ADSORPTION OF ACID FUCHSIN AND FAST GREEN ON ACTIVATED CARBONS

By

HO SOON MIN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia in Fulfilment of the Requirement for the Degree of Master of Science

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DEDICATION

I would like to dedicate this work to my beloved family members, especially my parents for their full support to carry out my Master Degree study in Universiti Putra Malaysia.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirements for the degree of Master of Science

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Chairman: Professor Mohd Zobir Bin Hussein, Ph.D.

Faculty: Science and Environmental Studies

Activated carbons produced from palm oil shell with H_3PO_4 activation (AC 34) and physical activation (AC 00) were used to adsorb dye solutions, namely Acid Fuchsin and Fast Green. The precursors were carbonized under an inert nitrogen atmosphere for three hours followed by carbon dioxide gas activation for another hour in an electric furnace at 500 °C. Analysis of the adsorption isotherms of N_2 at 77 K shows that the surface area of AC 34 (1017 m^2/g) is higher than AC 00 (426 m^2/g). The average pore diameter for AC 34 and AC 00 is 25.2 and 15.1 Å, respectively. Characterization of activated carbons were studied by using various analytical techniques such as Fourier Transform Infrared (FTIR), Scanning Electron Microscopy (SEM), determination of ash and moisture content. The contact time, adsorbent dosage, adsorbate concentration, temperature and pH of the adsorbate that affecting the adsorption process were also studied. The result shows that the AC 34 is very effective in adsorbing Acid Fuchsin and Fast Green compared to AC 00. The adsorption process agreed to the Langmuir and Freundlich

isotherms with endothermic nature. In addition to , the two samples prepared in this study, another two commercial activated carbons (AC 6070 and AC 3040) were also used for comparison. A favorable adsorption of both dye solutions on AC 6070 compared to the other activated carbons is due to its higher BET surface area and micropore volume. The amount of dye adsorbed on adsorbent is in the order of AC 34>AC 00>AC 6070>AC 3040.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

PENJERAPAN ACID FUCHSIN DAN FAST GREEN OLEH KARBON TERAKTIF

Oleh

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Disember 2003

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Karbon teraktif yang dihasilkan daripada tempurung kelapa sawit secara pengaktifkan kimia dengan H_3PO_4 (AC 34) dan pengaktifkan fizikal (AC 00) telah diguna untuk menjerap pencelup, iaitu Acid Fuchsin dan Fast Green. Bahan permulaan bagi karbon teraktif telah dikarbonkan pada 500 °C selama 3 jam di bawah aliran gas N_2 dan diikuti dengan sejam lagi untuk gas CO_2. Analisis isoterma penjerapan N_2 pada 77 K menunjukkan bahawa luas permukaan bagi AC 34 (1017 m^2/g) adalah lebih tinggi daripada AC 00 (426 m^2/g). Garis pusat keliangan purata bagi AC 34 dan AC 00 ialah masing-masing 25.2 dan 15.1 Å. Pencirian karbon teraktif telah dikaji menggunakan teknik-teknik spektra infra merah transformasi Fourier (FTIR), mikroskop pengimbasan elektron (SEM), penentuan kandungan lembapan dan bahan tak organik. Masa sentuhan, jisim penjerap, kepekatan bahan terjerap, suhu dan pH telah didapati mempengaruhi proses penjerapan. Keputusan juga menunjukkan bahawa AC 34 sangat berkesan sebagai

bahan menjerap pencelup berbanding dengan AC 00. Di samping itu, didapati proses penjerapan juga mematuhi model Langmuir dan Freundlich, dan proses tersebut adalah bersifat endotermik. Selain daripada itu, dua karbon teraktif komersil, iaitu AC 6070 dan AC 3040 telah juga digunakan dalam penyelidikan ini bagi tujuan perbandingan. Peratusan penjerapan bagi kedua-dua jenis pencelup adalah tertinggi untuk AC 6070 berbanding yang lain disebabkan AC 6070 mempunyai luas permukaan BET dan isipadu keliangan mikro yang lebih tinggi. Jumlah pewarna yang dapat dijerap oleh karbon teraktif adalah seperti siri berikut, iaitu AC 34>AC 00>AC 6070>AC 3040.

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I certify that an Examination Committee met on 15th December 2003 to conduct the final examination of Ho Soon Min on his Master of Science thesis entitled "Adsorption of Acid fuchsin and Fast Green on Activated Carbons" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malasyia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as partial fulfillment of the requirement for the degree of Master of Science. The members of the supervisory Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for the quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted or any other degree at UPM or other institutions.

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HO SOON MIN

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