



**UNIVERSITI PUTRA MALAYSIA**

***REMOVAL OF METHYL ORANGE AND METHYLENE BLUE FROM  
AQUEOUS SOLUTION USING DRAGON FRUIT FOLIAGE***

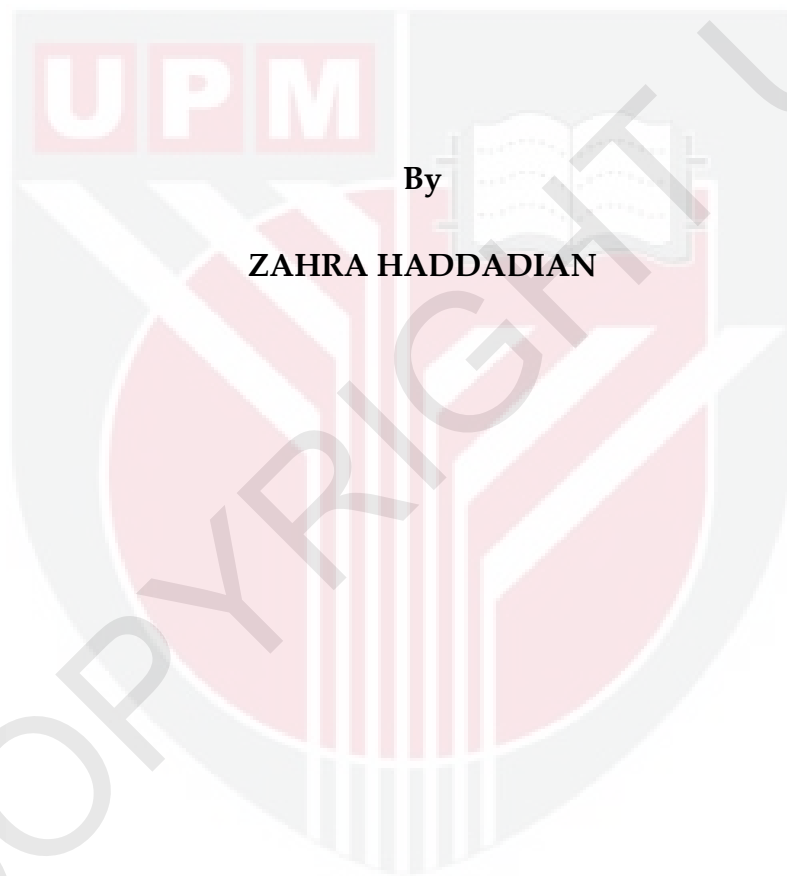
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**REMOVAL OF METHYL ORANGE AND METHYLENE BLUE FROM  
AQUEOUS SOLUTION USING DRAGON FRUIT FOLIAGE**

By

**ZAHRA HADDADIAN**



**Thesis Submitted to the School of Graduate Studies, Universiti Putra  
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Science**

**August 2012**

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

**REMOVAL OF METHYL ORANGE AND METHYLENE BLUE FROM AQUEOUS SOLUTION MENGGUNAKAN DRAGON FRUIT FOLIAGE**

By

**ZAHRA HADDADIAN**

**August 2012**

**Chair: Zurina Zainal Abidin, PhD**

**Faculty: Engineering**

The application of dragon fruit foliage (DFF) was investigated for decolourization of cationic and anionic dyes from aqueous solution. The effect of initial dye concentration, pH, amount of dragon fruit foliage, ion strength and contact time on adsorption capacity of DFF were investigated in batch and continuous mode. A maximum adsorption capacity (maximum amount of dye in mg that can be adsorbed to 1.0 g of foliage) of 105 (mg/g) and 21.27 (mg/g) were obtained for removal of cationic dye (methylene blue, MB) and anionic dye (methyl orange, MO) respectively. Based on the obtained results for the tested cationic and anionic dyes, methylene blue was chosen to study the effect of modification on the dye removal ability of dragon fruit foliage. The results determined that the adsorption capacity of DFF increased from 105 to 133 (mg/g) after modification. Dye adsorption over the adsorbent was evaluated by the use of Freundlich and Langmuir

adsorption isotherm models and it was found that the adsorption isotherm data of both mentioned dye in all three parts, best fitted the Freundlich model. The kinetic study data were well-represented by the pseudo-second-order kinetic model. The results suggest that dragon fruit foliage is more effective in removal of cationic dyes rather than anionic ones. In column test effect of flow rates and bed heights were the experimental parameters selected to obtain breakthrough curves. The maximum uptake of MB in a fixed bed adsorption column was 83 mg/g at pH 8, bed height 15 cm and flow rate 3 mL/min. The breakthrough time increased with a longer bed height and slower flow rate. Bohart–Adams and BDST models were applied to the data for predicting breakthrough curves and to determine the model parameters. Results from the experiments revealed that, DFF may be useful as an alternative low cost and environmental friendly biosorbent for the removal of cationic dyes from aqueous solutions.

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

**DIANGKAT METIL JINGGA DAN METILENA BIRU DARIPADA  
LARUTAN AKUAS OLEH DRAGON FRUIT DEDAUNAN**

Oleh

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**Ogos 2012**

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Penggunaan daun buah naga (DFF) telah dikaji untuk penyahwarnaan pewarna kationik dan anionik dari larutan akueus. Kesan kepekatan awal pewarna, pH, dos bahan penyingkir, kekuatan ion dan masa terhadap kapasiti penjerapan DFF telah dikaji dalam kumpulan dan terus mod. Maksimum kapasiti penjerapan iaitu sebanyak 105 (mg/g) dan 21,27 (mg/g) telah diperolehi masing – masing untuk menyingkirkan pewarna kationik (metilena biru, MB) dan pewarna anionik (metil jingga, MO). Berdasarkan keputusan yang diperolehi bagi pewarna kationik dan anionik, metilena biru telah dipilih untuk mengkaji kesan pengubahsuaian ke atas kebolehan penyingkiran pewarna oleh daun buah naga. Keputusan menunjukkan bahawa kapasiti penjerapan DFF meningkat dari 105 kepada 133 (mg/g) selepas diubahsuai. Penjerapan pewarna ke atas bahan penjerap telah dinilai dengan menggunakan Freundlich dan Langmuir penjerapan isoterma model dan didapati bahawa data kedua-dua pewarna yang disebutkan dalam tiga

bahagian tersebut paling sesuai dengan model Freundlich. Data kajian kinetik adalah sesuai diwakili oleh model pseudo kedua kinetik. Hasil kajian mencadangkan bahawa daun buah naga adalah lebih berkesan untuk menyingkirkan pewarna kationik berbanding dengan pewarna anionik. Dalam ujian kolum, kesan kadar aliran dan ketinggian bed adalah parameter eksperimen yang dipilih untuk mendapatkan kurva kejayaan. Pengambilan maksimum oleh MB dalam kolum penjerapan tetap adalah 83 mg/g pada pH 8, ketinggian bed 15 cm dan kadar aliran 3 mL/min. Masa bulus meningkat dengan bed yang lebih tinggi dan kadar aliran yang lebih perlahan. Data telah digunakan ke dalam Bohart-Adams dan BDST model untuk meramalkan lengkung bulus dan juga untuk menentukan model parameter. Keputusan daripada eksperimen menunjukkan bahawa DFF mungkin berguna sebagai alternatif kos rendah dan bio-penjerap yang mesra alam untuk penyingkiran pewarna kationik daripada larutan akueus.

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I certify that a Thesis Examination Committee has met on 30 September 2012 to conduct the final examination of Zahra Haddadian on her thesis entitled "Removal of textile dyes from aqueous solution by dragon fruit foliage" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the degree of Master of Science.

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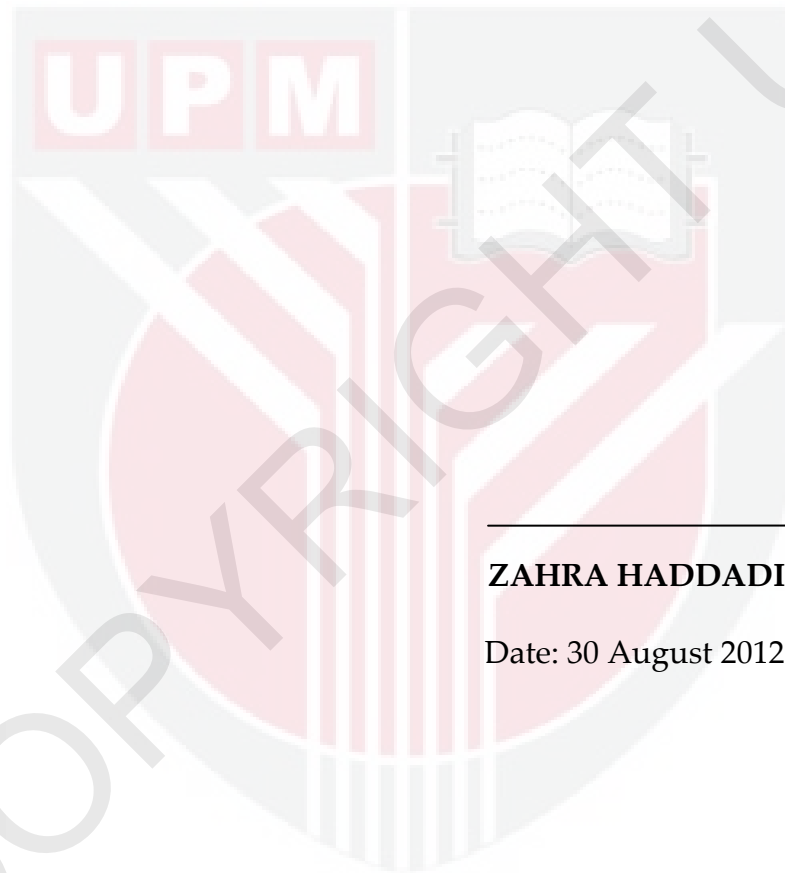
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## DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.



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**ZAHRA HADDADIAN**

Date: 30 August 2012

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