



# POLYANILINE-COATED CORN STOVER BIOMASS AS ADSORBENT FOR METHYL ORANGE REMOVAL



Rea B. Hachac<sup>1,a</sup>, Jewel A. Capunitan<sup>1,b,\*</sup>, Marvin U. Herrera<sup>2,c</sup>, Rowena B. Carpio<sup>1,d</sup>, and Veronica P. Migo<sup>1,e</sup>

<sup>1</sup>Department of Chemical Engineering, College of Engineering and Agro-Industrial Technology, University of the Philippines Los Baños, Philippines 4031

<sup>2</sup>Institute of Mathematical Sciences and Physics, College of Arts and Sciences, University of the Philippines Los Baños, Laguna, Philippines 4031

<sup>a</sup>rbhachac@up.edu.ph, <sup>b</sup>jacapunitan@up.edu.ph, <sup>c</sup>muherrera@up.edu.ph, <sup>d</sup>rbcarpio@up.edu.ph, <sup>e</sup>vpmigo@up.edu.ph

## INTRODUCTION

- Corn stover, a lignocellulosic biomass, consists of corn cobs, stalks, leaves and husks, is one of the top agricultural residues in the Philippines (Go et al., 2018), with an approximate generation of about 1.27 million metric tons in 2018.
- The performance of biomass as adsorbents can be further enhanced through various modification techniques (Abdolali, et.al, 2014). Polyaniline (PANI), a conductive polymer, is used in coating adsorbents due to its stability, high conductivity, and feasibility (Rasmussen, 2017).
- This study evaluated the potential of polyaniline-coated corn stover biomass as an alternative adsorbent in the removal of methyl orange from aqueous solution.
- The effects of pH, adsorbent dosage, and initial methyl orange concentration and their interactions on methyl orange removal were determined via a parametric study employing two-level factorial design of experiment.

## RESULTS AND DISCUSSIONS

- Significant factors affecting %MO removal: initial dye concentration (A), adsorbent loading (C), initial dye concentration-adsorbent loading (AC) interaction, and initial dye concentration-pH (AB) interaction

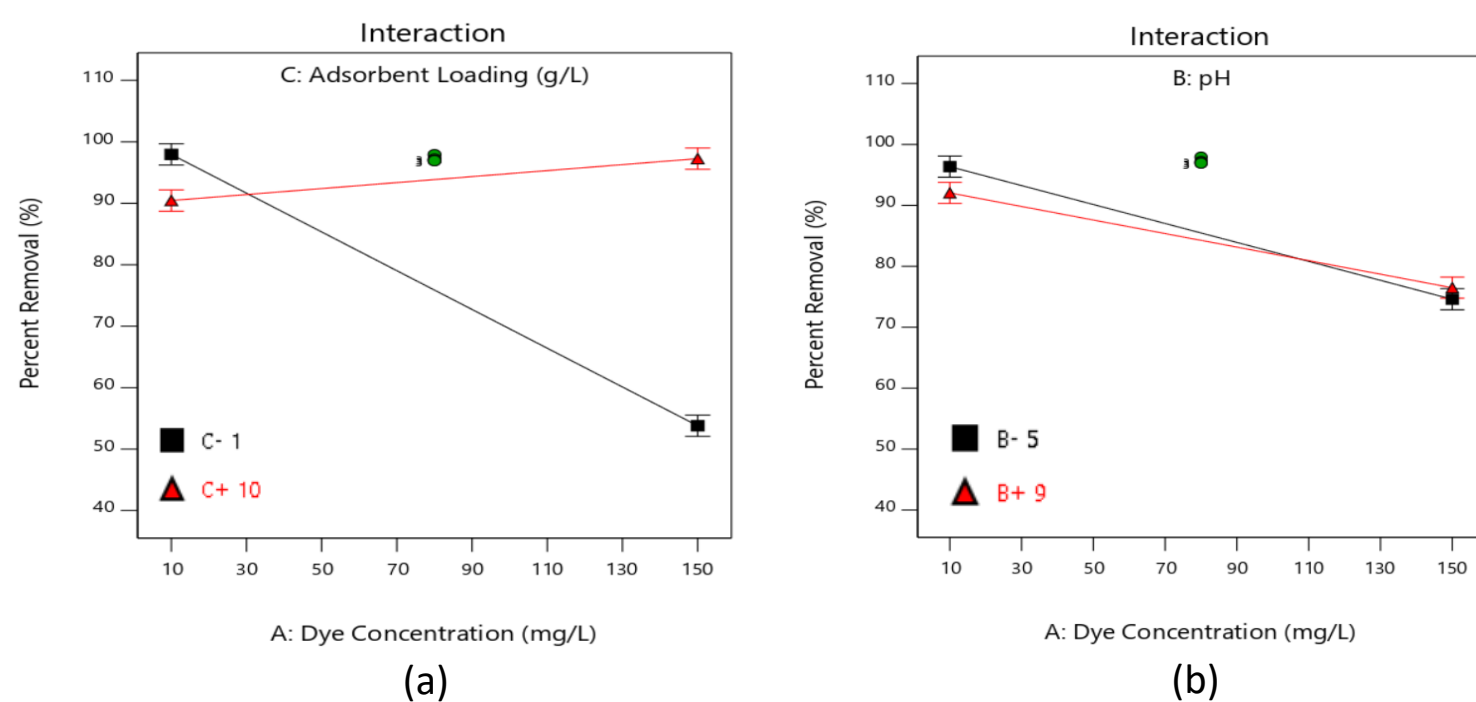


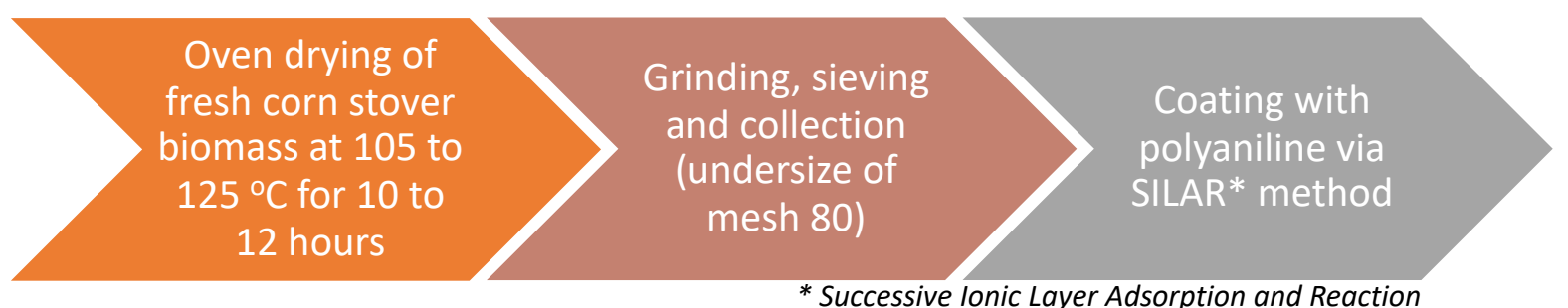
Figure 3. Effect of the interaction between (a) adsorbent loading and initial dye concentration and (b) pH and initial dye concentration on %MO removal.

- At high adsorbent loading, increasing initial dye concentration increased %MO removal: higher driving force and enhanced diffusion of the dye (Eljiedi et al., 2017).
- But at low adsorbent loading, %MO removal decreased with increasing initial dye concentration: saturation limit of the adsorbent surface and aggregation between adsorbent particles (Darwish et al., 2018).
- At low initial dye concentration, higher %MO removal at pH 5: enhanced interaction between the protonated adsorbent surface and the anionic dye particles.
- At high initial dye concentration, no significant difference in %MO removal between pH 5 and 9: enough quantity of dye particles to overcome the competition with -OH molecules (Darwish et al., 2018).

## CONCLUSIONS

- Higher %MO removal can be obtained at lower initial dye concentration, although higher removal may be obtained even with a higher initial dye concentration if the adsorbent loading is increased.
- The polyaniline-coated corn stover was found to be an effective adsorbent for the removal of methyl orange dye from aqueous solution, providing an alternative method for the utilization of this abundant agricultural residue.

## METHODOLOGY



\* Successive Ionic Layer Adsorption and Reaction



Figure 1. Ground corn stover.

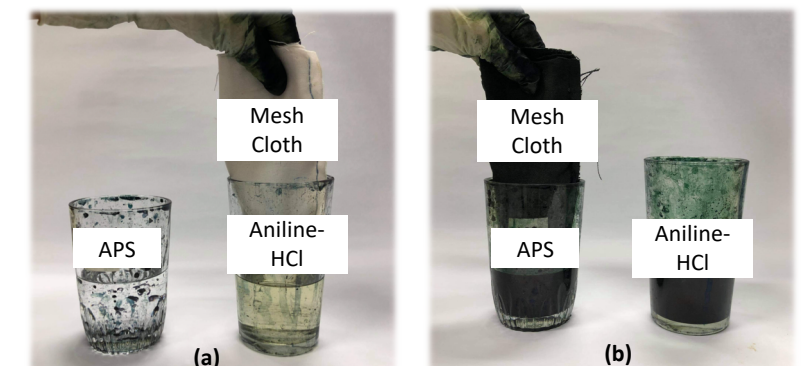


Figure 2. Corn stover biomass in mesh cloth (a) before and (b) after the coating cycle.

Table 1. Lower and upper limit values of the parameters for the 2<sup>3</sup> factorial experiment.

PARAMETERS	MINIMUM VALUE	MAXIMUM VALUE
pH	5	9
Initial methyl orange concentration (mg/L)	10	150
Adsorbent concentration (g/L)	1	10

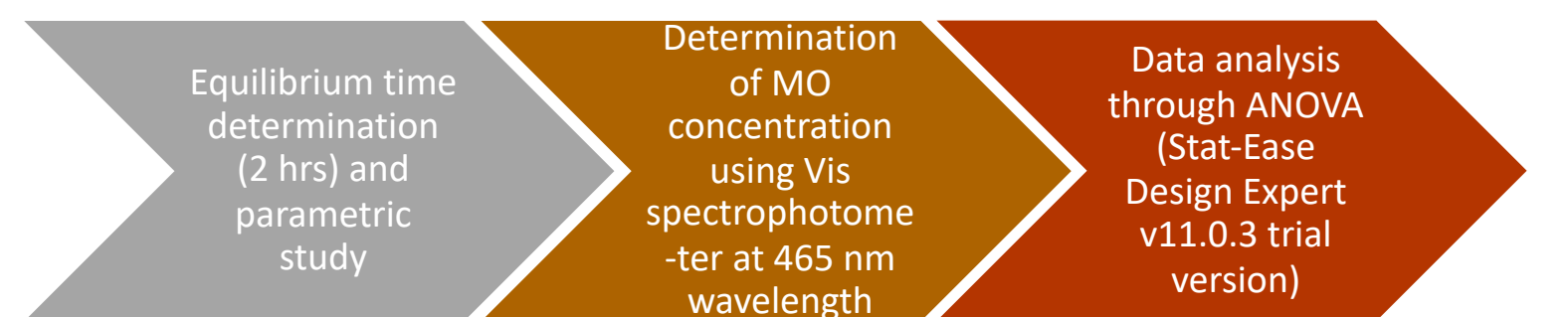


Table 2. Comparison of the %MO removal with some adsorbents.

PARAMETER	PANI-coated Corn Stover	Dragon Fruit Foliage (Haddadian et.al, 2013)	PANI-coated Kapok fiber paper (Lacuesta, et.al, 2018)
MO Removal, %	96.0-99.9	80	97
pH	5 or 9	6	Not stated
Adsorbent Loading, g/L	1	1.4	0.47
Initial Dye Conc'n, mg/L	10	50	25
Contact time, hr	2	1	6

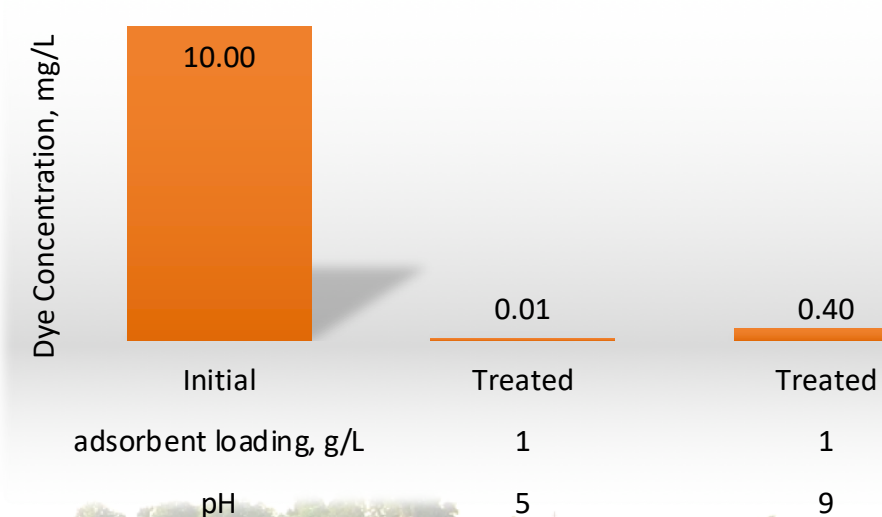


Figure 4. Comparison of initial and final MO concentration after adsorption.

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