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ABSTRACT
2nd ULICoSTE 2021

Bandar Lampung, 27 - 28 August 2021

"Promoting Synergy through Collaborative Research in Science and Technology for Digital Transformation"

Institute of Research and Community Service
Universitas Lampung

The 2nd Universitas Lampung International Conference on Science, Technology, and Environment (ULICoSTE) 2021

"Promoting Synergy Through Collaborative Research in Science, Environment and Technology for Digital Transformation"

Friday-Saturday, August 27-28 2021
Emersia Hotel, Bandar Lampung, Indonesia

Scope of Conference:

- Sustainable Development
- Environmental Science
- Remote Sensing and GIS
- Climate Change
- Renewable Energy
- Natural Science
- Design and Implementation of a Technology-Rich Learning Environment

Organized by:

WELCOME MESSAGE FROM CONFERENCE CHAIR

Dear Colleagues,

The Institute for Research and Community Services of Universitas Lampung was honored to host the Second Universitas Lampung International Conference on Science, Technology, and Environment (ULICoSTE) 2021. We warmly welcome all respected paper presenters and participants to the 2nd ULICoSTE 2021. Due to the COVID-19 pandemic, we are now dealing with a paradigm of completely online-organized event using Zoom.

The world is now moving toward digitalization, where technology reigns supreme, the Conference is dedicated to promoting synergy through collaborative research in science and technology for digital transformation. Furthermore, the pandemic has forced us to go digital. As a result, today's digital transformation requires synergy with multiple parties through various research and innovations. Therefore, this 2nd ULICoSTE 2021 was an invitation to discuss various topics related to our Conference theme “Promoting Synergy through Collaborative Research in Science, Environment, and Technology for Digital Transformation.”

We hope you have a good technical experience. The 2nd ULICoSTE 2021 promises to be both stimulating and informative with a fantastic line-up of keynote speakers from Murdoch University (Australia), Universitas Lampung (Indonesia), Universiti Teknologi MARA (Malaysia), and National Taiwan Normal University (Taiwan) to develop a relationship and exchange theoretical and practical ideas and knowledge whose interest is focused on collaborative interdisciplinary research in the areas of sustainable development, environmental science, remote sensing and GIS, climate change, renewable energy, and other related areas.

This conference includes invited sessions and panel discussions with notable speakers on a wide range of science and technology research topics. The interactive sessions allow all attendees to meet and communicate with one another online. We hope your experience with the 2nd ULICoSTE 2021 is a fruitful and long-lasting one.

We have raised the bar by focusing on better quality articles for acceptance to be published in reputable conference proceedings and journals. We expect that participants will recognize that publication is a lengthy and exhausting process that entails numerous rounds of reviews and corrections. For these reasons, we expect that participants will contribute by making a concerted effort to guarantee that the articles contributed are original, error-free, and meet the quality standards required. Thus, please assist us in assisting you and others, as a delay in submission by some individuals will have an impact on others.

The conference program represents the efforts of many individuals. Therefore, we would like to express our gratitude to the members of the organizing committee for putting much effort into ensuring the success of day-to-day operation of the conference and the reviewers for their hard work in reviewing submissions. We also thank the four invited

keynote speakers for sharing their insights with us. Finally, the conference would not be possible without the excellent papers contributed by authors. We thank all authors for their contributions and participation in the 2nd ULICoSTE 2021.

We wish all attendees of the 2nd ULICoSTE 2021 an enjoyable scientific gathering in Bandar Lampung, Indonesia. We look forward to seeing you next year at the 3rd ULICoSTE 2022 conference.

Conference Chair
Dr. Ryzal Perdana
Universitas Lampung, Indonesia

CONFERENCE SCHEDULE

The 2nd Universitas Lampung International Conference on Science, Technology and Environment

(ULICoSTE 2021)

RUNDOWN 2nd ULICoSTE

Friday

27th August 2021

The 2nd Universitas Lampung International Conference on Social Sciences, Technology and Environment (ULICoSTE), taking place on 27th and 28th August 2021, the city of Bandar Lampung, Lampung Province, Indonesia

Day/Date	Time Schedule		Activity	Speaker/PIC	Place	Moderator
	Time	Duration				
Friday, 27th August 2021	08.30-09.00 AM	30’	Registration of participants	Participants		
	09.00-10.00 AM	60’	1. Greeting and Dance Performance (10')	Committee Dewi Lestari (MC)	Emersia Hotel	
			2. Opening (5')	Dewi Lestari (MC)		
			3. National Anthem (5')	All participants		
			4. Welcoming address and opening speech. - Head of LPPM (10')	Dr. Ir. Lusmeilia Afriani, D.E.A.		
			- Rector of University of Lampung (10')	Prof. Dr. Karomani, M.Si.		
			5. Praying (10')	Dr. Mualimin, M.Pd		
			6. Photo Session and Closing (10')	All participants		
	10.00-10.45 AM	45'	Presentation 1	Prof. Peter Charles (Digital Transformation)	Zoom	Andi Nafisah Tendri Ajeng, S.Farm., M.Sc.

	10.45-11.30 AM	45'	Presentation 2	Prof. Chun Yen Chang (Sustainable Development)	Zoom	Andi Nafisah Tendri Ajeng, S.Farm., M.Sc.
	11.30-13.00 PM	90'	Break Session			
	13.00-13.45 PM	45’	Presentation 3	Muhamad Norhisyam Ph.D. (Research in Science)	Zoom	Dr. Agus, M.P.
	13.45-14.30 PM	45’	Presentation 4	Prof. Dr. Udin Hasanuddin (Environmental Science)	Zoom	Dr. Agus, M.P.
	15.00-16.00 PM	60’	Parallel Session	All Presenters	Zoom	

Saturday

28th August 2021

The 2nd Universitas Lampung International Conference on Social Sciences, Technology and Environment (ULICoSTE), taking place on 27th and 28th August 2021, the city of Bandar Lampung, Lampung Province, Indonesia

Day/Date	Time Schedule		Activity	Speaker/PIC	Place	Moderator
	Time	Duration				
Saturday, 28th August 2021	08.00-08.30 AM	30’	Participants joining in zoom	All Presenters	Zoom	
	08.30-11.30 AM	150’	Parallel Session	All Presenters	Zoom	
	11.30-12.00 AM	30’	Closing	Dr. Ryzal Perdana, M.Pd.	Zoom	

THE SPECIFIC SCHEDULE OF PARALLEL SESSION ULICoSTE 2021

DAY 2 (Saturday, August 28th 2021)

ROOM 2

Moderator : Khairun Nisa **Time: 08.30 - 11.30 (150 minutes)**

No	Paper ID	Title	Author	Affiliation	Theme
1	PAPERID-9	2D MODELING GRAVITY METHOD FOR MAPPING SUBSURFACE BASIN OF BANDAR LAMPUNG CITY	Nandi Haerudin, Rustadi, Roniyus Marjunus	Lampung University	Enviromental Science
2	PAPERID-15	OPTIMIZATION OF PROTEIN PRODUCTION FROM BANANA PEEL FLOUR BY RHIZOPUS ORYZAE THROUGH SOLID-STATE FERMENTATION USING RESPONSE SURFACE METHODOLOGY	Andhika Sukma, Hasrul Anwar	Lampung University	Enviromental Science
3	PAPERID-56	IDENTIFICATION OF PHENOTIVE DIVERSITY AND PHYSIOLOGICAL APPEARANCE OF SWAMP BUFFALO (BUBALUS BUBALIS) LIVESTOCK AS AN IMPROVEMENT OF LIVESTOCK GENETIC QUALITY	Muhammad Hamdani	Lampung University	Enviromental Science
4	PAPERID-76	LIME-ENHANCED PHYTOEXTRACTION OF COPPER AND ZINC BY LAND SPINACH (IPOMOEA REPTANS POIR.) FROM HEAVY-METAL CONTAMINATED TROPICAL SOILS	Abdul Kadir Salam	Lampung University	Enviromental Science
5	PAPERID-80	MODIFICATION OF ACTIVATED CARBON FROM RUBBER FRUIT SHELLS WITH MAGNETITE COATING AND ADSORPTION OF BRILLIANT BLUE IN SOLUTION	Pina Pratiwi, Buhani, Suharso, Laili Lestari	Lampung University	Enviromental Science
6	PAPERID-81	CHARGE CONVERSION OF THE SURFACE OF NANNOCHLOROPSIS SP. WITH CATIONS AND THE ADSORPTION TEST FOR METHYLENE BLUE AND METHYL ORANGE DYES IN SOLUTION	Suharso, Nurul Miftahza, Buhani, Mita Rilyanti, Desria Monica	Lampung University	Enviromental Science
7	PAPERID-85	EFFECTS OF SWALLOW GUANO LEVEL ON GROWTH AND YIELD OF BABY CORN INFECTED PERONOSCLEROSPORA MAVDIS	Ahmad Taofik	UIN Sunan Gunung Djati	Enviromental Science
8	PAPERID-91	GROWTH AND YIELD OF THREE BEAN PLANT CULTIVARS (Phaseolus Vulgaris L) ON VARIOUS PLANTING MEDIA HYDROPONICALLY	Budy Qurrohman, Muhamad Subandi, Tedi Priatna, Ahmad Humam	UIN Sunan Gunung Djati	Enviromental Science
9	PAPERID-94	APLICATION ORGANIC MATTER AND AMF IN SWEET CORN (Zea Mays Saccharata) CULTIVATION ON POST-MINE SANDPITS SOIL	Cecep Hidayat, Yati Rachmawati, Dini Fatimah	UIN Sunan Gunung Djati	Enviromental Science
10	PAPERID-154	IN VITRO PROPAGATION OF TROPICAL PITCHER PLANT (*Nepenthes Ventricose*)	Liberty Chaidir, Delmata Hafiani Budiana, Noladhi Wicaksana, Deni Miharja	UIN Sunan Gunung Djati	Enviromental Science

CONTENTS

Modification of Activated Carbon from Rubber Fruit Shells with Magnetite Coating and Adsorption of Brilliant Blue in Aqueous Solution

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Abstract. In this research, the synthesis and characterization of activated carbon from rubber fruit shells was carried out through physical-chemical activation (RS-AC) followed by magnetite coating to produce magnetite-physical-chemical activated carbon (RS-MAC) as a Comassie Brilliant Blue (CBB) adsorbent. Activation of carbon was carried out physically by heating at 700 and chemically using a 10% H_3PO_4 solution as activating agent. The magnetite coating was carried out by the co-precipitation method. Characterization of RS-AC and RS-MAC were carried out using XRD to identify the crystallinity level of adsorbent and SEM-EDX to determine surface morphology and identify elemental composition. The result show that RS-MAC had the maximum sorption for CBB (91.98%) at acidic condition (pH 3) and contact time of 90 minutes.
Keywords: activated carbon, rubber fruit shells, magnetite coating, adsorption, Brilliant Blue.

1. INTRODUCTION

The rapid development of the industry, especially the textile industry, is one of the characteristics that currently it has entered the era of modernization. Global production of all textile fiber apparel amounts to over 110 million tons per year, leading to the production of large amounts of textile waste [1]. The growth in consumer demand for textiles in various applications increases the use of textile dyes. Textile dyes are dyes that are synthesize through a mixture of various chemicals to give a particular appearance and acquire the desired color in textiles. Most of the textile industry waste is in liquid form resulting from the rinsing/washing process. Most dyes and chemicals used in textile industry are synthetic and not readily biodegradable. So, the wastewater generated during these processes is highly polluted, dangerous and discharged into water bodies without appropriate treatment. This disturbs the aquatic life and threatens millions of people health who are dependent on the water for their day-to-day life [2].

Coomassie Brilliant Blue (CBB) is a triphenyl methane colorant widely used in the fabric production and analysis of proteins in analytical biochemistry laboratory that represents an important class of toxic and steady organic pollutants [3]. It is stated in the literature that consumption of water containing this dye causes severe eye problems, poisons aquatic life, and causes irritation of the mucous membranes and upper respiratory tract of living organisms. So today treatment technologies are used to remove contaminant dyes and organic wastes that are discharged into water such as adsorption [4], precipitation, oxidation-ozonation, coagulation-flocculation, ion exchange [5] and biological methods. Among the various methods published, adsorption on activated carbon is one of the most successively used methods to diminish dye contamination levels because it has several advantages, namely high efficiency, fairly simple process, low cost, and environmental friendliness [6-8].

Regrettably, although activated carbon is an effective adsorbent along with its benefits in many aspects, it has rectrictions such as long process of separating the adsorbent from the solutions and limitations of regeneration for repeated use [9]. Thus, many researchers intensively have sought innovations on advancing and developing new alternative adsorbents with high adsorption capacities and low costs to overcome the problem described. Coating using Fe_3O_4 particles on activated carbon has received considerable attention due to its simple synthesis procedure. In addition, magnetic separation offers faster separation capabilities and reuse of the adsorbent for multiple adsorption cycles [10-13]. To meet demand and reduce preparation costs, activated carbon is produced from agricultural waste, which is a widely available low cost lignocellulosic material. The hard rubber fruit shell construction proves that it contains an active compound in the form of lignin, so that this part is potential enough to be processed into a very useful activated carbon product [14]. In this present investigation, activated carbon preparation was carried out from rubber fruit shells coated with Fe_3O_4 particles to adsorb CBB dye. By using this technique, an adsorbent that has maximum adsorption capacity and removal efficiency of the CBB dyes is obtained. Moreover, it also can isolate from solution quickly and eco friendly. This is a solution to utilize

rubber fruit shells as agro-industrial waste into materials that have economic value. That way, the field of wastewater treatment will develop and solve environmental issues due to rubber fruit shells waste.

2. MATERIALS AND METHODS

2.1 Materials

Rubber fruit shell from rubber plantations in Lampung, Indonesia was used as the precursor of activated carbon, Comassiee Brilliant Blue R-250, $FeSO_4 \cdot 7H_2O$, $FeCl_3 \cdot 6H_2O$, HCl, NaOH. 10 mmol/L Comassie Brilliant Blue stock solution was prepared by dissolved 8.258 g of CBB dye in 1 L distilled water. The absorbance of CBB dye was determined at a wavelength of 551 nm (UV-Vis spectrophotometer, Multiskan SkyHigh Microplate Spectrophotometer, Thermo Fisher). The initial pH of each solution was adjusted by adding 0.1 M HCl or NaOH solution before interacting with activated carbon. Deionized water was used throughout the experiments.

2.2 Activated carbon preparation

The rubber fruit shells were first washed then dried and placed in carbonization furnace. The carbonization process was carried out at 600 °C for one hour. The char was crushed and sifted with a 150 micron sieve. Powder carbon is activated in 2 ways, that are physical activation and chemical activation. The activated carbon of rubber fruit shells that had been refined was burned at 700ºC for 1 hour and then chemically activated using 10% H_3PO_4 solution according to the procedure performed [15] to generate activated carbon from rubber fruit shells (RS-AC).

2.3 Magnetite coating of activated carbon with Fe_3O_4

The synthesis of magnetite activated carbon was performed by co-precipitation method with iron (II) and (III) ions in alkaline medium. The ratio of activated carbon, iron (II) and (III) ions 2 : 2: 1, which was 6.483 grams of RS-AC was put into 300 mL of distilled water and then heated to a temperature of 70ºC. Furthermore, the mixture was added to the iron salt mixture consisting of 7.57 grams of $FeCl_3 \cdot 6H_2O$ and 3.89 grams of $FeSO_4 \cdot 7H_2O$ which have been dissolved in 300 mL of distilled water. Then the mixture was stirred with a magnetic stirrer for 30 minutes while dropping ± 23 mL of 5 M NaOH solution up to a black precipitate is formed. The black precipitate was washed with distilled water and then dried in an oven at 100ºC for about 3 hours, so that the activated carbon with magnetite coating (RS-MAC) was obtained [16,17].

2.4 Adsorbent Characteristics

The crystallinity level of the material (by use XRD; Shimadzu 6000, Japan) and surface morphology and constituent elemental analysis (by use SEM-EDX Zeiss MA10, Ger) were applied to investigated characteristics of RS-AC and RS-MAC.

2.5 Adsorption experiments

Batch method were used to studied the CBB adsorption process on the adsorbent. 25 mL of CBB solution was used with an initial concentration of 0.1 mmol/L. For each experiment, equal masses of 0.05 g RS-AC and RS-MAC were added to the CBB dye solution stirred using a shaker at a speed of 100 rpm for 60 minutes over ranges of pH from 3–12. Furthermore, the mixture is centrifuged to take the filtrate. The residual dye in the filtrate was measured photometrically. The amount of dye adsorption at equilibrium, q_e (mmol/g) and % removal, is calculated by

$$q_e = \frac{(C_o - C_e)V}{w} \quad (1)$$

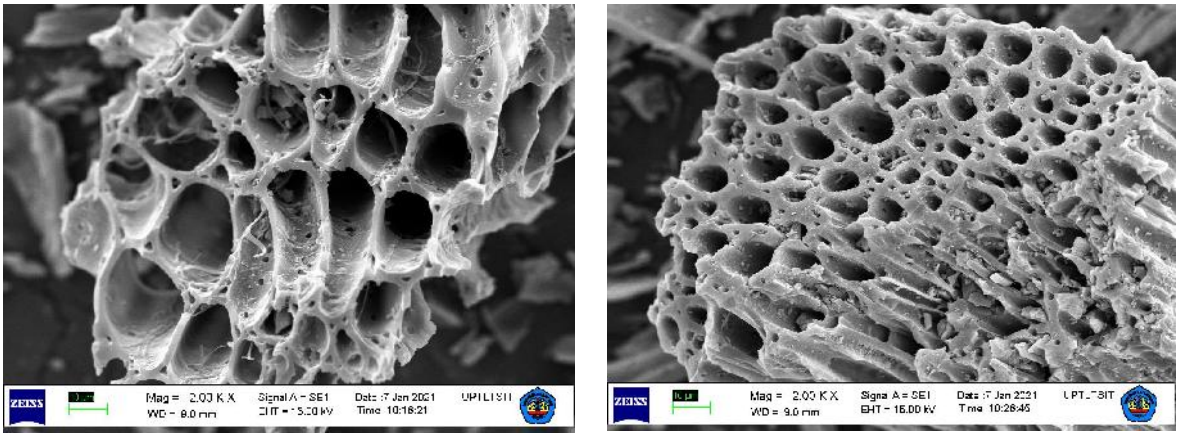
$$\text{Removal (\%)} = \frac{(C_o - C_e)}{C_o} \times 100 \quad (2)$$

where C_o and C_e (mmol/L) are initial and equilibrium CBB concentrations, w is the mass of adsorbent (g), and v represents the volume of solution (L), q_e is the amount of CBB solution adsorbed per unit mass (mmol/g).

3. RESULTS AND DISCUSSION

3.1 Synthesis and characterization of adsorbents

The adsorbents properties were characterized using XRD to identify crystal content. Surface morphology and constituent elements were examined by SEM-EDX. One of the adsorption ability of activated carbon is its surface morphology. This is because activated carbon is categorized as a porous material which in its function as an adsorbent. There is an interaction between the adsorbate and the pores on the surface of the activated carbon. Micrographs of adsorbent which chemically activated by H_3PO_4 (RS-AC) and magnetite activated carbon (RS-MAC) are showed in Figure 1.



(a) (b)

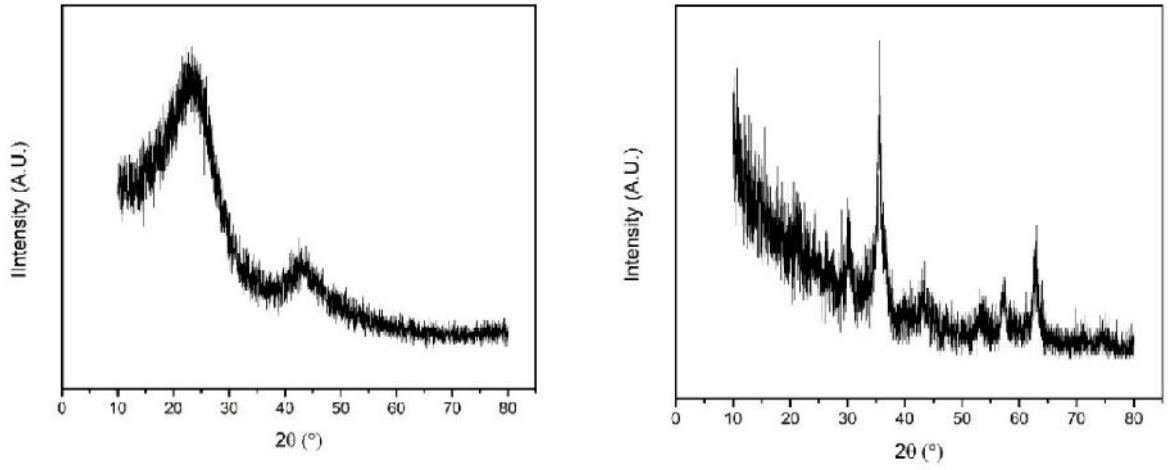
FIGURE 1. SEM images of (a) RS-AC and (b) RS-MAC

Based on Figure 1, it can be seen that there is a difference in morphological shape between RS-AC and RS-MAC which is seen at 2000x magnification. The visible pores on the surface of the activated carbon as observed from the SEM micrograph had a diameter in the micrometer (µm) range. From the figure, it can be seen that all of the adsorbents have heterogeneous surfaces and pore sizes that vary randomly. The pores are formed because the dirt on the surface of the charcoal has been lost during the activation process. During the activation process, H_3PO_4 as the activator reacts by oxidizing the charcoal and helps to remove impurities, tar and other compounds that stick to the surface of the charcoal so that the pores on the surface of the charcoal open up, forming new pores and increasing the diameter and volume of pores on the surface of the charcoal.

TABLE 1. Carbon composition from (RS-AC) and (RS-MAC).

Element	RS-AC (wt%)	RS-MAC (wt%)
C	94.30	46.02
O	05.70	19.37
Fe	-	34.61

The presence of magnetite in activated carbon can be verified through characterization with EDX that may be seen from Table 1 and supported by XRD patterns in Figure 2. The results obtained confirmed the presence of the elements C, O, and Fe with 46.02; 19.37; 34.61 (wt%) in the RS-MAC sample. The elements C and O are the main constituents of activated carbon while the Fe element which was not originally in the EDX spectrum from RS-AC indicates that the magnetite coating process on activated carbon has been successfully carried out.



(a) (b)

FIGURE 2. XRD patterns of (a) RS-AC and (b) (RS-MAC).

Based on Figure 2, RS-AC exhibits a typical amorphous carbon form and broad asymmetric peaks corresponding to 2θ~25°. Meanwhile, the RS-MAC diffractogram pattern appears at peak intensities of 30.18, 35.60, 43.22, 57.36 and 62.87

which correspond to the XRD pattern of the cubic crystalline structure of the magnetite (Fe_3O_4) phase. This supports EDX data that the outer surface of activated carbon has been coated with magnetite [13,18].

3.2 Influence of solution pH

The correlation between pH and the percentage of CBB dye adsorbed on RS-AC and RS-MAC obtained can be seen in Figure 3. One of an important factor in adsorption dye and contaminants is pH solution. The results obtained from this study indicate that the adsorption efficiency decreases with the increase in pH value and the highest adsorption efficiency value obtains at pH 3 [18,19]. At pH 3, the maximum dye removal rates for RS-AC and RS-MAC were 59.651% and 77.920%, respectively, after 1 hour.

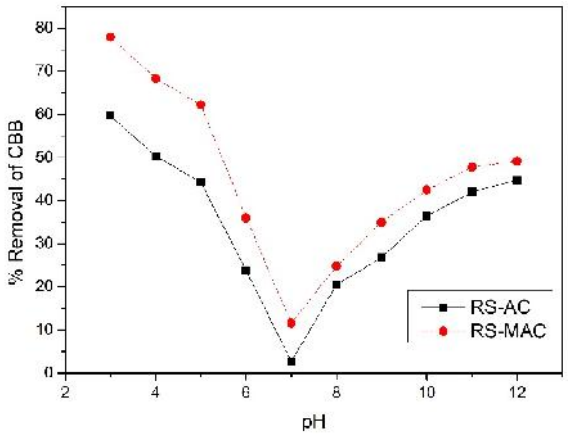


FIGURE 3. Consequence of pH on removal capacity of CBB to RS-AC and RS-MAC (contact time 60 minutes, CBB 0.1 mmol/L, and temperature 27 °C).

The pK_a of the CBB dye is less than 2.0, then at pH > 2 the CBB molecule is found in anionic form and the sulfonated functional group CBB ($-SO_3$) undergoes ionization [3]. When number of protons increases as the pH value decreases to the acidic range, these protons are adsorbed onto the adsorbent, and consequently, induce a positive electric charge on the adsorbent which attracts the dye functional group which carries a negative charge [19]. After number of protons decrease by increasing the pH of the solution, consequently, the long-distance repulsive interactions between the negative charges become dominant, causing abate in the adsorption capacity. However, at pH values > 7, considerable dye removal was observed. This shows that the adsorption process includes not only the impact of simple electrostatic interactions but also through other mechanisms. Electron donor-acceptor interactions, hydrogen bond, and hydrophobic interactions are various types of short-range interactions that support the adhesion of non-ionic molecules to positively charged surfaces [21].

3.3 Influence of contact time

The optimum contact time of adsorption process between the activated carbon and the dye molecules in this study was seen by intermixing 0.05 grams of adsorbent with 25 mL of CBB 0.1 mmol/L with variations in contact time of 0, 15, 30, 60, 90 and 120 minutes.

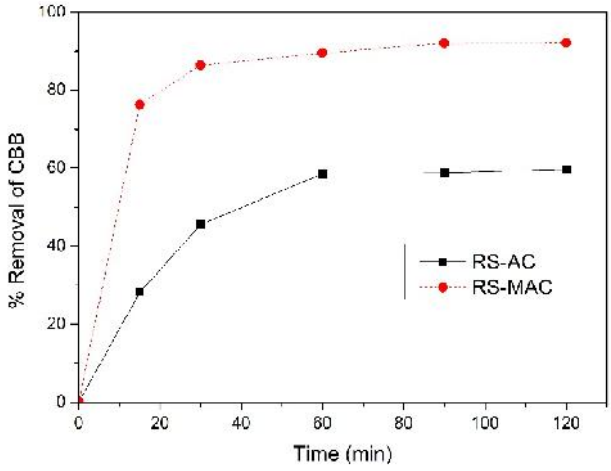


FIGURE 4. Consequences of contact time on removal capacity of CBB on RS-AC and RS-MAC (pH 3, 0.1 mmol/L CBB and temperature 27°C).

Based on Figure 4, it can be seen that the longer contact time between the adsorbate and the adsorbent, the higher adsorption capacity will increase. The adsorption process occurs as soon as the CBB solution mixed with RS-AC and RS-MAC adsorbent where 28.24 and 76.35% CBB removed within 15 min. This occurs because in the initial state, more empty sites are available for CBB adsorption. After the fast preliminary period, the enhancement CBB adsorption observed slowly along with longer agitation time. The optimal removal efficiency was reached within about 90 minutes with the proportion of adsorbed CBB dye for RS-AC and RS-MAC, respectively 58.75 and 91.98%. The longer contact in the adsorption process, the greater the frequency of particle collisions between the adsorbent and the adsorbate. So the amount of adsorbate absorbed will be greater [22]. However after the passage of time; the remaining empty sites are difficult to fill up due to the repulsive force between the CBB molecules to the adsorbent and the liquid phase.

CONCLUSIONS

In this research, modification of activated carbon through magnetite coating by co-precipitation method has been successfully carried out. This adsorbent has been characterized by XRD and SEM-EDX techniques. Based on the results, it shows that the adsorption ability of the dye is good ~ 0.00368 mmol CBB per gram of solid with a removal efficiency of 91.98% in acidic conditions (pH 3) for 90 minutes. Applications of the rubber fruit shell activated carbons with this technique as adsorbent are expected to be economical and obtained new adsorbent which has high adsorption capacity for CBB in solution, eco-friendly and fast isolation.

ACKNOWLEDGEMENT

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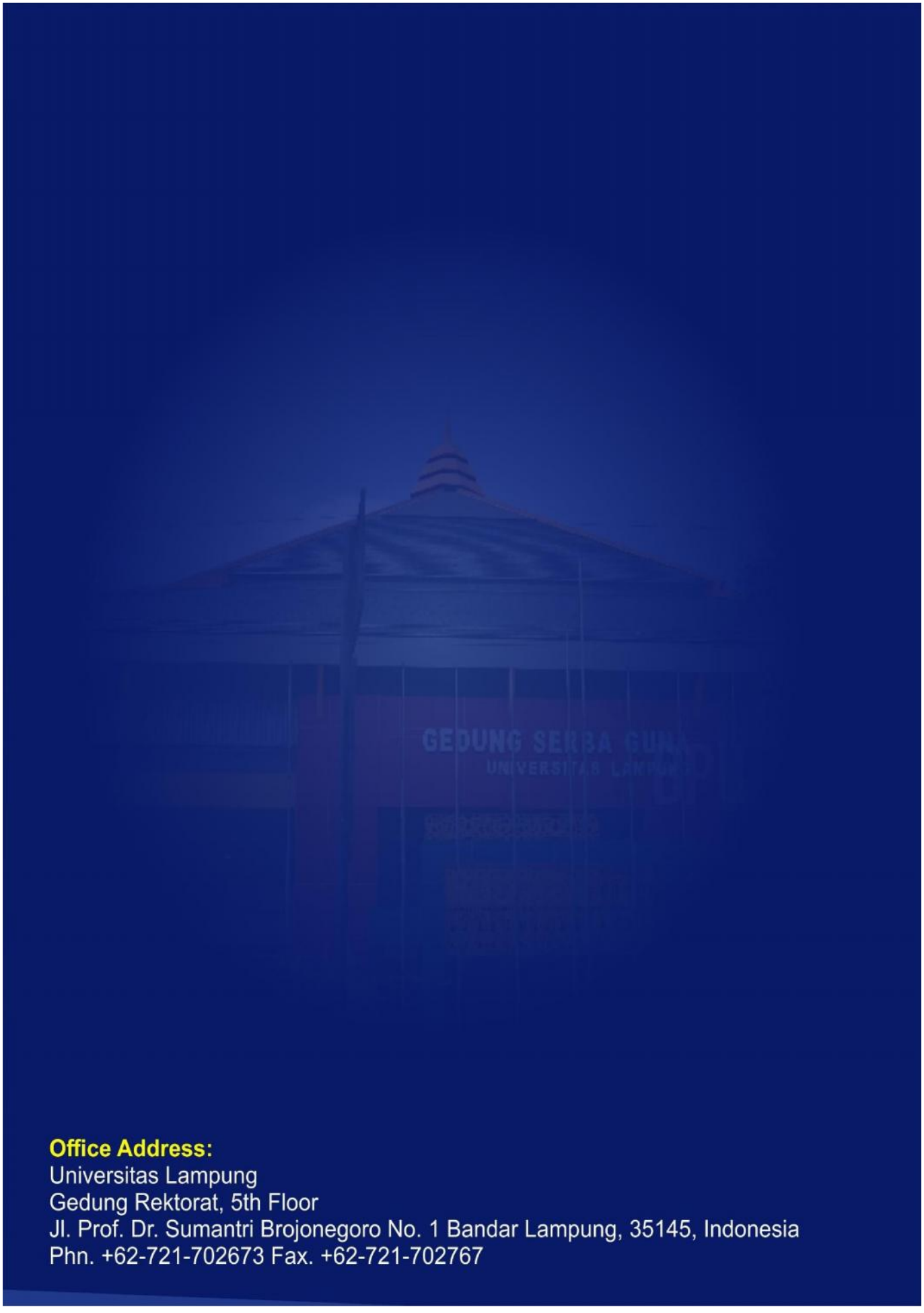

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