time needed to boil each of the microwave with power of 30%, 50% and 70%, are 8, 4, and 2 minutes, respectively.



(a) (b) (c)

Figure 1. Sample (a) before the copolymerization reaction, (b) after the copolymerization reaction, and (c) after precipitated with methanol.

Synthesis of chitosan copolymer with acrylamide is a graft copolymerization in which acrylamide is grafted into the chitosan. The number of acrylamide monomers that can be grafted into chitosan can be determined by calculating the results of grafting (%G) and grafting efficiency (%E) based on equations (1) and (2). The results of grafting (%G) and grafting efficiency (%E) synthesis of chitosan and acrylamide copolymers at various microwave powers are presented in Table 1. Table 1 showed that %G and %E were decreased with the increasing of microwave power used. Due to the greater radiation power, the greater homopolymer reaction occurred thus %G and %E were decrease. A decrease in %G with the increasing of microwave power in the synthesis of chitosan-grafting-polyacrylamide was also reported by previous researchers, namely chitosan-polyacrylamide copolymers, which is carried out in various power of 60, 70, 80, 90 and 100%. The results showed a decrease in %G with the increasing of microwave power of 80% and 100%, due to more homopolymerization reactions [10].

Table 1. Effect of variation of microwave power on %G and %E.

Power of Microwave	%G	%E
30%	399.18	99.79
50%	367.06	91.76
70%	309.00	72.25

Chitosan copolymerization with acrylamide is free radical polymerization using the ammonium persulfate initiator. The mechanism of chitosan copolymerization with acrylamide which has been proposed by Machalova *et al* (2006) is presented in Figure 2. Based on the polymerization of free radicals in the initial stages of the reaction, the initiator undergoes initiation to form radicals. Radicals are formed due to heat generated in a microwave oven. Furthermore, a propagation reaction occurs where radicals from the initiator attack the chitosan functional groups and free the H atoms contained in the NH_2 and OH groups contained in chitosan. Thus, chitosan will form radicals. The chitosan radical then attacks the acrylamide monomer to forms another radical. In the final stage, the termination stage, there is a bond formed between the radicals from the polymer that has been grafted.

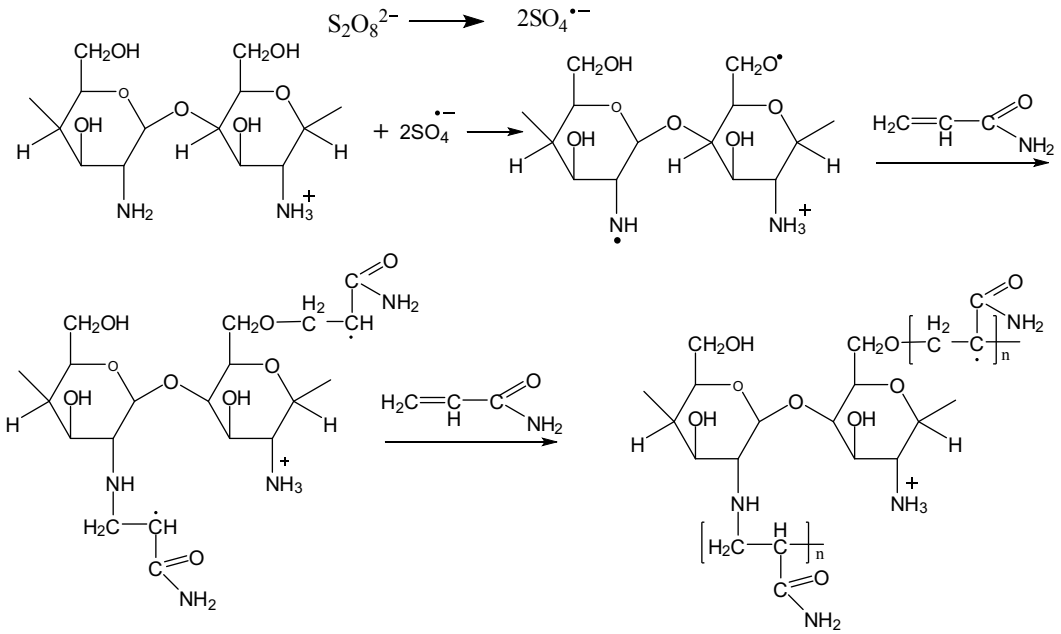


Figure 2. Mechanism of copolymerization of chitosan with acrylamide [14].

3.2. Characterization of copolymers

3.2.1. FTIR Spectroscopy Analysis. FTIR spectroscopic analysis was carried out on chitosan, acrylamide and chitosan-acrylamide copolymers and the spectra are shown in Figure 3. FTIR spectra for copolymers were taken from the results of copolymer synthesis at 70% microwave power. Figure 3 (a) shows the FTIR spectra of the chitosan. The absorption peak with high intensity at 3427.51 cm^{-1} is the stretching vibration from OH and NH_2 groups. The absorption at 2920.23 cm^{-1} and 2881.65 cm^{-1} shows the stretching vibration of C-H. The absorption peak at 1660.71 cm^{-1} is the C=O vibration of carboxylate group of chitosan, while the absorption peak at 1596.99 cm^{-1} is the absorption of N-H. Vibration stretching of C-N appears at the absorption peak of 1427.32 cm^{-1}.

Figure 3 (b) is an FTIR spectra of acrylamide. The emergence of absorption peaks at 3352.26 cm^{-1} and 3178.69 cm^{-1} is the peak of NH_2 vibration stretching from acrylamide. The absorption peak at 1674.21 cm^{-1} is the C = O absorption band of amide (I). The C-N absorption band of acrylamide

appeared at 1429.25 cm^{-1}. While the absorption peak of N-H bending vibration of acrylamide appeared on 1610.56 cm^{-1}. The presence of the C = C double bond of acrylamide appeared on the absorption peak around 900-990 cm^{-1} and 3057 cm^{-1}.

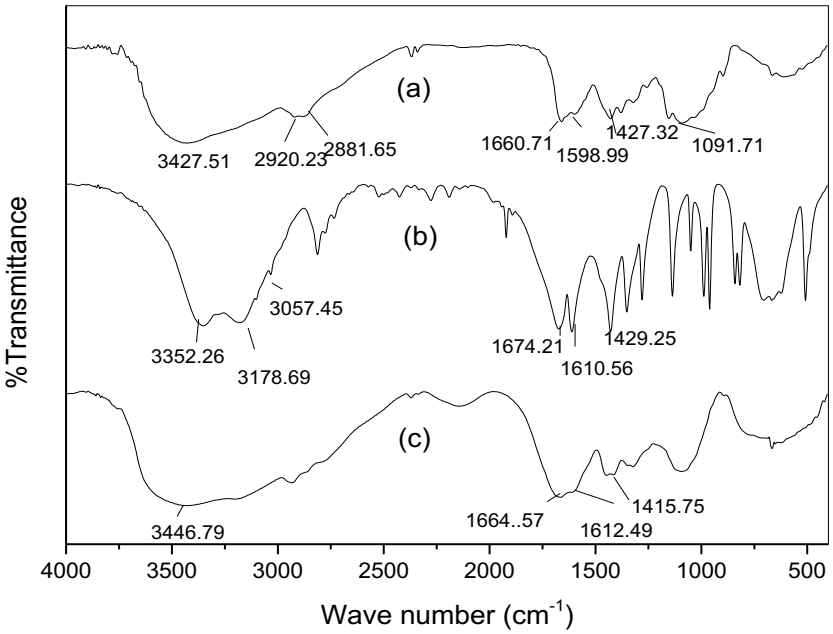


Figure 3. Spectra FTIR of (a) chitosan, (b) acrylamide, (c) copolymer of chitosan-acrylamide.

FTIR spectra of chitosan-acrylamide copolymers can be seen in Figure 3 (c). From the spectrum of the copolymer in Figure 3 (c), it is observed that the double bond C=C does not appear at wavelengths around 900-990 cm^{-1} and 3075-3095 cm^{-1}. This shows that the copolymerization reaction has taken place. Moreover, the spectra show the formation of copolymers is the shift in the absorption of C=O amide from 1674.21 cm^{-1} to 1664.57 cm^{-1}. There was a broad peak at wave number of 3446.79 cm^{-1} due to OH absorption. The broad absorption peak is also caused by an overlap between the N-H vibrations of chitosan and NH_2 from acrylamide. In addition, an indication of chitosan-acrylamide copolymers has been formed is the peak of C-N absorption at wave number of 1415.75 cm-1. Based on previous research showing that the peak of the adsorption of chitosan-acrylamide copolymer appeared in 3434.71 cm^{-1} which is OH stretching from polyacrylamide and chitosan. While the adsorption band at 1411.69 cm^{-1} is C-N stretching vibration from the chitosan-acrylamide copolymer [12]. Based on the FTIR spectra, the chitosan and acrylamide copolymers have been successfully synthesized using microwave oven.

The FTIR spectra of the copolymer that has been synthesized with microwave power variations of 30, 50, and 70% can be seen in Figure 4. From the spectra, it can be seen that the absorption peaks of the copolymers produced in the microwave power variation have identical absorption peaks. FTIR spectra in Figure 4 shows that the copolymer has been successfully synthesized in various microwave power.

3.2.2. SEM Analysis. Scanning Electron Microscope (SEM) analysis is a surface analysis that can shows the surface morphology of a material. The results of SEM analysis can be seen in Figure 5. SEM analysis was carried out for chitosan, acrylamide, and chitosan-acrylamide copolymers. The SEM analysis results (Figure 5) show the surface differences of chitosan, acrylamide and chitosan-acrylamide copolymers. Based on Figure 5 (c), chitosan-acrylamide copolymers with porous surfaces were observed. The formation of these pores is due to the grafting between chitosan and acrylamide.

This porous surface indicates that chitosan-acrylamide copolymers can be used as adsorbents. Based on Figure 5, it can be seen that the surface of the copolymer is more homogeneous compared to that of chitosan.

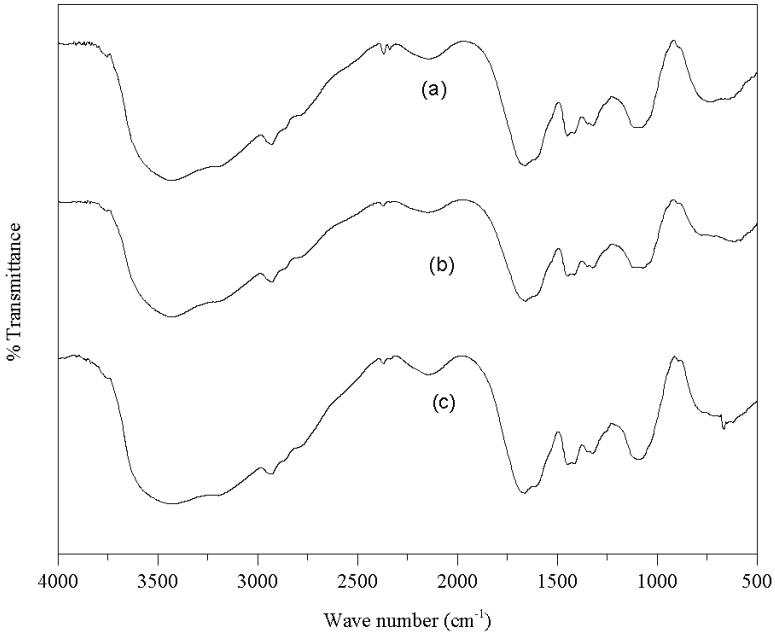


Figure 4. FTIR Spectra of chitosan-acrylamide copolymers synthesized by various microwave power of (a) 30%, (b) 50% and (c) 70%.

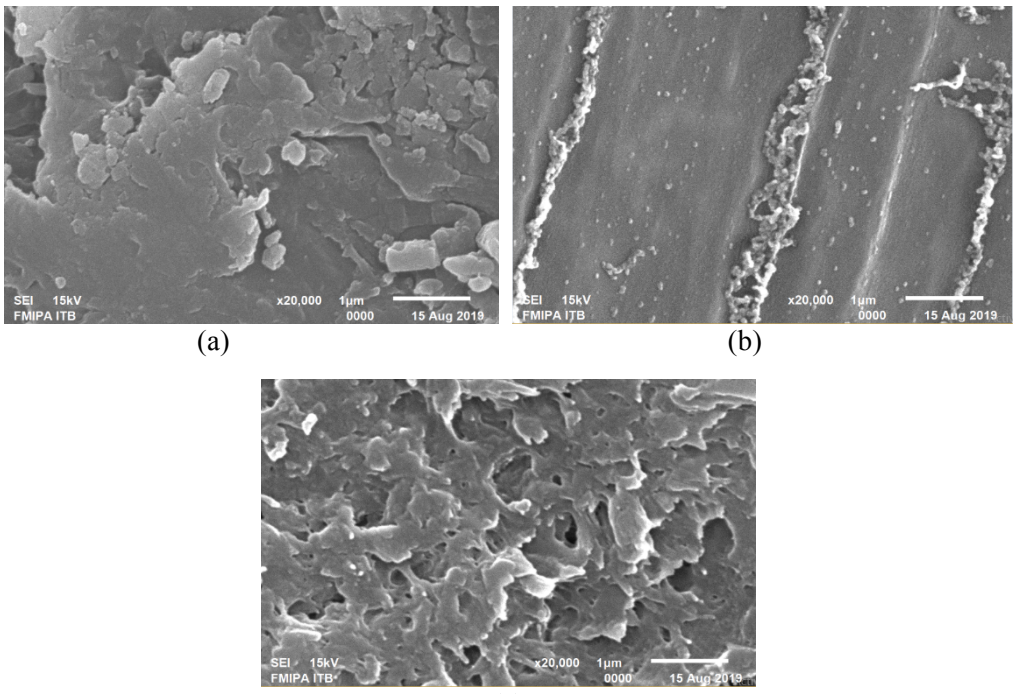


Figure 5. SEM (a) chitosan (b) acrylamide (c) copolymer of chitosan-acrylamide

4. Conclusion

The chitosan copolymerization with acrylamide using ammonium persulfate initiator was successfully synthesized in a microwave oven. The decrease in %G and %E as the microwave power increases was caused by the occurring of more homopolymer reactions.

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Acknowledgments

This research was funded by Sriwijaya University for Sains Teknologi dan Seni Sriwijaya University Research Grant No. 0016 / UN9 / SKL.LP2M.PT / 2019.

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Synthesis of Copolymer of Chitosan with Acrylamide as an Adsorbent for Treatment of Heavy Metal Waste

in The 2nd International Conference on Chemistry and Material Science. This conference was held on 2 - 3 November 2019 in Malang, Indonesia, organized by Chemistry Department of Brawijaya University.

Prof. Adi Susilo Ph.D
Dean of Faculty of Mathematics and Natural Science

Dr. Yuniar Ponco Prananto, M.Sc
The 2nd IC2MS Chairman