# Report on 49th Annual Conference of Japan Society on Water Environment

アリ・ラーマン
Ari RAHMAN
環境ソリューション工学専攻博士課程　2014 年度修了

## 1. Preface

I have presented my research by poster presentation with the title of "**Colored wastewater removal by textile sludge-based adsorbent**" in Kanazawa University, Kakuma Campus from March 16th to 18th, 2015.

## 2. Summary of Presentation

### 2.1 Introduction

Textile sludge was converted into potential adsorbent through carbonization process in order to tackle textile sludge and colored wastewater problem. Previous research reported that carbonization at 600℃ was an optimum temperature to create larger specific surface area (138.9 $m^2/g$) than 400～800℃. The carbonized sludge at 600℃ was tested its performance for methylene blue removal in the pure solution and had 60.3 mg/g of adsorption capacity. The practical test in the real wastewater becomes the next challenge especially to investigate the effect of other contaminants for its adsorption performance. The objectives of this research were to investigate the performance ability of carbonized sludge for methylene blue removal and to determine the necessary adsorbent dose for complete color removal from real wastewater.

### 2.2 Material for experiment

Wastewater was obtained from a restaurant at Ryukoku University, Japan. Methylene blue powder was received from Nacalai Tesque, Japan. It then was diluted with deionized water to get the necessity of dye concentration for experiment. The raw wastewater consists of 500 mL of the restaurant wastewater and 100 mL of methylene blue (500 mg/L). While textile sludge was received from a textile industry in Wakayama Prefecture. Sludge was come from the activated sludge and coagulation-flocculation system. Textile sludge was carbonized at 600℃ with a Muffle Furnace F 0410 (Yamato, Japan) for 2 hours without influence of oxygen.

### 2.3 Experimental apparatus

Plastic container (1 L) containing 600 mL of raw wastewater and 400 mL of activated sludge (MLSS around 2000 mg/L) were firstly aerated for 8 hours followed by sedimentation for 3 hours. The dye remains on the solution then was treated by adsorption with carbonized sludge at 600℃ as adsorbent. The experimental design is shown on Fig. 1.

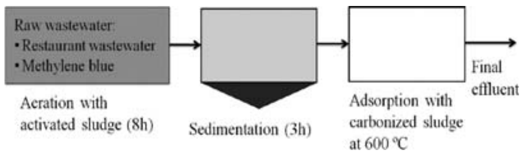


**Fig. 1 Experimental design in case of real wastewater**

In adsorption experiment, Erlenmeyer flask (300 mL) containing 100 mL of solution with different initial adsorbent dose (0.05～0.4 g/L) were shaken with a bio-shaking machine, series TB-9R-3F (Takasaki Scientific Instrument Corp., Japan) at 150 rpm at 25℃ for 1280 minutes. The absorbance of sample then was measured at 665 nm ($\lambda_{max}$) with UV-2550 UV-Visible Spectrophotometer (Shimadzu, japan) after centrifugation (2900 rpm for 15 minutes).

### 2.4 Result and discussion

Table 1 shows the aeration process with activated sludge was able to remove 76.6% of methylene blue from the wastewater. While in adsorption treatment, according to the calculation and plotting into methylene blue calibration curve the completely methylene blue removal was reached when the adsorbent dose start from 0.2 g/L. However the actual condition showed that the color slightly remained at 0.2. Thus in order to satisfied both calculation and visibility analysis this research deduced that the completely removal was achieved by 0.3 g/L of adsorbent dose. Furthermore, in order to investigate the influence of other contaminants on adsorbent performance, the observed-residual concentration was compared with the predicted-residual concentration follow the Langmuir adsorption isotherm. The predicted-residual concentration can be estimated by following equation (1) :

$$\frac{(ObsC_o - ObsC_e)V}{m} = \frac{q_{\max} \times K_L \times \mathrm{Pr}edC_e}{1 + K_L \times \mathrm{Pr}edC_e} \quad (1)$$

Where : $ObsC_o$ is observed-initial concentration (mg/L), $ObsC_e$ is the observed-residual concentration (mg/L), $PredC_e$ is the predicted-residual concentration (mg/L), $m$ is the adsorbent mass (g), $V$ is volume of solution (L), $q_{\max}$ is maximum monolayer capacity (mg/g) and $K_L$ is Langmuir capacity factor (L/ mg). According to the previous research carbonized sludge at 600℃ has $q_{\max}$ of 60.30 mg/g with $K_L$ of 0.851 L/g for methylene blue removal from synthetic wastewater. As shown on the Table 1 $PredC_e$ was lower than $ObsC_e$ at 0.05 g/L of adsorbent dose while $PredC_e$ was higher than $ObsC_e$ at 0.1 g/L and more. Due to the adsorbent dose at 0.3 g/L was preferable for completely color removal, this research deduced that there was almost no inhibition during adsorption of methylene blue into carbonized sludge at 600℃ in case of real wastewater.

**Table 1 Color removal performance**

| Raw wastewater (mg/L) | Raw wastewater with activated sludge (mg/L) | After aeration (mg/L) | After adsorption | | |
|---|---|---|---|---|---|
| | | | Adsorbent dose (g/L) | $ObsC_e$ (mg/L) | $PredC_e$ (mg/L) |
| 43.78 | 9.71 | 2.28 | 0.05 | 1.07 | 0.79 |
| | | | 0.1 | 0.48 | 0.50 |
| | | | 0.2 | 0 | 0.27 |
| | | | 0.3 | 0 | 0.17 |
| | | | 0.4 | 0 | 0.12 |

### 2.5 Conclusion

This research demonstrated that carbonized textile sludge-based adsorbent at 600℃ was able to remove methylene blue from the real wastewater with almost no inhibition by other contaminants. The necessary adsorbent for complete color removal was achieved at 0.3 g/L-wastewater of adsorbent dose.

## 3. Acknowledgment

I would like to thankful for the opportunity doing research presentation in the 49th Annual Conference of Japan Society on Water Environment in Kanazawa University. Sharing idea and conducting valuable discussion during poster session would contribute for developing further research.