REMOVALOF METHYLENE BLUE USING ACTIVATED CHARCOAL OF *POLYALTHIALONGIFOLIO* (THIN-PAW TE)LEAVES

Hnin Yu Wai[1], Kaung Htet Swe[2]

Abstract

Removal of Methylene Blue (MB) from aqueous solution is carried out using carbonized material prepared from leaves of *Polyalthialongifolia* (PL) commonly called as Ashoka. The dried leaves samples were carbonized at 150° C for 2 h. The carbonized sample was heated at 175 °C for 1 h in muffle furnace to give the heated *Polyalthialongifolia* leaves charcoal (HPL). The activated carbon was prepared from *Polyalthialongifolia* leaves (APL) by chemical activation with $ZnCl_2$ as activation agent.The HPL and APL were characterized by FT IR and SEM. Batch sorption study has been carried out to investigate the effect of various parameters such as initial concentration of dye solution, contact time and amount of biosorbent. It was observed that the dye removal efficiency and adsorption capacity depended upon initial concentration of dye solution, contact time and amount of biosorbent. The equilibrium data were described by Freundlich and Langmuir isotherms. The resulting activated carbons were tested for their ability to sorb methylene blue in aqueous solution. The removal percent of methylene blue by HPL was 79.58 % and that by APL was 70.17 %.From Freundlich isotherm studies, the sorption capacity of HPL was 0.3716 mg g^{-1} and that of APL was 0.2773 mg g^{-1} for methylene blue and from Langmuir isotherm studies, the removal capacity of HPL was 232.55 mg g^{-1} and that of APL was 126.58 mg g^{-1} for methylene blue.The removal of methylene blue by HPL fits both Langmuir and Freundlich isotherms better than APL. The sorption capacity of *Polyalthialongifolia* leaves as found from the result suggests it to be a non-conventional and efficient biosorbent for the removal of MB from aqueous solution which can be used for the development of clean and cheap technology for effluent treatment.

Keywords: methylene blue, *Polyalthia longifolia* leaves, carbonized material, biosorbent

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Introduction

Polyalthia longifolia is a large genus of shrubs and trees found in tropic and sub-tropic regions. It belongs to the family of Annonaceae. *Polyalthia longifolia* which is also known as false Ashoka, Buddha Tree, Green champa, Indian mast tree, and Indian Fire tree. It exhibits symmetrical pyramidal growth with willowy weeping pendulous branches and long narrow lanceolate leaves with undulate margins. The tree is known to grow over 30 ft in height(Parvin *et al*., 2013).

The leaves are used for ornamental decoration during festivals. The tree is a main attraction in gardens throughout India. The tree can be cut into various shapes and maintained in required sizes. The flexible, straight and light-weight trunks were used in the making of masts for sailing ships. The tree is mostly used for manufacturing small articles such as pencils, boxes, matchstick, etc,(Parvin *et al*., 2013).

Scientific classification

Kingdom	:	Plantae
Order	:	Magnoliales
Family	:	Annonaceae
Genus	:	*Polyalthia*
Species name	:	*Polyalthia longifolia*
Binomial name	:	*Polyalthia longifolia* Sonn.
English name	:	Ashoka tree, Buddha tree, Green champa
Myanmar name	:	Thin-Paw Te
Habital	:	Roadside tree

Coloured compounds are the most easily recognizable pollutants in the environment because of their appearance (Abudullah *et al*., 2005). Most of the industries such as textile, carpet, rubber, plastic, cosmetic, food and printing use dyes and pigments to colour their products. Among these various industries, textile ranks first in usage of dyes for colouration of fiber (Ladhe *et al*., 2011). Due to their good solubility, synthetic dyes are common water pollutants and they may frequent be found in trace quantities in industrial wastewater. However, the discharge of dye-bearing wastewater in natural

streams and rivers possess a severe problem, as dyes impart toxicity to aquatic life and are damaging the aesthetic nature of the environment. However, wastewater containing dyes is very difficult to treat, since the dyes are recalcitrant organic molecules, resistant to aerobic digestion, and is stable to light, heat and oxidizing agents due to their structure and molecular size (Tahir*et al*., 2008).

Different methods are available for the removal of dye and pollutants from waste water. Effluent is usually treated by either physical or chemical processes includes, chemical coagulation, ion exchange, membrane filtration, electrochemical destruction, irradiation, precipitation, floatation, membrane separation, chemical oxidation reverse osmosis, aerobic and anaerobic microbial degradation, hydrogen peroxide catalysis and ozonation. However, these processes are very expensive and could not be effectively used to treat the wide range of pollutants. The conventional biological treatment process is not very effective in treating a wastewater, due to low biodegradation of dyes (Velmurugan *et al*., 2011).

Among these adsorption method is the most effective and economical method. The process of adsorption has an edge over the other methods. It is potential alternative to conventional treatment techniques for the removal of pollutants from the contaminated effluent even from diluted solution. Adsorption is operative in most natural physical, biological, chemical system. It is widely used in industrial applications due to its sludge free clean operation, its simplicity of design, high removal capacity and ease of operation at large scale (Kalderis *et al*., 2008).

Activated carbon is the most widely used adsorbent as it shows excellent adsorption efficiency. The high adsorption capacity of activated carbon is associated with internal porosity and other properties such as, high surface area, pore volume, and pore size distribution. An attempt has been made to develop cheaper and effective adsorbents from low-cost waste material. In this situation, natural raw materials are possible biosorbents that could provide a successful solution.(Rengarag *et al*., 1996).

Methylene blue is not strongly hazardous but various harmful effects such as eye burns, irritation to the gastrointestinal tract and the skin, nausea, vomiting, profuse sweating, mental confusion, methemoglobine, mica by

ingestion. Tendency to change colour when touched by sweaty fingers, its toxicity. *P.longifolia* leaves are easily available, a garden waste and has no food value. In the present work an attempt has been made to investigate the adsorption potential of carbonized *P.longifolia* prepared from leaves of the said plant for the removal of MB.

Materials and Methods

The chemicals used in the experimental works were from British Drug House Chemical Ltd., England. In all the investigations, the recommended and standard procedures of both conventional and modern techniques were employed. The experiment was carried out in the Physical Chemistry Research Laboratory of the Department of Chemistry, and FT IR spectra was measured at the Department of Chemistry, University of Yangon and SEM micrograph was at West Yangon University.

Collection of Samples

In the experiments, healthy disease free mature fresh *P.longifolia* leaves were collected from University of Yangon Campus.

Preparation of Samples

P.longifolia leaves were cut into pieces. The cut pieces were washed thoroughly with distilled water to remove dust and impurities.After cleaning the sample; it was dried at room temperature. The dried sample was then ground in a mechanical grinder and screened through a sieve to obtain fine power of uniform particle size. The sieved material was then stored in an airtight plastic bottle for further experiment.

Preparation of Heated *Polyalthia longifolia* Leaves Charcoal Powder

The purified sample was ashed and sieved into 0.5 mm aperture size. The dried leaves samples were carbonized at 150˚C for 2 h. The carbonized sample was heated at 175˚C for 1 h in muffle furnace. The heated *longifolia* (HPL) was obtained.

Preparation of Activated *Polyalthia longifolia* Leaves Charcoal Powder

The dried samples were carbonized at 150°C for 2 h. Activated carbon was produced from carbonized samples soaked were in 10 % $ZnCl_2$ solution for 24 h. After soaking, the excess solution was decanted off and air dried. Then the samples were carbonized at 200°C for 4 h.The resultant activated carbon was washed several times with distilled water to obtain neutral pH.The sample was dried at 115°C and stored in a sealed bottle and the activated *Polyalthia longifolia* leaves charcoal powder was coated as APL.

Preparation of Stock Solution of Methylene Blue

A stock solution of 100 ppm for methylene blue solution was prepared by dissolving 0.1 g of dye in 1L of distilled water. By serial dilution the dye solutions methylene blue within the concentration range of 10 ppm to 60 ppm were prepared. Analyses were carried out by colorimetric method using Cary UV-Visible Spectrophotometer and calibration curves of methylene blue solution were plotted.

Physicochemical Properties of Powdered *Polyalthia longifolia* Leaves (PL), Heated *Polyalthia longifolia* Leaves Charcoal (HPL) and $ZnCl_2$ Activated *Polyalthia longifolia* Leaves Charcoal (APL)

The physicochemical properties (moisture content, ash content, bulk density, and pH) of prepared samples were determined by conventional method.

FT IR analysis

FT IR analysis was performed in order to characterize the functional groups of the sorbents HPL and APL.A Perkin-Elmer Spectrum GX, USA was used for FT IR analysis.

SEM analysis

The morphology of prepared adsorbents was studied by using scanning electron micrograph for analysing micro and macropores present on the surface of sorbents. The scanning electron micrographs of sorbents HPL and APL were obtained with the help of Scanning Electron Microscope (JSM-5160, JEOL Ltd., Japan).

Determination of Capacity of the Prepared Sorbents for the Removal of Methylene Blue

Optimization of process parameters such as the initial concentration of dye solution, contact time and dosage of sorbents on sorption were assessed by performing batch mode sorption experiments. Appropriate dosages of sorbents were added and the solution was stirred by using Orbital shaker at 150 rpm.The solutions, after adsorption were filtered by using filter paper. The absorbance was measured on UV–visible spectrophotometer at 665nm before and after adsorption to evaluate the initial concentration (C_0) and equilibrium concentration (C_e) of methylene blue.

Isotherm Studied

The adsorption capacities of heated *Polyalthia longifolia* leaves charcoal powder (HPL)and $ZnCl_2$ activated *Polyalthia longifolia* leaves charcoal powder (APL) were studied by Freundlich and Langumuir isotherm models.

Results and Discussion

Table 1 shows that the physicochemical properties (moisture content, ash content, bulk density, and pH) of the prepared samples (*Polyalthia longifolia* leaves powder (PL),heated *Polyalthia longifolia* leaves charcoal powder (HPL)and $ZnCl_2$ activated *Polyalthia longifolia* leaves charcoal powder (APL))were determined by conventional method. The pH values of samples were determined by pH meter. The pH value of samples were found to be 6.5,7.5 and 5.5 in PL, HPL and APL. The adsorption of methylene blue on adsorbent HPL increases with the increases of pH indicating favourable adsorption at alkaline medium which can be explained from the pH value of HPL.

Table1: Physicochemical Properties of Powdered *Polyalthia longifolia* Leaves (PL),Heated *Polyalthia longifolia* Leaves Charcoal (HPL) and Activated *Polyalthia longifolia* Leaves Charcoal (APL)

No.	Physical Properties	PL	HPL	APL
1.	Moisture content (%)	11.50	17.00	16.15
2.	Ash content (%)	6.12	12.07	9.40
3.	Bulk density (g mL^{-1})	38.54	36. 66	20.15
4.	pH	6.5	7.5	5.7

Plant based adsorbents have cellulosic nature. Several characteristic functional groups of cellulosic materials, which are capable of adsorbing dye, can be identified by using FT IR technique and SEM analyzer. The FT IR spectra show HPL and APL samples have especially hydroxyl and carbonyl stretching because of the presence of cellulose plays an important role in adsorption of dye were shown in Figures 1 (a) and (b). In the Figure 2(a), the surface morphology of HPL indicates that non uniform cavities and pores on surface of HPL which can be attributed to the adsorption of dye on HPL and the surface morphology of APL indicates spongy structure was shown in Figure 2(b). The pores were completely filled after adsorption of dye were shown in Figures 3(a) and (b).

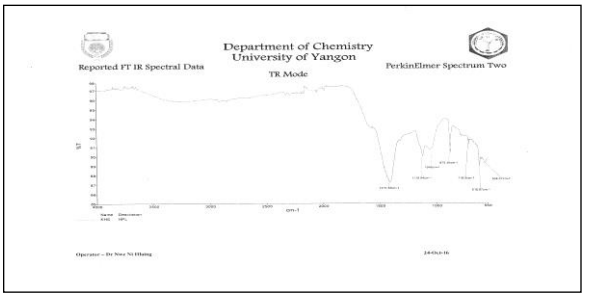

Figure 1:(a) FT IR spectrum of heated *Polyalthia longifolia* (HPL)

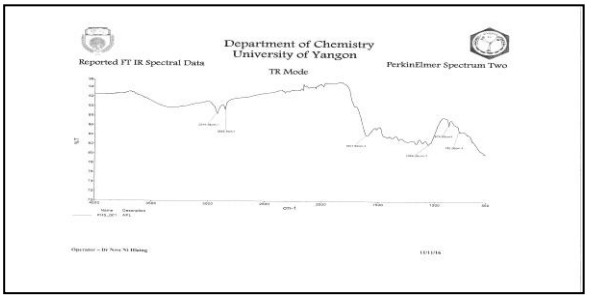

Figure 1:(b) FT IR spectrum of activated *Polyalthia longifolia* (APL)

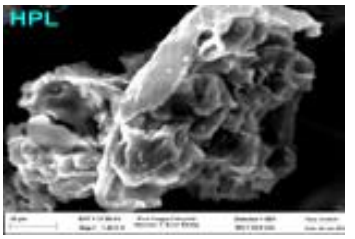

Figure 2:(a)SEM image of ofheated *Polyalthia longifolia* leaves charcoal (HPL) at 1.40 kx magnification

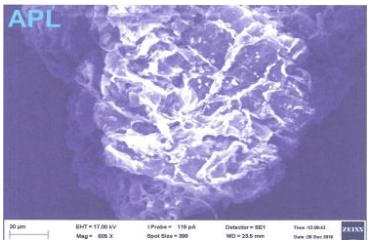

Figure 2: (b) SEM image of Activated *Polyalthia longifolia* leaves charcoal (APL)at 1.40 kx magnification

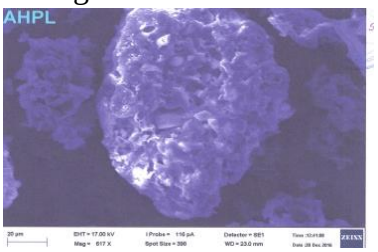

Figure 3:(a)SEM image of methylene blue sorbed of heated *Polyalthia longifolia* leaves charcoal (HPL)) at 1.40 kx magnification

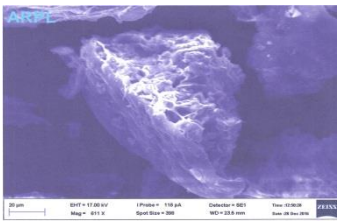

Figure 3: (b)SEM image of methylene blue sorbed Activated *Polyalthia longifolia* leaves charcoal (APL))at 1.40kx magnification

Effects of various parameters were studied and the results were recorded. Effect of initial concentration (C_0) was studied. The adsorption capacity (mg/g) decreased from 10 to 60 mg L^{-1} dose in all studied initial concentrations as indicated in Tables 2(a)and (b) and Figures 4 (a) and (b). It was observed that as the agitation time increased 60 min, percent removal and adsorption capacity increased in all initial concentrations used thereafter it remained constant. This may be due to higher rate of adsorption at low concentration were presented in Tables 3(a) and (b) and Figures 5(a) and (b).It was observed the as the amount of HPL is increased from 1 to 6 g L^{-1}, the percentage removal of methylene blue increased from 70.17 % to 93.23 % at C_0 = 30 mgL^{-1} of methylene blue. Increase in adsorbent dose increases surface area and availability of more adsorption sites, which results in increase in the removal of dye were shown in Tables 4(a) and (b) and Figures 6(a) and (b).

The removal effenciencies of adsorbents (HPL and APL) for sorption of dyes solution were calculated in equation (1)by the following:

$$R(\%) = \frac{(C_0 - C_e)}{C_0} \times 100 \qquad (1)$$

where, R is the removal percent (%), $C_0$and C_e are initial and equilibrium concentration of dye solution.

The results were shown Table 5. It indicated that the removal percent of dye solution was found to be 79.58 % and 70.17 % for removal of methylene blue by HPL and APL respectively. This result found that heated *Polyalthia longifolia* leaves charcoal (HPL)was more effective adsorbent for the sorption of methylene blue solution compared to $ZnCl_2$ activated *Polyalthia longifolia* leaves charcoal (APL) .

Tables 6(a) and (b) represented the data and Figures 7(a) and (b) were shown the sorption data for Freundlich equation is

$$\text{Log } x/m = 1/n \log C_e + \log K \quad (2)$$

where, x/m is the amount adsorbed per unit mass of the adsorbent

C_e is the equilibrium concentration

Tables 7(a) and (b) corresponding Figures 8(a) and (b) were shown the sorption data for Langmuir isotherms pertaining to Langmuir sorption equation 3. The Langmuir sorption equation 3 was used to fit the experimental sorption.

$$(1/x/m) = (1/b\ X_m C_e) + (1/X_m) \quad (3)$$

where, b is the adsorption coefficient or Langmuir constant

X_m is the monolayer capacity

Where, slope is $1/b\ X_m$ and intercept is $1/X_m$, regarding to the above equation 3, Figures 8(a) and (b) give linear plot. From the linear plot, Langmuir constant 'b' and 'X_m' were evaluated. The resulting data were shown in Table 8.

The calculated results of Langmuir and Freundlich isotherm constants were presented in Table 8. From Freundlich isotherm studies, the adsorption capacity of HPL was 0.3716 mgg^{-1} and that of APL was 0.2773 mgg^{-1} for methylene and from Langmuir isotherm studies, the removal capacity of HPL was 232.55 mgg^{-1} and that of APL was 126.58 mgg^{-1} for methylene blue. The removal of methylene blue by HPL fits both Langmuir and Freundlich isotherms as better than APL.

Table 2: (a) Effect of Initial Concentration on Percent Removal of Methylene Blue Using Heated *Polyalthia longifolia* Leaves Charcoal (HPL)

No.	Initial concentration(mg/L)	Final concentration(mg/L)	Removal	Percent (%)
1.	10	0.384	0.062	96.16
2.	20	2.768	0.447	86.16
3.	30	6.087	0.983	79.71
4	40	9.653	1.559	75.86
5.	50	13.486	2.178	73.03
6.	60	17.771	2.870	70.38

Dosage of HPL = 2 g/L, contact time = 1 h

Table 2: (b) Effect of Initial Concentration on Percent Removal of Methylene Blue Using Activated *Polyalthia longifolia* Leaves Charcoal (APL)

No.	Initial concentration(mg/L)	Final concentration(mg/L)	Adsorbance	Removal Percent (%)
1.	10	1.504	0.243	84.96
2.	20	5.089	0.822	74.56
3.	30	7.839	1.266	73.87
4	40	11.226	1.813	71.94
5.	50	14.804	2.391	70.39
6.	60	18.705	3.021	68.83

Dosage of APL = 2 g/L, contact time = 1 h

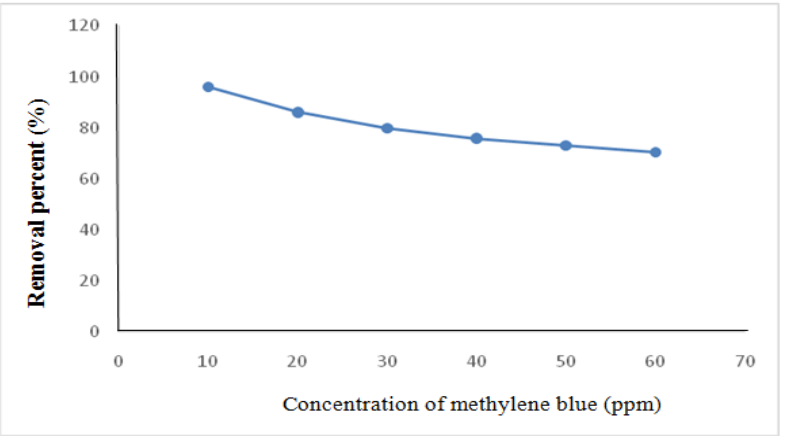

Figure 4:(a) Effect of concentration on removal percent of methylene blue by heated *Polyalthia longifolia* leaves charcoal (HPL)

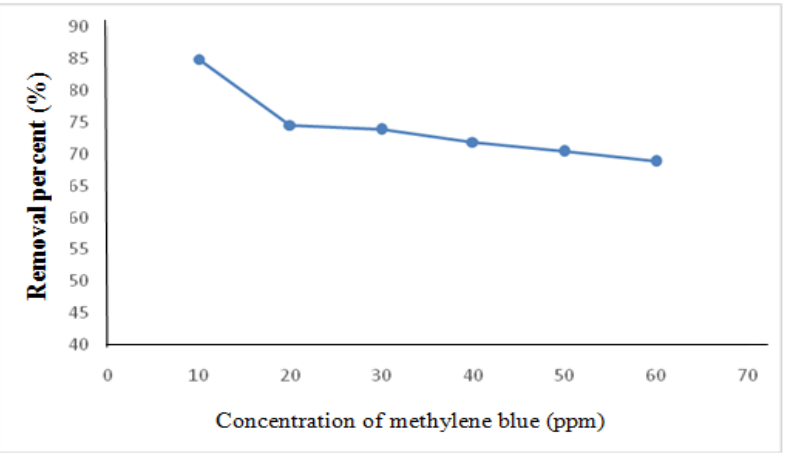

Figure 4: (b) Effect of concentration on removal percent of methylene blue by Activated *Polyalthia longifolia* leaves charcoal (APL)

Table 3: (a) Effect of Contact Times on Percent Removal of Methylene Blue Using Heated *Polyalthia longifolia* Leaves Charcoal (HPL)

No.	Contact time (min)	Final concentration (mg/L)	Absorbance	Removal Percent (%)
1.	30	7.963	1.286	73.46
2.	60	6.124	0.989	79.58
3.	90	4.663	0.753	84.46
4	120	2.266	0.366	92.45
5.	150	1.901	0.307	93.66
6.	180	1.616	0.261	94.61

Initial concentration = 30 mg/L, Dosage of HPL = 2 g/L

Table 3: (b) Effect of Contact Times on Percent Removal of Methylene Blue Using Activated *Polyalthia longifolia* Leaves Charcoal (APL)

No.	Contact time (min)	Final concentration (mg/L)	Absorbance	Removal Percent (%)
1.	30	9.715	1.569	67.61
2.	60	8.978	1.450	70.07
3.	90	8.458	1.366	71.81
4	120	8.359	1.350	72.14
5.	150	7.672	1.239	74.43
6.	180	7.622	1.231	74.59

Initial concentration = 30 mg/L, Dosage of APL = 2 g/L

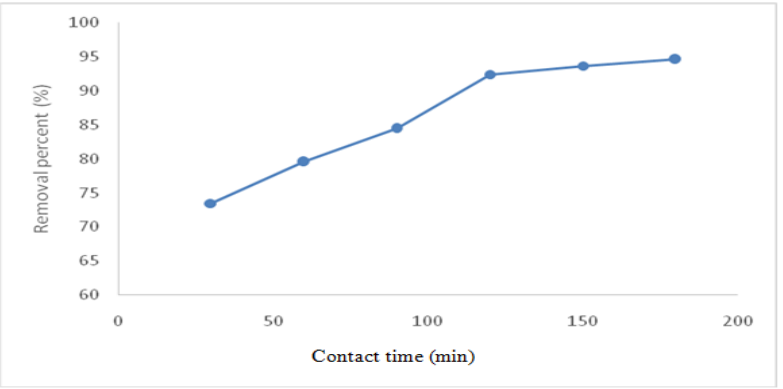

Figure 5: (a) Effect of contact times on removal percent of methylene blue by heated *Polyalthia longifolia* leaves charcoal (HPL)

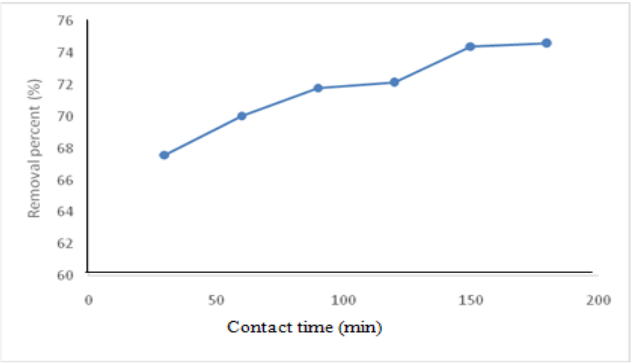

Figure 5: (b) Effect of contact times on removal percent of methylene blue by activated *Polyalthialongifolia* leaves charcoal (APL)

Table 4: (a) Effect of Adsorbent Dose on Percent Removal of Methylene Blue Using Heated *Polyalthia longifolia* Leaves Charcoal (HPL)

No.	Dosage (g /L)	Final concentration (mg/L)	Absorbance	Removal Percent (%)
1.	1	8.947	1.445	70.17
2.	2	5.888	0.951	80.37
3.	3	3.820	0.617	87.26
4	4	2.910	0.470	90.30
5.	5	2.359	0.381	92.13
6.	6	2.030	0.328	93.23

Initial concentration = 30 mg/L, contact time = 1 h

Table 4: (b) Effect of Adsorbent Dose on Percent Removal of Methylene Blue Using Activated *Polyalthia longifolia* Leaves Charcoal (APL)

No.	Dosage(g /L)	Final concentration (mg/L)	Adsorbance	Removal Percent (%)
1.	1	11.244	1.816	56.62
2.	2	6.588	1.064	77.19
3.	3	5.188	1.838	82.71
4	4	3.678	0.594	87.74
5.	5	2.953	0.477	90.15
6.	6	2.563	0.414	91.45

Initial concentration = 30 mg/L, contact time = 1 h

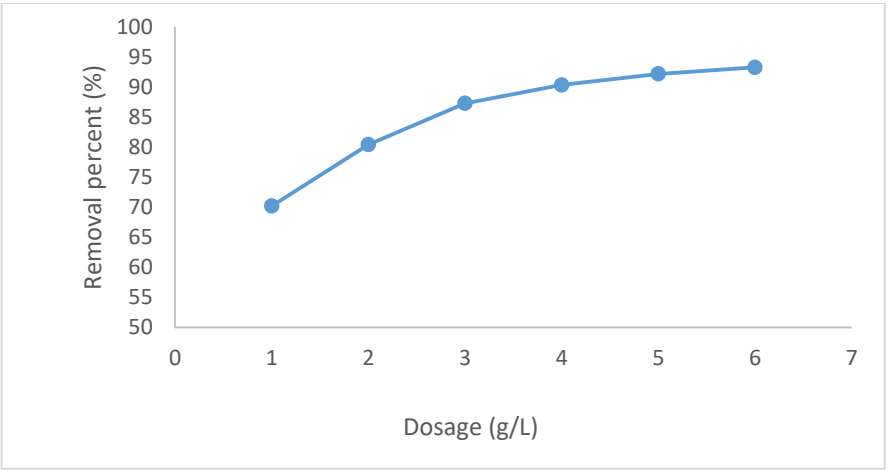

Figure 6:(a) Effect of adsorbent dosage on removal percent of methylene blue by heated *Polyalthia longifolia* leaves charcoal (HPL)

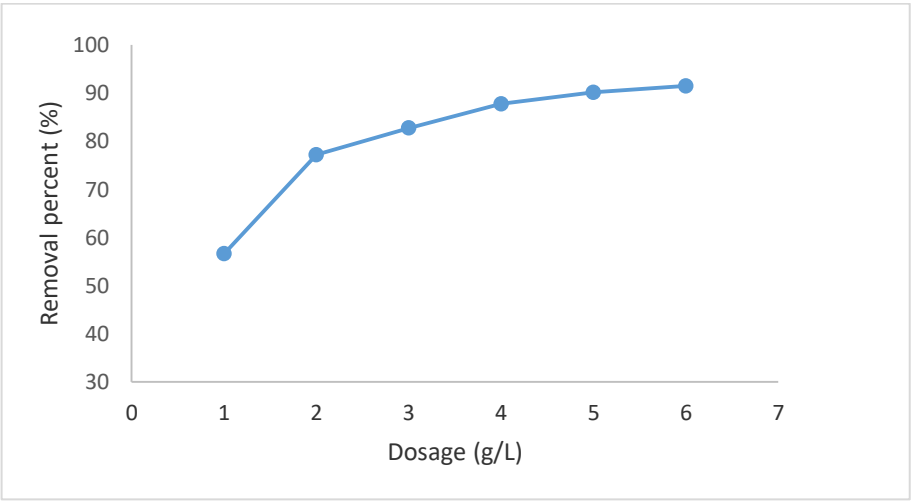

Figure 6:(b) Effect of adsorbent dosage on removal percent of methylene blue by activated *Polyalthia longifolia* leaves charcoal (APL)

Table 5: Comparison of Removal Percent of Methylene Blue by Heated *Polyalthia longifolia* Leaves Charcoal (HPL)and Activated Polyalthia *longifolia* Leaves Charcoal (APL)

Adsorbent	Removal percent of methylene blue (%)
HPL	79.58
APL	70.17

HPL = Heated *Polyalthia longifolia* Leaves Charcoal
APL = Activated *Polyalthia longifolia* Leaves Charcoal
Initial concentration = 30 mg/L
Dosage = 2 g/L
Contact time = 1 h

Table 6: (a) Freundlich Isotherm Adsorption of Methylene Blue by Heated *Polyalthia longifolia* Leaves Charcoal (HPL)

Wt of Sample (g/L)	Final Conc: C_e(mg/L)	Amount of MB adsorbed, x (mg/L)	x/m	Log C_e (mg/ g)	Log x/m
1	8.947	21.053	21.053	0.951	1.323
2	5.888	24.112	12.056	0.769	1.081
3	3.820	26.180	8.726	0.582	0.940
4	2.910	27.090	6.772	0.463	0.830
5	2.359	27.641	5.528	0.372	0.742
6	2.030	27.970	4.661	0.307	0.668

Initial concentration = 30 mg/L, contact time = 1 h

Table 6: (b). Freundlich Isotherm Adsorption of Methylene Blue by $ZnCl_2$ Activated *Polyalthia longifolia* Leaves Charcoal (APL)

Wt of Sample (g/L)	Final Conc: C_e(mg/L)	Amount of MB adsorbed, x (mg/L)	x/m (mg /g)	Log C_e	Log x/m
1	11.244	18.756	18.756	1.050	1.273
2	6.588	23.412	11.706	0.818	1.068
3	5.188	24.812	8.270	0.714	0.917
4	3.678	26.322	6.580	0.565	0.818
5	2.953	27.047	5.409	0.470	0.733
6	2.563	27.437	4.572	0.408	0.660

Initial concentration = 30 mg/L, contact time = 1 h

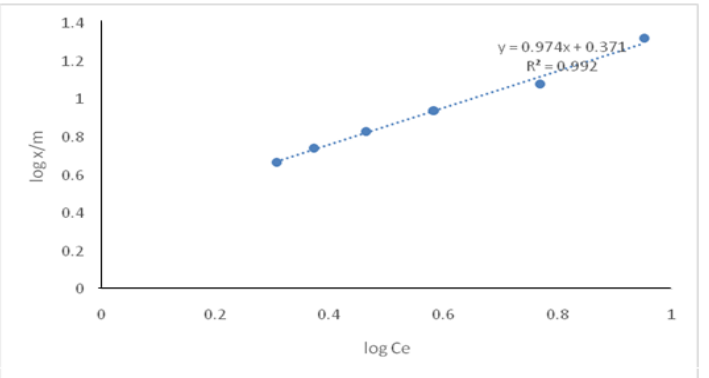

Figure 7: (a) Freundlich model of methylene blue on heated *Polyalthia longifolia* leaves charcoal (HPL)

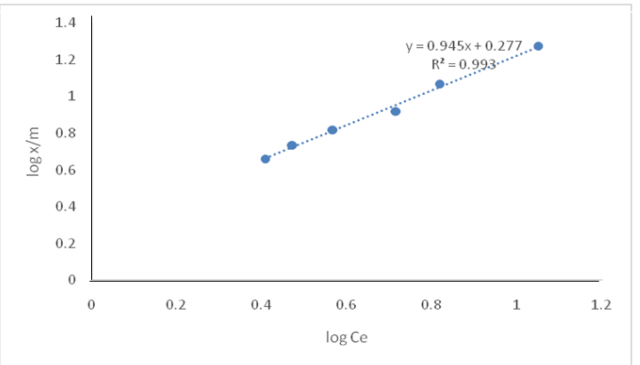

Figure 7: (b) Freundlich model of methylene blue on activated *Polyalthia longifolia* leaves charcoal (APL)

Table 7: (a) Langmuir Isotherm Adsorption of Methylene Blue by Heated *Polyalthia longifolia* Leaves Charcoal (HPL)

Wt of Sample (g/L)	Final Conc: C_e(mg/L)	$1/C_e$ (L/mg)	Amount of adsorbed, x (mg/L)	x/m (mg /g)	m/x (g/mg)
1	8.947	0.111	21.053	1.053	0.047
2	5.888	0.169	24.112	12.056	0.082
3	3.820	0.261	26.180	8.726	0.114
4	2.910	0.343	27.090	6.772	0.147
5	2.359	0.423	27.641	5.528	0.180
6	2.030	0.492	27.970	4.661	0.214

Initial concentration = 30 mg/L, contact time = 1 h

Table 7: (a) Langmuir Isotherm Adsorption of Methylene Blue by $ZnCl_2$ Activated *Polyalthia longifolia* Leaves Charcoal (APL)

Wt of Sample (g/L)	Final Conc: C_e(mg/L)	$1/C_e$ (L/mg)	Amount of adsorbed, x (mg/L)	x/m (mg/g)	m/x (g/mg)
1	11.244	0.088	18.756	18.756	0.053
2	6.588	0.151	23.412	11.706	0.085
3	5.188	0.192	24.812	8.270	0.121
4	3.678	0.271	26.322	6.580	0.151
5	2.953	0.338	27.047	5.409	0.185
6	2.563	0.390	27.437	4.572	0.219

Initial concentration = 30 mg/L, contact time = 1 h

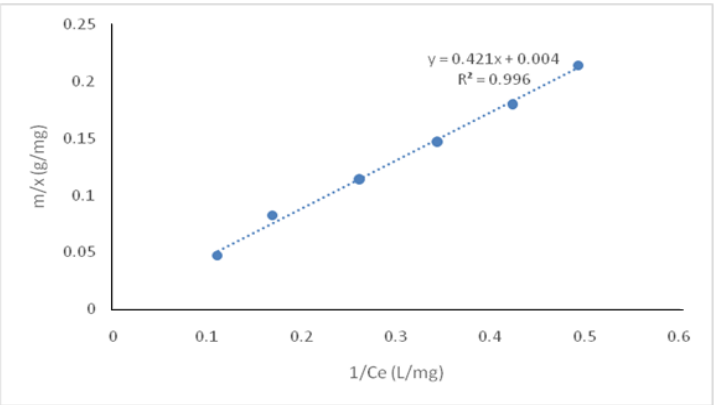

Figure 8:(a) Langmuir model of methylene blue on heated *Polyalthia longifolia* leaves charcoal (HPL)

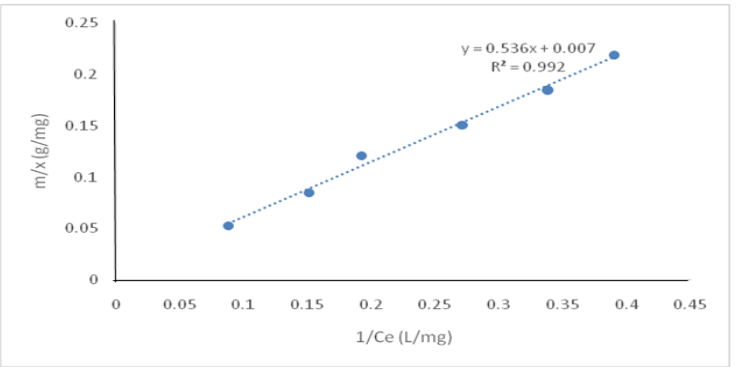

Figure 8:(b) Langmuir model of methylene blue on activated *Polyalthia longifolia* leaves charcoal (APL)

Table 8: **Adsorption Parameters for Monolayer Species by Two Types of Sorbents**

Sorbent	sorbat	Langmuir model			Freundlich model			
		X_m (mg g^{-1})	b (Lm g^{-1})	R^2	K (mg g^{-1})	1/n	n (Lm g^{-1})	R^2
HPL	MB	232.55	0.0102	0.9960	0.3716	0. 9740	1.0260	0.9920
APL	MB	126.58	0.0147	0.9920	0.2773	0.9454	1.0570	0.9930

HPL = Heated *Polyalthia longifolia* Leaves Charcoal
APL = Activated *Polyalthia longifolia* Leaves Charcoal
MB =Methylene Blue

Conclusion

This study reveals that the heated *Polyalthia longifolia* leaves charcoal (HPL)and activated *P. longifolia* leaves charcoal (APL) were tested with regards to decolourization nature of methylene blue in aqueous solution. *P.longifolia* leaves was collected at the Yangon University Campus, Yangon Region. The physicochemical properties of *P. longifolia* leaves powder (PL), heated *P.longifolia* leaves charcoal (HPL) and activated *P.longifolia* leaves charcoal (APL) were determined by conventional methods. FT IR analysis confirms the presence of active functional groups on the surface of sorbent and SEM analysis shows the presence of large cavities on the surface of HPL. The effect of initial concentration, dosage and contact time, were also investigated for the removal of dye (methylene blue) by HPL and APL samples. It was deduced that the percent removal of dye increased with the increasing time. The removal percent of methylene blue by HPL was 79.58 % and that by APL was 70.17 % by using 30 mg/L concentration of dye, 2 g of dosage and 1 h contact time. From Freundlich isotherm studies, the adsorption capacity of HPL was 0.3716 mgg^{-1} and that of APL was 0.2773 mgg^{-1} for methylene and from Langmuir isotherm studies, the removal capacity of HPL was 232.55 mgg^{-1} and that of APL was 126.58 mgg^{-1} for methylene blue. The removal of methylene blue by HPL fits both Langmuir and Freundlich isotherms was better than APL. This natural adsorbent has several advantages, such as low cost, environmental friendliness, high uptake capacity, and non-toxicity. Thus, it can be considered as an effective biosorbent on the removal of MB dye from aqueous solutions.

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