Evaluation of the Effectiveness of Bamboo Leaves on the Textile Mill Effluents

Than Than Aye

Abstract

The present research was aimed not only the preparation of bamboo leaf samples but also the application of these samples as the effective sorbents for the removal of organic dyes. The bamboo leaves were collected from the Shwegu Township, Kachin State. Two types of sorbents were prepared by heating at 100˚C and 200˚C for 2 hr. Sorption studies of two sorbents were carried out by spectrophotometric method. Then, methylene blue as basic dye and congo red as acid dye were used in sorption experiments. The effects of sorption parameters such as concentration of dye solution, contact time and sorbent dose of each sorbent upon the removal of specified coloured dye were investigated. These results were indicated the sorption capacities of sample 1(100˚C) and sample 2 (200˚C). Based on the manipulating data, the sorption capacities of sorbents for the removal of congo red and methylene blue were observed that sample 2 is greater than that of sample 1. And then, the bamboo leaves were applied for the removal of textile dyes (organic contarminants) from textile mill effluents collected from drainage of textile mill, South Okalapa Township, Yangon Region.

Keywords : Bamboo leaves, acid dye, basic dye, congo red, methylene blue

Introduction

Nowadays, the environment is very important for our live, all people must be aware of the side effects from environmental change that impact on people. The agricultural wastes are the ones that are very important; many research works report to use the waste for treatment of toxic substance. Bamboos are useful plant; all parts of bamboo can use for many purposes such as stem is used as home construction, furniture and bio reinforcement. Baby shoot is also used as delicious food, leaves used as antioxidant substance source and used as a medicinal material in china to treat inflammation, cardiovascular disease, craft, pulp, paper, board, wood-composite products, furniture, and fuel energy. (Ming-Miong He et al., 2014) However, bamboo generates large volumes of leaf wastes, which are deposited in landfills or burned in an uncontrolled manner, with negative effects in the environment. In this work, the wastes as bamboo leaves fallen from their stem were changed to other useful materials as an adsorbent material by simple method. (Baniamerian , et al., 2009)

Morphological Character

Scientific name :*Phyllostachys nigra*(Lodd.ex Lindl.) Munro
Family name : Poaceae
Englishname : Black bamboo
Myanmar name : Wanet
Part used : Leaf

Uses of Bamboo Leaf

Bamboo is not only a delicious dish to be savored with its unique flavor, but it also has many health benefits that we should know about and keep in mind. Medicinal uses of bamboo have been known and practiced by Asian healers of old. Let us acquaint ourselves with a few of these uses and benefits. Bamboo leaves have antioxidant properties. Antioxidants help to keep the balance of free radicals

and ward off any excessive amount that can cause a large variety of problems like heart disease and even cancer. It is also great for healthy skin (Wang, et al., 2015). Bamboo is a low calorie product that is high in dietary fiber. Thus, eating bamboo shoots will fill you up because of its high fiber content. This can help battling hunger pangs through the day and help with losing weight healthily. Bamboo shoots are good for the stomach and can cure mild symptoms like indigestion and diarrhea. Studies have indicated that consuming bamboo shoots can reduce cholesterol and thus, ensure a healthier life. Advantages of bamboo include its ability to control blood pressure due to the abundance of potassium. Potassium helps to lower blood pressure and keeps the body healthy (Zuo, 2001). Bamboo is also used in aromatherapy as it is known to be a natural exfoliate. A lot of cosmetic products integrate bamboo ingredients for facial and hair care. In addition, uses of bamboo plants are not only limited to dietary benefits. It is also used to make furniture and is an excellent raw material for construction purposes (Wang, 2012).

Materials and Methods

Sample Collection

The bamboo leaves were collected from the area of Shwegu Township at Kachin State. The collected bamboo leaves were dried in air and grinding with mechanical blender. The finely powdered bamboo leaves were sieved with 80-mesh size.

Preparation of sample 1

The bamboo leaves were air-dried, finely powdered and sieved with 80-mesh size. An accurately weighed bamboo leaves (20g) were put into a pre-dried and cooled dish with a cover. The uncovered dish was placed in an electric oven and heated for 2 hr at 100°C. After heating, the resultant sample was cooled at room temperature and stored in a sealed bottle. This sample was denoted as sample 1.

Preparation of sample 2

The bamboo leaves were air-dried, finely powdered and seived with 80-mesh size. An accurately weighed bamboo leaves (20g) was put into a pre-dried and cooled dish with a cover. The uncovered dish was placed in an electric oven and heated for 2 hr at 200°C. After heating, the resultant sample was cooled at room temperature and stored in a sealed bottle. This sample was denoted as sample 2.

Sorption Studies of Bamboo Leaf Samples for the Colour Removal of Dye Solutions

Sorption studies of two sorbents were carried out spectrophotometrically. Then, methylene blue as basic dye and congo red as acid dye were used in sorption experiments. The effects of sorption parameters such as concentration of dye solution, contact time and sorbent dose of each sorbent upon the removal of specified coloured dye were investigated. The results were shown in following Tables and Figure. And then the sorbents were also applied in the removal of textile dyes (organic contaminants) from textile mill effluents collected from drainage of textile mill.

Results and Discussion

Sorption Studies of Bamboo Leaf Samples for the Colour Removal of Dye Solutions

The removal of congo red and methylene blue were also determined by two types of sorbents. The maximum removal percent of congo red were found to be 85.45 % of sample 1 and 91.78 % of sample 2 at 40 mgL^{-1} of initial dye concentration, 0.1 g/10 mL of dosage and 60 min of contact time. The maximum removal percent of methylene blue by sample 1 and sample 2 were found to 65.98 % and 73.43 % respectively under the same conditions. The removal of dye effluent from textile mill in South Okalapa Township, Yangon Region by sample 1 and sample 2 were observed as57.23% and 72.32% for contact time (1h) and 71.38% and 90.25%for contact time (24 h) respectively.

Effect of Initial Concentration of Dye Solution

Table 1 Effect of Initial Concentration of Dye Solution on the Sorption of Congo Red by Sample 1 and Sample 2

Concentration (mgL^{-1})	Percent removal(%)	
	Sample 1	Sample 2
20	91.64	98.96
40	85.45	91.78
60	82.53	88.37
80	79.19	85.14
100	75.74	81.83
120	71.94	79.47

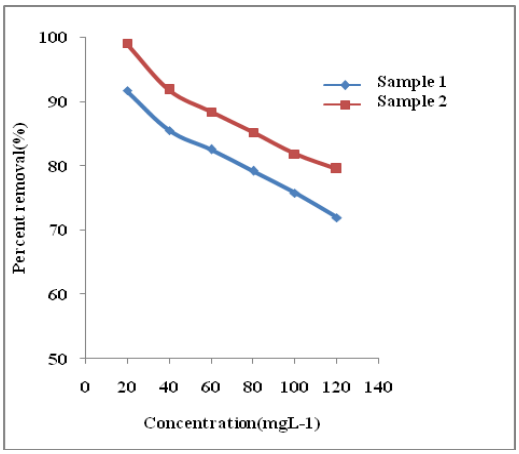

Figure 1 Effect of initial concentration of dye solution on the sorption of congo red by sample 1 and sample 2

Table 2 Effect of Initial Concentration of Dye Solution on the Sorption of Methylen Blue by Sample 1 and Sample 2

Contact time = 60 min

Dosage = 0.1 g/10 mL

Concentration (mgL^{-1})	Percent removal(%)	
	Sample 1	Sample 2
20	80.45	89.94
40	65.98	73.43
60	60.41	68.65
80	58.45	66.38
100	55.07	63.36
120	50.11	60.28

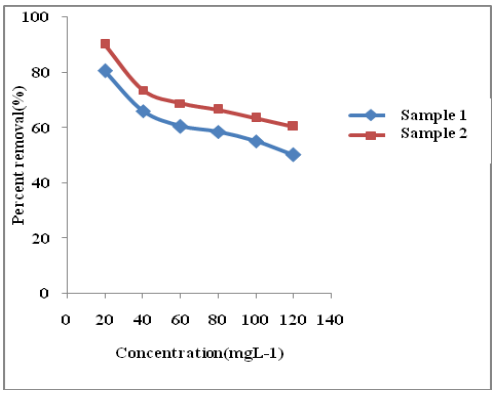

Figure 2 Effect of initial concentration of dye solution on the sorption of methylene blue by sample 1 and sample 2

Effect of Contact Time

Table 3 Effect of Contact Time on the Sorption of Congo Red by Sample 1 and Sample 2

Initial Concentration = 40 mgL^{-1}

Dosage = 0.1 g/10 mL

Contact time (min)	Percent removal(%)	
	Sample 1	Sample 2
15	83.05	90.07
30	83.73	90.38
45	84.42	91.08
60	85.45	91.78
75	85.76	92.07
90	86.01	92.17

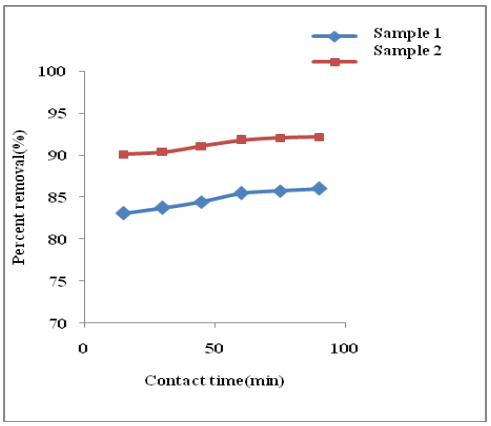

Figure 3 Effect of contact time on the sorption of congo red by sample 1 and sample 2

Table 4 Effect of Contact Time on the Sorption of Methylene Blue by Sample 1 and Sample 2

Initial Concentration = 40 mgL^{-1}

Dosage = 0.1 g/10 mL

Contact time (min)	Percent removal(%)	
	Sample 1	Sample 2
15	55.23	65.33
30	58.31	66.95
45	62.02	69.72
60	65.98	73.43
75	66.84	75.24
90	67.02	75.82

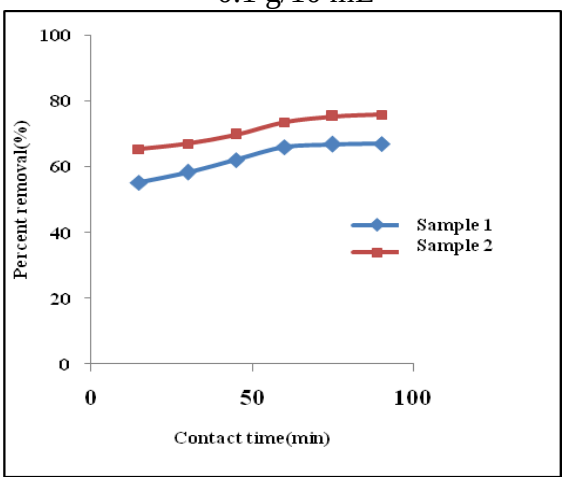

Figure 4 Effect of contact time on the sorption of methylene blue by sample 1 and sample 2

4.3.3 Effect of dosage

Table 5 Effect of Dosage on the Sorption of Congo Red by Sample 1 and Sample 2

Initial concentration = 40 mgL^{-1}

Contact time = 60 min

Dosage (g/10mL)	Percent removal(%)	
	Sample 1	Sample 2
0.02	50.05	64.38
0.04	67.07	79.12
0.06	76.48	85.85
0.08	81.56	89.38
0.1	85.45	91.78
0.12	87.95	93.35
0.14	89.57	94.29

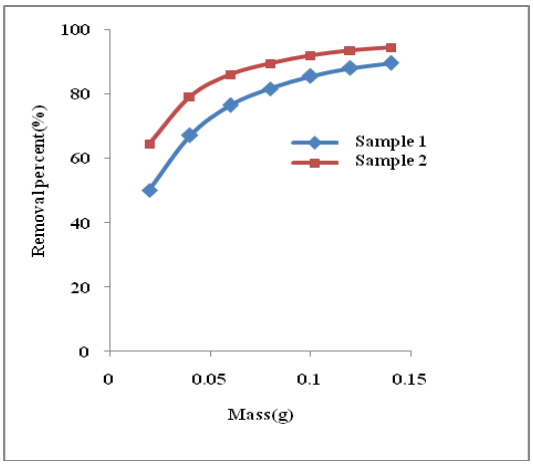

Figure 5 Effect of dosage on the sorption of congo red by sample 1 and sample 2

Table 6 Effect of Dosage on the Sorption of Methylene Blue by Sample 1 and Sample 2

Initial Concentration = 40 mgL^{-1}

Contact time = 60 min

Dosage (g/10 mL)	Percent removal(%)	
	Sample 1	Sample 2
0.02	26.03	32.51
0.04	42.13	50.11
0.06	54.08	60.81
0.08	60.51	68.23
0.1	65.98	73.43
0.12	70.56	76.96
0.14	73.85	79.98

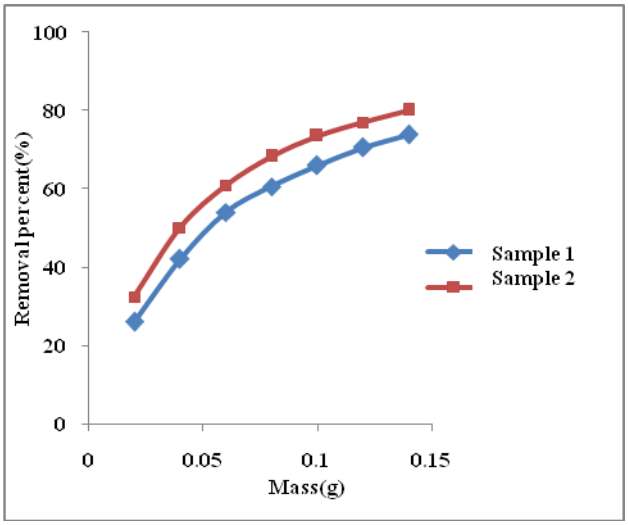

Figure 6 Effect of dosage on the sorption of methylene blue by sample 1 and sample 2

Table 7 Removal of Textile Dye by Bamboo Leaf Samples for 1 Hour Contact Time

Dosage = 0.1g/10mL
Contact time = 1 h
λ_{max} = 542nm

Sample	Absorbance of original textile dye solution	Absorbance of sorbent treated textile dye solution	Removal percent (%)
Sample 1	0.636	0.272	57.23
Sample 2	0.636	0.177	72.32

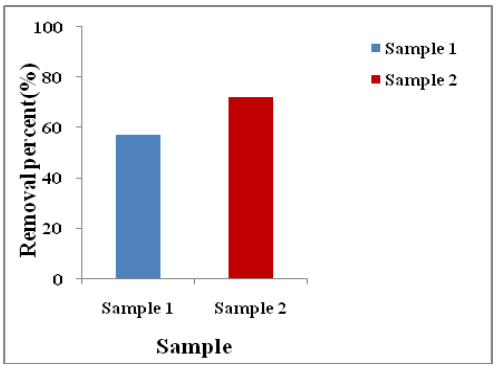

Figure 7Removal of textile dye by bamboo leaf samples for 1 h contact time

Table 8 Removal of Textile Dye by Bamboo Leaf Samples for 24 Hour Contact Time

Dosage = 0.1g/10mL
Contact time = 24h
λ_{max} = 542nm

Sample	Absorbance of original textile dye solution	Absorbance of sorbent treated textile dye solution	Removal percent (%)
Sample 1	0.636	0.182	71.38
Sample 2	0.636	0.062	90.25

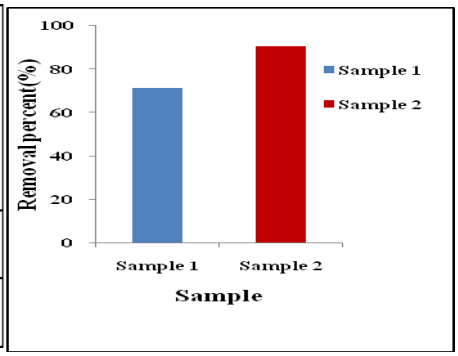

Figure 8 Removal of textile dye by bamboo leaf samples for 24 h contact time

5. CONCLUSION

In this paper, the bamboo leaves were collected at the area of Shwegu Township at Kachin State. The two bamboo leaf samples were prepared. Bamboo leaf sample 1 was heated at 100˚C for 2 hr and sample 2 at 200˚C for 2 hr respectively. The effects of sorption parameters such as concentration of dye solution, contact time and sorbent dose) of bamboo leaf samples were investigated. The maximum removal percent of congo red was found to be 85.45 % of sample 1 and 91.78 % of sample 2 at 40 mgL^{-1} of initial dye concentration, 0.1 g/10 mL of dosage and 60 min of contact time. The maximum removal percent of methylene blue by sample 1 and sample 2 were found to 65.98 % and 73.43 % respectively under the same conditions. According to these results, the sorption capacities of congo red and methylene blue on bamboo leaf sample 2 were better than that of sample 1. And then, the removal of dye effluent from textile mill in South Okalapa

Township, Yangon Region by sample 1 and sample 2 were also observed as57.23% and 72.32% for contact time (1h) and 71.38% and 90.25%for contact time (24 h) respectively. Bamboo leaf samples were the most effective and efficient sorbent for acid dye and basic dye. Bamboo leaf is much cheaper than others. Bamboo leaf samples could be applied to purify the colour polluted waste water.

Acknowledgements

We would like to say thanks to Dr Soe Win, Principal, Yenanchaung Degree College, for their kind permission to do this research work. I would like to express my sincere thanks to Professor and Head, Dr Lin Lin Tun , Department of Chemistry, Yenanchaung Degree College for their kind advices and permission to use research facilities in Department of Chemistry.

REFERENCES

Baniamerian, M.J., et al.,(2009), " The effect of surface modification on heavy metal ion removal from water by carbon nano porous adsorbent", *Appl. Surf. Sci.* **256**, 1347–1354

Ming-xiong He,et al.,(2014), "Bamboo: A new source of carbohydrate for biorefinery Review Article."Carbohydrate Polymers, **111**,(13) ,645-654

Wang, L.(2012), " Application of activated carbon derived from 'waste' bamboo culms for the adsorption of azo disperse dye: Kinetic, equilibrium and thermodynamic studies," *Journal of Environmental Management,* **102**, 79 – 87.

Wang,Y.X., et al.,(2015), "Preparation of a specific bamboo based activated carbon and its application for ciprofloxacin removal", *Science of the Total Environment*,**533**,32-39.

Zuo,T.,et al.,(2001), "Ecomaterials Research in China"' Materials and Design,**22**,107- 110