PREPARATION OF ACTIVATED CARBON FROM PINK GUAVA *(PSIDIUM GUAJAVA)* WASTE FOR THE REMOVAL OF METHYLENE BLUE DYE FROM AQUEOUS SOLUTION

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1. Letter of Report Submission

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Penolong Naib Canselor (Penyelidikan)
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Y.Bhg.Prof,

FINAL RESEARCH REPORT "PREPARATION OF ACTIVATED CARBON FROM PINK GUAVA *(PSIDIUM GUAJAVA)* WASTE FOR THE REMOVAL OF METHYLENE BLUE DYE FROM AQUEOUS SOLUTION".

Referring to the above matter, attached herewith 4 (four) copies of final research reports and a CD entitled "Preparation of Activated Carbon from Pink Guava (Psidium Guajava) Waste for The Removal of Methylene Blue Dye from Aqueous Solution" by our group of researcher from Faculty of Chemical Engineering, UiTM Cawangan Pulau Pinang for your kind attention.

Thank you,

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5. Report

5.1 Proposed Executive Summary

Activated carbons are the most versatile and commonly used adsorbents because of their extremely high surface areas and micropore volumes, large adsorption capacities, fast adsorption kinetics and relative ease of regeneration. The most precursors used for the production of activated carbons are organic materials that are rich in carbon. In recent years, agricultural wastes has gained a significant interest among researches and being economic and eco-friendly due to their unique chemical composition, availability in abundance, renewable, low in cost and more efficient seem to be possible option for dye removal. Thus, the main objective of this research is to prepare activated carbon from pink guava waste (PGW) using simple thermo-chemical activation method. The raw material will be carbonized carbonized at temperature of 400°C for 1 h in a muffle furnace in order to produce char. Then, the char will be impregnated with sodium hydroxide (NaOH) at different impregnation ratios (1- 3) by weight followed by activation process at activation temperatures (400°C - 600°C) under different activation time (0.5 - 2 h). The optimize conditions for the preparation of activated carbon will be determined using Response Surface Methodology (RSM) with response to the activated carbon yield and percentage removal of methylene blue (MB) dye onto the adsorbent in order to obtain high adsorption capacity of the MB dye. The prepared pink guava seed based activated carbon (ACPGS) obtained by optimum conditions will be characterized through Brunauer Emmett Teller (BET) surface area, Scanning Electron Microscopy (SEM), Fourier Transform Infrared (FTIR) and Elemental Analyzer (EA). Then, the comparison on adsorption performance between ACPGW and commercial activated carbon (CAC) will be done using the batch adsorption study to determine the adsorption capacity for both adsorbents. The batch adsorption study will be carried out at different initial concentrations of methylene blue (50-500 mg/L) at room temperature (30°C) for 6 h. This research will explore the potential application of a low cost adsorbent to replace the commercial activated carbon for removal of dyes from wastewater.

5.2 Enhanced Executive Summary

The main objective of this research were to prepare activated carbon from pink guava waste (GWAC) using simple thermo-chemical activation method and to evaluate the adsorption performance of GWAC onto methylene blue dye. The raw material was carbonized at temperature of 400°C for 1 h in a muffle furnace in order to produce char. Then, the char was impregnated with sodium hydroxide (NaOH) at different impregnation ratios (1- 3) by weight followed by activation process at activation temperatures (400°C - 600°C) under different activation time (0.5 - 2 h). The optimize conditions for the preparation of activated carbon was determined using Response Surface Methodology (RSM) with response to the activated carbon yield and percentage removal of methylene blue (MB) dye onto the adsorbent in order to obtain high adsorption capacity of the MB dye. The optimum guava waste activated carbon GWAC preparation conditions were obtained using 550°C activation temperature, 1.93 hour activation time and 1.00 impregnation ratio resulting in 71.71% of activated carbon yield and 54.58% of methylene blue removal. The comparison on adsorption performance between GWAC and commercial activated carbon (CAC) were done using the batch adsorption study to determine the adsorption capacity for both adsorbents. The batch adsorption study were carried out at different initial concentrations of methylene blue (50-500 mg/L) at room temperature (30°C) for 6 h. The experimental data of adsorption studies on methylene blue using GWAC and CAC adsorbent were described well by Langmuir adsorption isotherm model with correlation coefficient, R^2 of 0.998. This indicate that the methylene blue adsorption onto both GWAC and CAC adsorbent were monolayer adsorption with maximum adsorption capacity of 250.00 and 333.33 mg/g, respectively. The kinetic adsorption studies on methylene blue using both activated carbons were best described by pseudo-second order model. This was due to the highest values of correlation coefficient, R^2 and the lowest differential value of adsorption capacities, Δq that obtained by this model on adsorption for both adsorbents. Thus, the GWAC was shown to be a promising adsorbent and have potential to replace the commercial activated carbon for removal of methylene blue from aqueous solution.