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:

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

Conversion of The Surface Charge of *Nannochloropsis* sp. with Cations and The Adsorption Test for Methylene Blue and Methyl Orange in Dyes Solution

Desria Monica[1, a)], Buhani[2, b)], Mita Rilyanti, Suharso, and Nurul Miftahza

[1]Postgraduate Student of Master Program in Chemistry, Department of Chemistry, University of Lampung, Jl. Sumantri Brojonegoro No 1, Bandar Lampung, Indonesia
[2]Department of Chemistry, Faculty of Mathematic and Natural Sciences, University of Lampung, Jl. Soemantri Brojonegoro No. 1 Bandar Lampung, Indonesia

[a)] Corresponding author:desria.monica3@gmail.com
[b)]buhani@fmipa.unila.ac.id

Abstract. Conversion of algae biomass load of *Nannochloropsis* sp. (AB-N) with Na^+ cations to produce algae-Na (AB-NS) as adsorbent of methylene blue (MB) and methyl orange (MO) has been carried out. Adsorbent characterization using Infrared Spectrophotometer (IR) to identify functional groups on the adsorbent, and Scanning Electron Microscopy with Energy Dispersive X-Ray (SEM-EDX) to analyze surface morphology and elemental composition in the adsorbent. The pH used in the MB dan MO adsorption test by the AB-NS adsorbent at pH 3-12. The optimal MB dye adsorption process at pH 12 with removal efficiency of 75.53% while MO at pH 3 with removal efficiency of 59%.

Keywords: Adsorption, *Nannochloropsis* sp., methylene blue, methyl orange, dye.

1. INTRODUCTION

The growing industrial sector has a bad influence on the environment because the waste produced is more and more and of course disturbs the balance of the ecosystem [1]. Most of the pollutants contained in industrial waste are dyes. When the dye is present in the waste, it will form a more complex chemical structure so that the mixture becomes difficult to separate [2]. Nearly 10.000 types of dyes with an amount in excess of 7×10^5 tons are produced annually [3], and of these dyes contained in water about 15% [4] which have a high potential as environmental pollutants.

Some of the textile dyes that pollute the aquatic environment are methylene blue and methyl orange. Methylene blue is a dye that can irritate the digestive tract, skin and cyanosis in the nose [5]. One of the anionic dyes which has an azo group in the form of dark orange powder is methyl orange [6]. Most of these synthetic dyes are an environmental problem due to their wide use, are toxic and cancer-causing [7-9]. In addition, the supply of oxygen in water decreases and triggers the activity of anaerobic organisms resulting in a product that smells bad. Several methods have been used to reduce contamination due to textile dyes such as filtration, coagulation, precipitation, ion exchange, electrodialysis, ultrafiltration, adsorption and others [10-11]. Of these several methods to reduce water pollution, the adsorption method is the most frequently used [12-14], because the adsorption process is simpler, the cost used is quite cheap, has no side effects, is environmentally friendly, and the adsorbent can be reused [15-16].

In recent years, scientist have focused on treating dyes and heavy metals contaminated waste by using organism such as algae. Currently, adsorbents derived from natural materials have been developed for processing waste such as algae biomass. Algae biomass is quite abundant in marine waters and in the form of cultivation in several parts of Indonesia. Algae biomass is an excellent adsorbent to absorb pollutants, both organic [17-18] and inorganic compounds such as dyes [19]. The ability of algae as an adsorbent that is able to adsorb well because it has a functional group and can be reused has received a lot of attention [20]. Nevertheless, algae have several drawbacks, namely being very soft, easily damaged, and not large in size. Therefore, this weakness must be overcome, then the surface charge is converted using various supporting polymers. The conversion of the surface charge of algae biomass has proven to be an effective technology such as the use of cations which can make the adsorbent rich in positive charges. The algae biomass adsorbent is negatively charged and has an active group of alkaline or alkaline earth cation exchangers. This active group acts as a charge counterweight which can be converted to other cations. In this research, adsorbent from the algae biomass of *Nannochloropsis* sp. to adsorb MB and MO dyes by utilizing active algae biomass groups and the cation-exchange properties of Na^+ cations. Thus it is expected that an adsorbent that is effective in absorbing the dye in solution will be obtained. The results of this research can be a solution to overcome the spread of harmful dyes in the environment.

2. MATERIALS AND METHODS

2.1 Materials

In this study, the biomass of the algae *Nannochloropsis* sp. originating from the Lampung Marine Cultivation Development Center (BBPBL), aquadest, NaCl, $NaNO_3$, NaOH, HCl, methylene blue (MB), and methyl orange (MO). To obtain a stock solution, 1 g of MB and MO dye were dissolved in 1 L of water, then the concentration of 2.8 mmol L^{-1} of MB and 3.05 mmol L^{-1} of MO was produced. The absorbances of MB and MO dyes were shown in 663 and 464 nm, respectively. Before being mixed with the adsorbent, 0.1 M NaOH or HCl was added which was adjusted to the initial pH.

2.2 Algae biomass production

The algae obtained were dried for 3 days. Furthermore, it is heated using an oven at 400 ºC for 2-3 hours. After being roasted, the algae are crushed using a grinding machine until they are smooth with a size of 100 mesh.

2.3 Convert the surface charge of algae to Na^+ cations

The algae surface charge conversion process was carried out by dissolving 5 grams of *Nannochloropsis* sp. with 0.1 M NaCl as much as 100 mL in Erlenmeyer. Then stirred using a shaker for 1 hour, and allowed to stand for 24 hours. After that it was filtered using filter paper, the precipitate was washed with distilled water to pH 7 to remove the remaining sodium chloride. Then the precipitate was dried at room temperature.

2.4 Adsorbent characterization

AB-N and AB-NS adsorbents were characterized by an IR spectrophotometer (Model 8201 PC Shimadzu) to determine the presence of functional groups of algae biomass. Then characterized by SEM-EDX (Model EVO MA 1) to determine the composition of the constituents and the shape and morphology of the algae surface.

2.5 Zero point charge measurement

The pzc value and the optimum pH of the adsorbent were used to determine the AB-N and AB-NS charge. In determining this pzc value, as much as 0.05 g of AB-N and AB-NS were put in 10 mL of 0.1 M $NaNO_3$ solution in 10 different Erlenmeyer. Each Erlenmeyer is made with a different pH, namely at pH 3-12. Then stirred for 24 hours at 100 rpm. After that, the pH was measured. Then the pH of the sample was measured at last, then the value of ΔpH was calculated. Then a ΔpH graph is made against the initial pH, and it will get a line located at point 0 on the x axis (initial pH) the value obtained is called the pzc value.

2.6 Adsorption

In this experiment, MB and MO dye solutions were used with a concentration of 0.1 mmol L^{-1}. First, 0.05 g AB-N and AB-NS was added to the MB dye solution stirred using a shaker at 100 rpm for 60 minutes at various pH ranges from 3–12. Furthermore, the mixture was centrifuged to take the filtrate. The absorbance of the filtrate was measured at a wavelength of 664 nm using a UV-Vis spectrophotometer. The amount of adsorbate adsorbed at equilibrium, q_e (mmol g^{-1}), is calculated by

$$q_e = \frac{(C_0 - C_e)V}{w} \qquad (1)$$

$$\text{Removal (\%)} = \frac{(C_0 - C_e)}{C_0} \times 100 \qquad (2)$$

where q_e is the amount of MB and MO solution adsorbed (mmol g^{-1}), w is the mass of adsorbent (g), C_o is initial concentration of MB and MO solutions (mmol L^{-1}), C_e is the final concentrations of MB and MO solutions (mmol L^{-1}), and v is the volume (L).

3. RESULTS AND DISCUSSION

3.1 Synthesis and characterization of adsorbents

Both adsorbents were characterized by FTIR to determine the presence of functional groups and SEM-EDX to determine the constituent composition and shape and surface morphology.

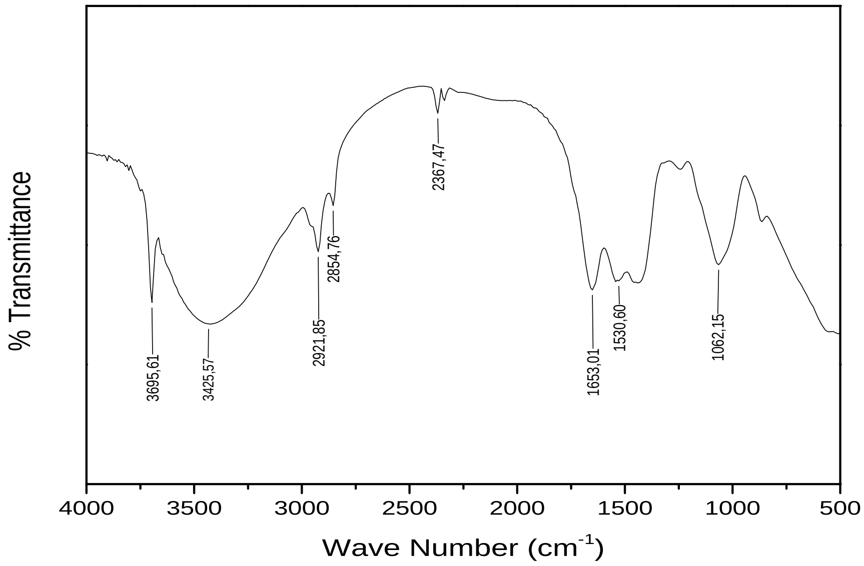


FIGURE 1. IR spectrum of AB-N

The IR spectrum of AB-N (Figure 1) obtained an absorption band at a wave number 1653.01 cm^{-1} which shows a typical C = O absorption of a carboxylic acid. In addition, the absorption band is found at the wave number 3695.61 cm^{-1} which indicates the primary N-H groups. Furthermore, the absorption at a wave number 2921.85 cm^{-1} which indicates the C-H of a CH_2 (aliphatic) carbon chain [21].

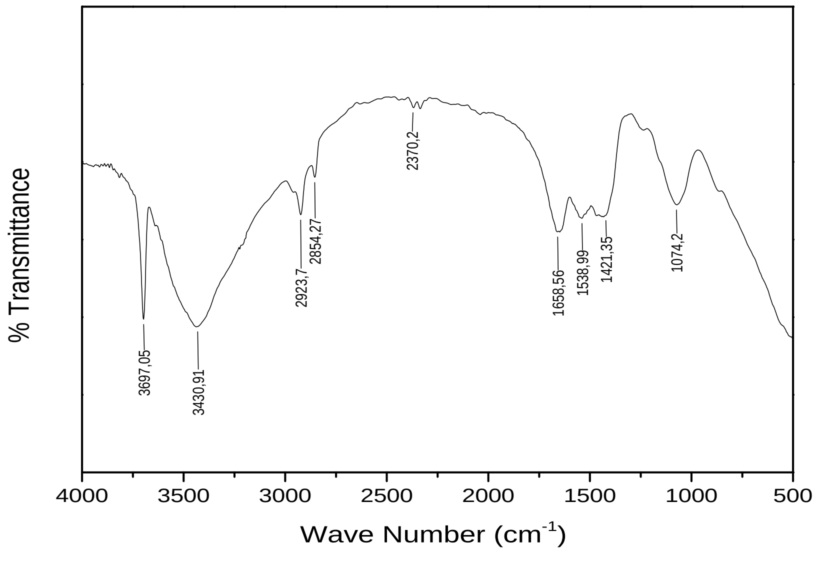
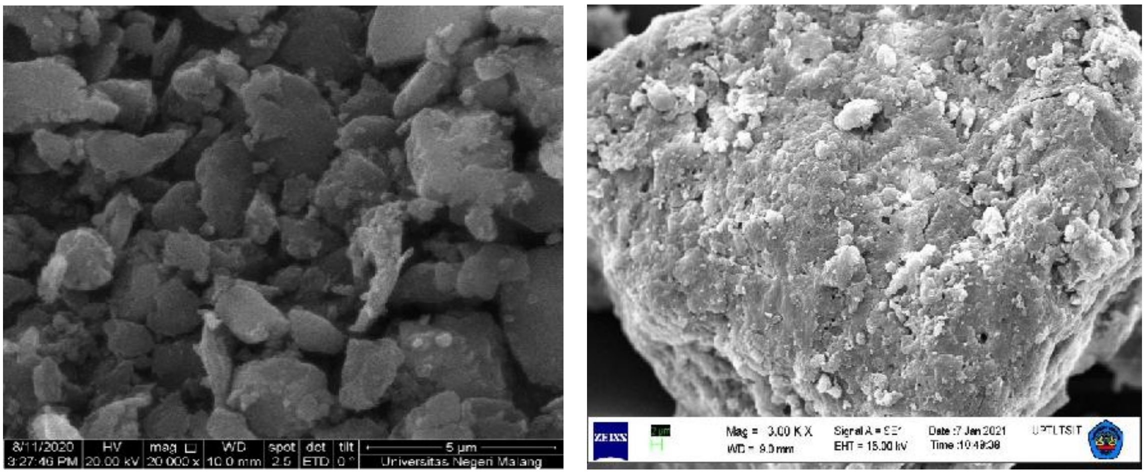


FIGURE 2. IR spectrum of AB-NS

The IR spectrum of AB-NS (Figure 2) gives absorption peaks at wave numbers 1658.56 and 3697.05 cm^{-1} which indicated the presence of typical absorptions of C=O and N-H. The absorption bands at 2854.27 and 2923.7 cm^{-1} indicate C-H (aliphatic) groups. The absorption which indicates that AB-NS has been formed is at wave number 1421.35 indicating the presence of an O-Na group (Na cation bonds with O on the carboxylic group).

SEM analysis provides information on surface morphology. Based on Figure 3 (a) it looks like a solid chunk. While in Figure 3 (b) the AB-N after being modified with Na, it shows a large surface area, and it is observed that there are grains attached to the surface which indicates the presence of Na^+ in AB-NS [22].



(a) (b)

FIGURE 3. SEM micrographs (a) AB-N and (b) AB-NS

TABLE 1. Elemental composition of AB-N and AB-NS

Element	AB-N (wt%)	AB-NS (wt%)
C	40.46	35.68
O	52.15	54.42
N	07.38	8.69
Na	-	1.21

Based on EDX data on the AB-N. (Table 1) that there are elements C, N and O from the carboxyl and amine groups in algae, besides that there are also elements such as Na, Mg, Zr and Ca which are cations contained in algae. In AB-NS that there are elements of C, N, O, and Na, where there has been uniformity with excess Na cations.

3.2 Determination of Zero Point Charge

Determination of the pH_{pzc} value was made to determine the effect of pH on the surface charge of AB-N and AB-NS adsorbents. This can be seen on the surface of the adsorbent whose pzc value (initial pH – final pH) is close to zero, which is the optimum pH_{pzc} of the adsorbent. The pzc value of the optimum AB-N adsorbent is at pH 8 and the optimum AB-NS is at pH 10 with pzc values 0.13 and 0.5, respectively (Figure 4).

The pH_{pzc} AB-N and AB-NS adsorbents are at pH 8 and 11. Thus, the pH area that is below pH_{pzc} is positively charged, while the pH area above pH_{pzc} is negatively charged [23].

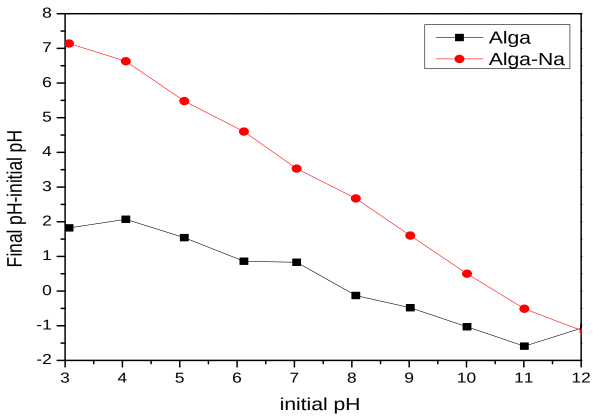


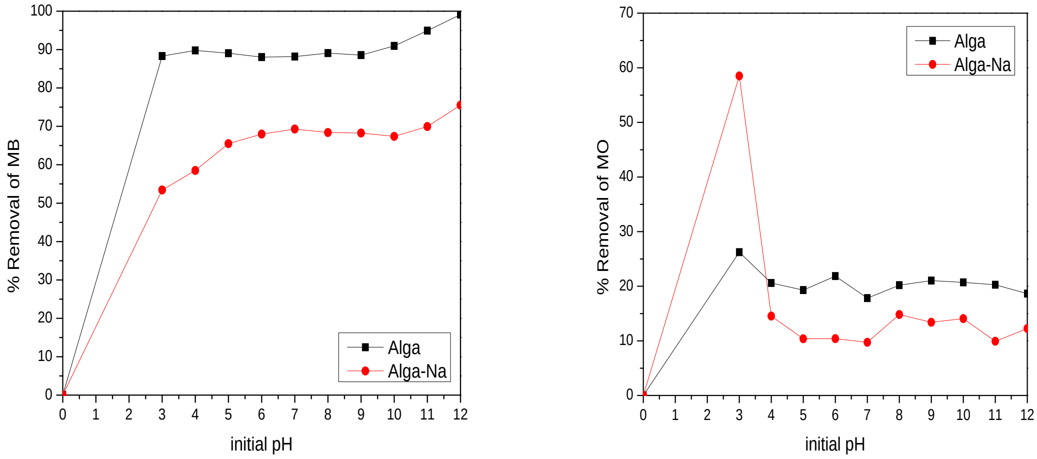
FIGURE 4. pH_{pzc} curve on AB-N and AB-NS adsorbents

3.3 Effect of pH

One of an significant factor in adsorption dye and contaminants is pH solution. Based on Figure 5 (a) for the AB-N and AB-NS adsorbents which adsorbents MB dye showed the highest adsorption power at pH 12. Whereas in Figure 5 (b) the adsorption of MO dye by AB-N and AB-NS adsorbents showed the highest adsorption at pH 3.

Based on the results of the pH_{pzc} determination, for AB-N adsorbent where the pH area is below pH_{pzc} (pH 8 for AB-N and pH 10 for AB-NS) is positively charged while the pH area above pH 8 and pH 10 is negatively charged. MB is a cationic dye where at high pH (alkaline) there is an electrostatic interaction between cationic dyes and functional groups (carbonyl and amines) [24], while at low pH (acid) there is a cation exchange between MB dyes and Na^+ cations. MO is an anionic dye where at low pH it causes the surface of the biomass wall to be protonated so that there is an electrostatic interaction, while at high pH it causes the surface of the biomass to be negatively charged, but there is an electrostatic interaction between MO and Na^+ cations.

In this study, MB adsorption was more effective at high pH which showed that electrostatic interactions were more dominant and showed more effective results than cation exchange, while MO dye showed effective results at pH 3.



(a) (b)

FIGURE 5. Curves for the influence of pH on the adsorption of MB (a) and MO (b) dyes

CONCLUSION

In this research, the surface charge conversion of AB-N with Na cations have been successfully carried out. This adsorbent has been characterized by FTIR and SEM-EDX and the results show that the adsorption ability of the dye is good ~ 0.01 mmol L^{-1} MB with a removal efficiency of 75.53% at pH 12 and MO with a removal efficiency of 59% in acidic conditions (pH 3). With this technique, AB-NS is obtained which has a high adsorption capacity for MB dye and causes the absence of side products that can damage the environment.

ACKNOWLEDGEMENT

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Office Address:
Universitas Lampung
Gedung Rektorat, 5th Floor
Jl. Prof. Dr. Sumantri Brojonegoro No. 1 Bandar Lampung, 35145, Indonesia
Phn. +62-721-702673 Fax. +62-721-702767