ITATS, Jl. Arief Rachman Hakim 100 Surabaya icatech.support@itats.ac.id

ICATECH 2018

1ST INTERNATIONAL CONFERENCE ON ADVANCED ENGINEERING AND TECHNOLOGY

Event Date 2018-09-29 : 7.30 AM Venue: Swiss-Belinn, Manyar, Surabaya

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Institut Teknologi Adhi Tama Surabaya proudly presents, the 1st International Conference on A

Multidisciplinary Approach Towards Sustainable Techn

The 1st ICATECH is organized by Lembaga Penelitian dan Pengabdian kepada Masyarakat, ITATS, Surabaya academicians to share their knowledge and experience in Engineering, Design, Information System and Technolo each other and to exchange ideas. This conference will be held on September 29th, 2018. The scientifi

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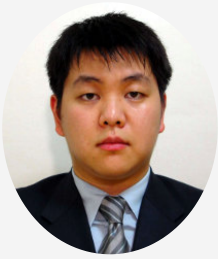
Chair of ICATECH

Keynote Speakers



Prof. Bon-Yong Koo
Assistant Professor

Kunsan National University, South Korea

Prof. Kuo Lung Lian
Associate Professor

National Taiwan University of Science and Technology, Taiwan

Robertus Theodore
Executive Staff of Deputy-I

Executive Office of the President, Republic of Indonesia

Conference Schedule

The conference will be held on Saturday, September 29, 2018

Saturday

07:30 – 08:00	Registration & Opening by MC
08.00 – 08:55	Welcoming Speech
08:55 – 09:45	Keynote Speech 1
09:45 – 10:00	Coffee Break

10:00 – 10:50	Keynote Speech 2
10:50 – 11:40	Keynote Speech 3
11:40 – 13:00	Lunch Break
13:00 – 15:00	Parallel Session
15:00 – 15:15	Coffee Break
15:15 – 17:00	Parallel Session & Closing

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IMPORTANT DATES

Jul ~~2~~ 16[1] 30[2]: Paper Submission Deadline *(extended)*
Jul 23[1] Aug 6[2]: Paper Acceptance Notification
Aug 24: Camera-Ready
Sep 29: Conference Date

CONTACT US

Address: Jl. Arief Rachman Hakim 100, Surabaya-Indonesia
+62-821-1000-2280 (Laras Lestari)
+62-857-2134-7802 (Indra Komara)
icatech.support@itats.ac.id

IOP Conference Series: Materials Science and Engineering

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The 1st International Conference on Advanced Engineering and Technology

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Preface

It is my great honor, and pleasure, to welcome you, in the name of the Adhi Tama Institute of Technology Surabaya, on the occasion of the 1st International Conference on Advanced Engineering and Technology (ICATECH 2018) held in Surabaya, Indonesia, September 29, 2018.

This seminar is the first international seminar which has the main purpose to bring researchers and academicians to share their knowledge and experience in Engineering, Design, Information System and Technology area. The conference serves as an excellent opportunity to meet each other and to exchange ideas with theme, Multidisciplinary Approach towards Sustainable Technology and Industry.

This proceeding contains selection papers from graduate students, faculty members, researchers, and academia from various universities and research institutions, and also professional associations and other related organization in infrastructure area. The selected papers are selected based on the paper quality and the relevancy to the theme.

A total of 52 manuscripts are selected to be submitted in IOP Conference Series: Materials Science and Engineering and to be presented in ICATECH 2018 seminar. Our deepest gratitude to all of our speakers, participants and contributors who have given the ICATECH 2018 their generous supports. Also to all the reviewers who helped us managing the papers so that all the manuscripts are well written. Many thanks are due to all our Organizing Committee members for their dedication and continuous efforts and hard work in preparing and organizing the seminar. We would like also to thank to all members of the Steering Committee, Scientific Committee and our distinguished international board of reviewers for all their support and advice.

Dr. Syamsuri, Adhi Tama Institute of Technology Surabaya
On behalf of ICATECH 2018 Organizing Committee
September 28, 2018

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IOP Conference Series: Materials Science and Engineering

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The Production of Activated Carbon from Indonesian Mangrove Charcoal

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The Production of Activated Carbon from Indonesian Mangrove Charcoal

A Budianto[1], E Kusdarini[2], S S W Effendi[1] and M Aziz[1]

[1]Department of Chemical Engineering, Institut Teknologi Adhi Tama Surabaya (ITATS), Jalan Arief Rahman Hakim 100, Surabaya 60117, Indonesia; email:
[2]Department of Mining Engineering, Institut Adhi Tama Surabaya (ITATS), Jalan Arief Rahman Hakim 100, Surabaya 60117, Indonesia; email: esti@itats.ac.id

budichemical@itats.ac.id

Abstract. Activated Carbon is an important material for purification, colour removal, adsorbent, and catalyst in the chemical industry. One of the iodine industries in East Java use active carbon as adsorbent that captures iodine from the solution. Indonesia still imports activated carbon despite the numerous raw materials of activated carbon in Indonesia. This research aims to determine the effect of the concentration of phosphoric acid (activating agent) and activation temperature on the production of activated carbon from mangrove charcoal. The activating agent used was phosphoric acid with 0.4-1.0 M and 2 hour immersion. The activation temperature was 650-725°C. The activated carbon of the research results was tested for its proximate level, iodine number, and specific surface area. The results showed that water content ranged from 0.11-0.38%, iodine number was around 769.075-1,019.087 mg/g. The highest iodine number was 1,019.87 mg/g and the surface area of 354.977 m^2/g that occurred at 725 °C with activator concentration of 1 M. Proximate analysis, iodine number, and specific surface area of activated carbon from mangrove charcoal have met Indonesian National Standardization (SNI 06-3730-1995).

1. Introduction

Indonesia is a country with the most number of islands in the world which makes Indonesia have the longest coastal area in the world. This fact makes the coastal area as important area. Two regions in East Java that actively cultivate mangroves are Tuban and Banyuwangi. Dry wood from these mangroves is widely used for firewood and charcoal, some of which are not even utilized. While at the same time, wood waste is very important for industry, especially for charcoal briquettes [1]. This utilization can still be increased to activated charcoal which is needed by various chemical industries and water treatment.

Changes in charcoal or wood into activated carbon require further processing. Some researchers have tried to use charcoal, sawdust, and agriculture waste for activated carbon. They examined the production of activated carbon from mahogany sawdust. The activation process was carried out using sodium carbonate and caustic soda, however, the absorption capacity of benzene still did not meet the requirement. The absorption capacity of this benzene was 14.5% [2]. Alpian et, al. tried to produce activated carbon from gelam wood, the result showed that the activated carbon produced from gelam wood has met SNI 06-3730-1995 standard [3]. Orange peel and Sapelli sawdust were made into activated carbon using microwave with rapid heating [4][5]. Eragrostis Plana Nees leaves were made into activated carbon with the help of microwave as well [6]. Masthura and Zulkarnain examined the formation of pores in the heating of mangrove wood and coconut shell. This research showed that the most pore formation of mangrove wood and coconut shell were respectively at the temperature of 500 °C and 900 °C [7]. However, this research still has not shown the complete success of activated charcoal production from mangrove wood.

This research modifies the production method of activated charcoal from wood. The modified method was employed to transform mangrove charcoal to activated charcoal that complies with Indonesian National Standardization (SNI). The novelty of this research is the process of making activated carbon from mangrove charcoal using two methods of alternating activation, namely thermal and chemical. It is expected that the research results will be a reference for producing commercial activated carbon in the future.

2. Problem and data presentation

2.1 Problem

The production of activated carbon from mangrove charcoal is still a main attraction, especially in economic terms. Some researchers have made activated carbon from raw wood but the results still cannot be used to produce for commercial purposes. In 2018, Mastura and Zulkarnain have started a research on the effect of activation temperature on pore formation, but the research data were incomplete in which were not equipped with iodine absorption and SNI standards [7]. Accurate research is required since the commercial production of activated carbon from mangrove charcoal needs accurate data on procedure, proper activation temperature, activation time, chemical concentration for activation, and activated carbon specification.

2.2 Aim

This research aims to determine the effect of phosphoric acid concentration and activation temperature on the product proximate, iodine absorption, the addition of surface area after activation, and the best operating conditions for producing activated carbon to the product specifications compared to SNI 06-3730-1995.

3. Methodology

3.1. Data collection

This research was conducted in ITATS Chemical Engineering and mangrove charcoal was bought in the nearest traditional market in Surabaya. Mangrove charcoal was activated in two stages. The first stage was soaking the charcoal in phosphoric acid with certain concentration for 8 hours. Then, the charcoal was rinsed twice with distilled water at a temperature of 85°C until neutral pH was obtained. The dried mangrove charcoal was then ground and sieved to pass the 40 mesh filter. The ground mangrove charcoal was thermally activated for 2 hours at the selected temperature. Then, the activated carbon was cooled down in a desiccator and dried at 105°C for 6 hours followed by an analysis. Activated carbon analysis covered specific surface area with BET method, iodine absorption, and proximate analysis.

4. Data Analysis and result

4.1 Water content

Water content is one of the requirements of activated carbon. High water content may reduce the quality of activated carbon. According to SNI 06-3730-1995, the standard water content of activated carbon is less than 15%. Water content of mangrove charcoal activated carbon can be seen in Figure 1.

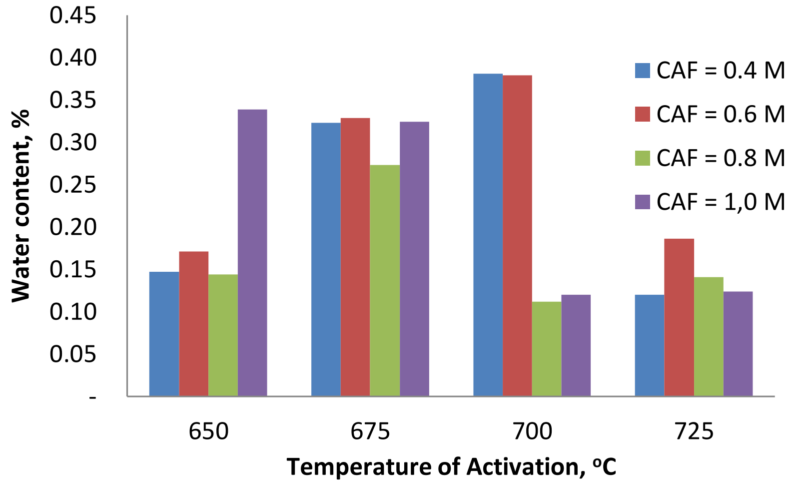

Figure 1. Water content of mangrove charcoal activated carbon at various temperatures

Figure 1. is the result of water content analysis of activated carbon at various temperature and phosphoric acid concentration. The water content of mangrove charcoal activated carbon ranged from 0.11-0.38% indicating that the water content of this activated carbon has met the SNI 06-3730-1995. This water content was better than activated carbon from bituminous and mahogany coal [2][8]. Besides due to thermal activation, the low water content was also caused by drying procedure at the end of the process.

4.2 Ash content

Ash content is one of the important active carbon requirements. If the ash content is high, it will reduce the absorption of this activated carbon. SNI 06-3730-1995 requires a maximum of 100% ash content in the activated carbon. Data on the ash content of mangrove charcoal activated carbon with thermal activation at various temperature and phosphate acid chemical activation are shown in the Figure 2. The maximum ash content of this activated carbon ranged from 6.8-10 % which has met Indonesian National Standardization (SNI 06-3730-1995), in which the maximum ash content of activated carbon is 10%.

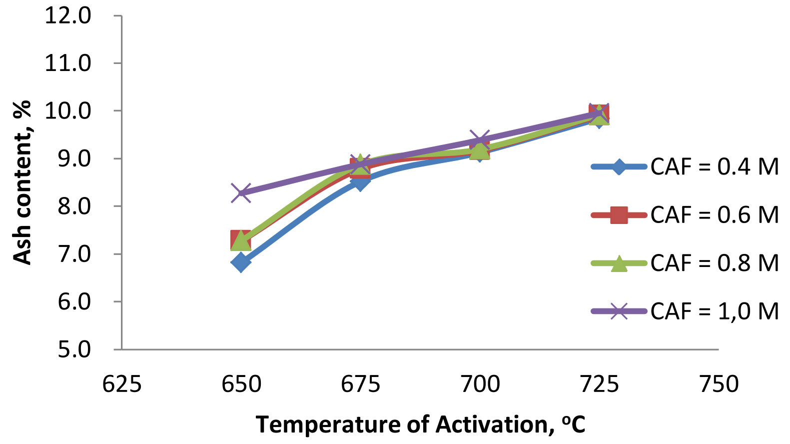

Figure 2. Ash content of mangrove charcoal activated carbon with thermal activation at various temperature and phosphate acid chemical activation

The increase of activation temperature from 650°*C* to 725°*C* may increase ash content from 6.8-9.8%. This happens due to the partial increase of the volatile matter temperature will leave activated carbon. The ash content in this study was better than in the activated carbon from bituminous coal [8][9]. High ash content may cover the pores of activated carbon.

4.3Volatile Matter

Volatile matter is a parameter describing the number of materials decomposed from activated carbon in certain temperature range. The maximum volatile matter allowed by SNI 06-3730-1995 is 25%. The data on activated carbon volatile matter of mangrove charcoal are presented in Figure 3. The volatile matter content of this activated carbon ranged from 19.8-23.4%. This number shows that all variables of activation temperature and phosphate acid concentration have formed activated carbon that met the requirement of volatile matter.

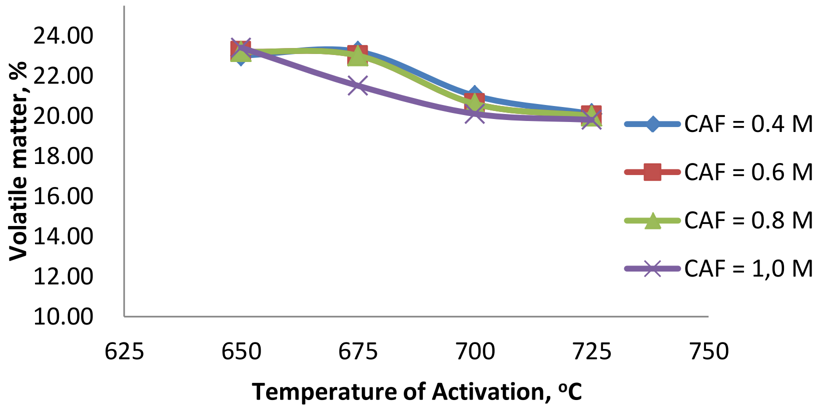

Figure 3. Volatile matter content in mangrove charcoal activated carbon with chemical and thermal activation at various activation temperatures and phosphoric acid concentration (CAF)

4.4 Fixed Carbon

Fixed carbon is a parameter describing the amount of carbon bound from activated carbon at certain temperature range. Fixed carbon content required by SNI 06-3730-1995 is 65%. The data on the analysis results of mangrove charcoal activated carbon can be seen in Figure 4. The fixed carbon content of this activated carbon ranged from 68.13%-70.25% showing that all activation temperature ranges and phosphate acid concentration used have met the requirement of fixed carbon. The highest fixed carbon content of mangrove charcoal activated carbon was 70.51% occurred at operating condition of 725°C thermal activation and phosphate acid concentration of 1.0 M. Fixed carbon in this study was higher than bituminous coal [8].

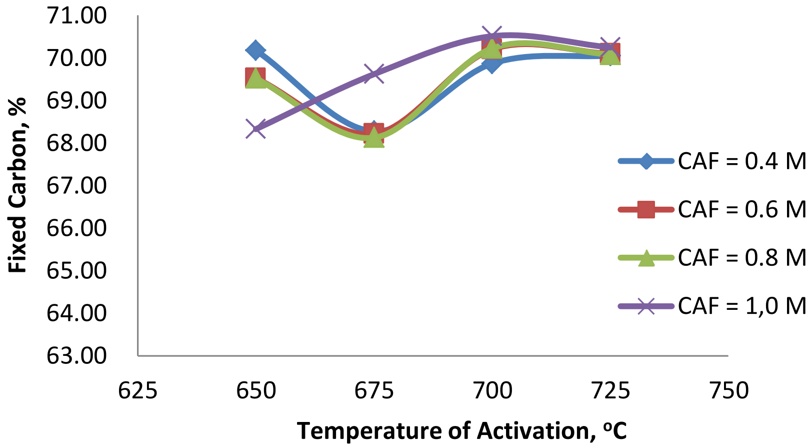

Figure 4. Fixed carbon content of mangrove charcoal activated carbon with chemical and thermal activation at various temperatures and phosphate acid concentration

4.5 Iodines Number

Iodine number is a number showing the ability of 1 g activated carbon in absorbing iodine in mg. This iodine number is an absolute requirement of SNI that must be fulfilled by activated carbon. The iodine number required by SNI 06-3730-1995 is 750 mg/g. Data on iodine number of activated carbon is presented in Figure 6. This figure shows that iodine number of activated carbon from mangrove charcoal activated by phosphate acid with 0.4-1.0 M concentration and activation temperature ranged from 650-725°C is around 769–1019 mg/g. This showed that all operation conditions chosen in the experiment of producing mangrove charcoal activated carbon have met SNI requirement in terms of iodine number. The increase of temperature from 650°C to 725°C may increase iodine number up to 19-24 percent. The highest iodine number of mangrove charcoal activated carbon is 1,019 mg/g occurred at 725°C operation condition and phosphate acid concentration of 1.0 M. Iodine absorption in this study was lower than activated carbon from mahogany [2].

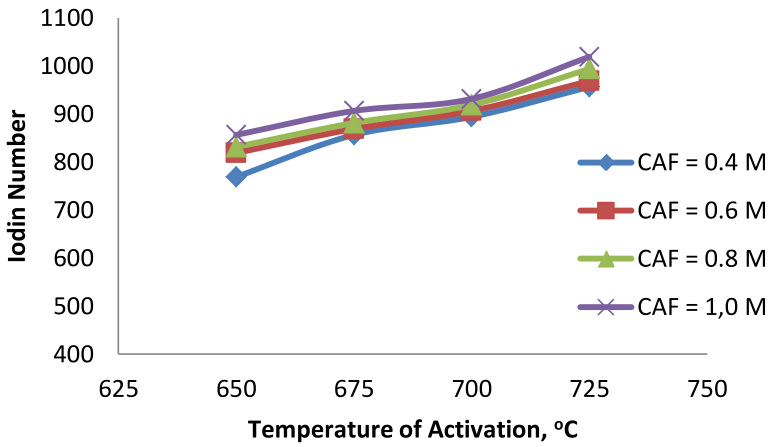

Figure 5. Iodine number of mangrove charcoal activated carbon activated using chemical and thermal activation at various activation temperatures and phosphate acid concentration

4.6 *Specific Surface Area*
Specific surface area of mangrove charcoal before activation was 136.345 m2/g. Activation of 1.0 M phosphate acid and heating at 725°C produced activated carbon with surface area of 354.977 m^2/g. The activation process has succeeded in increasing specific surface area by 160%. The specific surface area of this activated carbon was better than activated carbon from cacao shell, but lower than those from coconut shell [10],[11],[12]. The specific surface area of this activated carbon is sufficient to be commercial activated carbon.

5. Conclusion
Activation temperature and phosphate acid concentration affected proximate properties, specific surface area, and iodine number of mangrove charcoal activated carbon. Water content, ash content, volatile matter content, tethered carbon content, iodine number, and specific surface area of mangrove charcoal activated carbon in this research have met the SNI–06-3730-1995 activated carbon standard. The highest iodine number was 1,019 mg/g occurred at 725°C and phosphate acid concentration of 1.0 M. The specific surface area of this mangrove activated carbon was 354.977 m^2/g. The best operating conditions for producing activated carbon from mangrove charcoal was at 725°C with phosphate acid concentration of 1,0 M.

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