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Study on methylene blue dye removal by eco-friendly adsorben produced from coastal plant casuarina equisetifolia seeds / No Atiera Nabila Ismail.

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PERPUSTAKAAN SULTANAH NUR ZAHIRAH UMT

STUDY ON METHYLENE BLUE DYE REMOVAL BY ECO-FRIENDLY  
ADSORBENTS PRODUCED FROM COASTAL PLANT *CASUARINA*  
*EQUISETIFOLIA* SEEDS

By  
NOR ATIERA NABILA BINTI ISMAIL

A thesis submitted in partial fulfilment of  
the requirements for the award of the degree of  
Bachelor of Technology (Environment)

SCHOOL OF OCEAN ENGINEERING  
UNIVERSITI MALAYSIA TERENGGANU  
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SCHOOL OF OCEAN ENGINEERING  
UNIVERSITI MALAYSIA TERENGGANU

VERIFICATION AND APPROVAL FORM

This thesis entitled *Study on Methylene Blue Dye Removal by Eco-Friendly Adsorbents Produced from Coastal Plant, Casuarina equisetifolia Seeds* prepared and submitted by Nor Atiera Nabila Binti Ismail, Matric No. UK29522 in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology (Environment) has been examined and is recommended for approval of acceptance.

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## DECLARATION

I hereby declare that this PITA research report entitled *Study on Methylene Blue Dye Removal by Eco-Friendly Adsorbents Produced from Coastal Plant, Casuarina equisetifolia Seeds* is the result of my own research except as cited in the references.

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**STUDY ON METHYLENE BLUE DYE REMOVAL BY ECO-FRIENDLY  
ADSORBENTS PRODUCED FROM COASTAL PLANT, *CASUARINA  
EQUISETIFOLIA* SEEDS**

**ABSTRACT**

Water is one of the precious sources to all living things and its consumption increases as human population increases. However, water becomes polluted by anthropogenic influences in domestic, agriculture, commercial and industrial sectors especially in batik industry which consumes a large amount of water. The high color of water discharge from batik effluent can reduce the light penetration to aquatic life. Color is also most notorious characteristics of dye wastewater and has a strong negative impact to aquatic life. Methylene Blue (MB) is a common pollutant material in textile wastewater and frequently used in textile industries especially. Therefore, this study was conducted to examine the potential of *C. equisetifolia* seeds treated *p-toluene sulfonic acid monohydrate* as an eco-friendly adsorbent to remove the color of MB by adsorption process. The characterization of *Casuarina equisetifolia* seed adsorbent was based on elemental analysis, morphology, surface area, surface charge and their chemical functional group (FTIR). The adsorbent contains 47.47% of carbon, 5.97% of hydrogen, 0.59% of nitrogen, and 0.99% of sulphur. Micrographs obtained using Scanning Electron Microscope (SEM) clearly show rough surface of adsorbent. BET surface area for *Casuarina* adsorbent was  $0.4154 \text{ m}^2/\text{g}$ . The point of zero charge ( $\text{pH}_{\text{pzc}}$ ) of adsorbent was determined as -12.03 and predominately negative charged. FTIR analysis results show, adsorbent had capability to adsorb color by bands that were observed at peak which were OH (alcohol), CH (alkenes) and C-O (alcohols, carboxylic acids, esters and ethers). The percentage of dye removal increases from 0% to 28.5% as the amount of dosage increases from 0.2 g to 1.0 g. The applicability of common adsorption isotherms by Langmuir and Freundlich were also studied. The adsorption of MB dye on treated *C. equisetifolia* adsorbent best fit Langmuir isotherm but with low correlation value,  $R^2$ .

# KAJIAN TERHADAP PENYINGKIRAN WARNA BIRU METILENA MENGUNAKAN PENJERAP MESRA ALAM YANG DIHASILKAN DARIPADA BIJI TUMBUHAN PANTAI, *CASUARINA EQUSETIFOLIA*

## ABSTRAK

Air adalah salah satu sumber yang berharga untuk semua yang hidupan di dalam kehidupan seharian dan penggunaannya meningkat dengan bertambahnya bilangan penduduk manusia. Walau bagaimanapun, air telah menjadi tercemar oleh aktiviti manusia yang dipengaruhi dalam sektor domestik, pertanian, perdagangan dan perindustrian terutamanya dalam industri batik yang menggunakan jumlah bilangan air yang banyak. Warna tinggi pelepasan air dari efluen batik boleh mengurangkan penembusan cahaya kepada kehidupan akuatik. Warna juga ciri-ciri yang paling terkenal pewarna air sisa dan memberi kesan negatif yang kuat kepada hidupan akuatik. Biru metilena merupakan salah satu bahan pencemar yang biasa dihasilkan dari air sisa dan kerap digunakan dalam industri tekstil. Oleh itu, tujuan kajian ini dijalankan adalah untuk mengkaji potensi biji *C. equisetifolia* yang dirawat oleh *p-toluene sulfonic acid monohydrate* sebagai penjerap mesra alam untuk menyingkirkan warna biru metilena dengan proses penjerapan. Pencirian penjerap *C. equisetifolia* telah memberi tumpuan kepada kandungan elemen analisis unsur, morfologi, kawasan permukaan, caj permukaan dan analisa kumpulan berfungsi kimia (*FTIR*). Penjerap ini mengandungi 47.47% karbon, 5.97% hidrogen, 0.59% nitrogen, dan 0.99% sulfur. Grafmikro Imbasan Elektron telah menunjukkan secara jelas penjerap mempunyai permukaan kasar. Kawasan permukaan untuk penjerap *Casuarina* adalah  $0.4154 \text{ m}^2/\text{g}$ . Titik caj sifar ( $\text{pH}_{\text{pzc}}$ ) untuk penjerap ini adalah -12.03 dan sebahagian besarnya bercas negatif. Analisis keputusan *FTIR* menunjukkan penjerap mempunyai keupayaan untuk menjerap warna dengan ikatan OH (alkohol), CH (alkena) dan C-O (alkohol, asid karboksilik, ester, dan eter. Peratusan penyingkiran warna meningkat daripada 0% kepada 28.5% apabila jumlah dos penjerap juga meningkat daripada 0.2 g kepada 1.0 g. Kebolehgunaan isoterma yang biasa oleh *Langmuir* dan *Freundlich* juga telah dikaji. Penjerapan pewarna biru metilena ke atas penjerap *C. equisetifolia* yang telah dirawat menunjukkan penyesuaian terbaik adalah isoterma *Langmuir* tetapi dengan nilai korelasi,  $R^2$  yang rendah.