# ADSORPTION OF DYES FROM INDUSTRIAL WASTE WATER USING BIOCHAR

# Submitted By Yasser Abd EL-Razek Mohamed Roushdy Borghol

B.Sc. of Science (Microbiology/Chemistry), Faculty of Science Ain Shams University, (2004)

A Thesis Submitted in Partial Fulfillment
Of
The Requirment for the Master degree
In
Environmental Sceince

Department of Environmental Basic Sciences Institute Environmental Studies & Research

Ain Shams University

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#### APPROVAL SHEET

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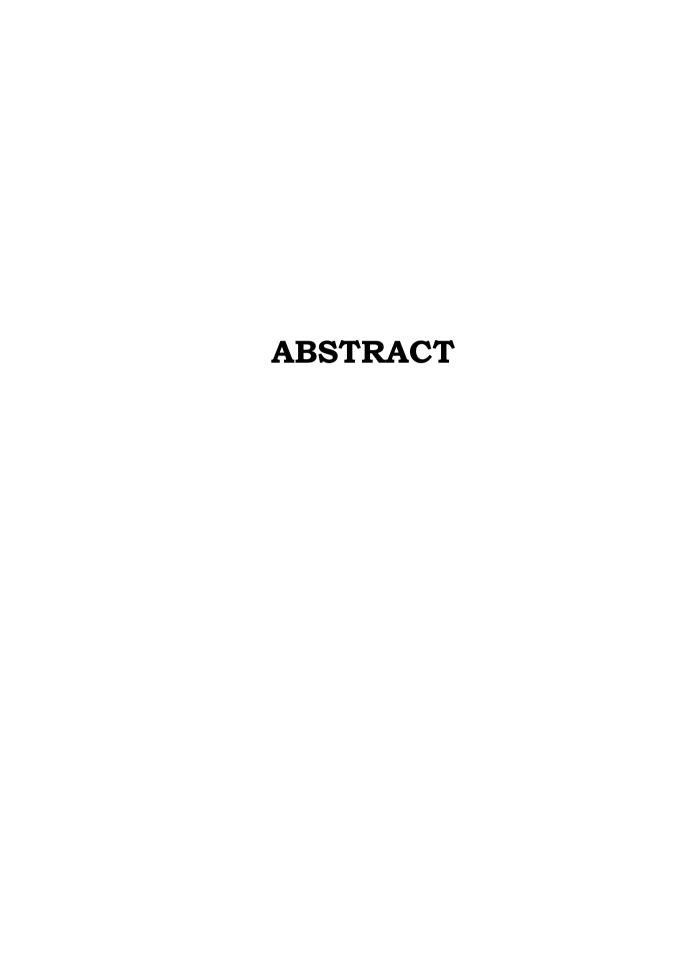
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### **Abstract**

**Thesis Titels:** Adsorption of dyes from industrial waste water using Biochar.

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In this thesis, we studied the adsorption ability of three adsorbents.

Two Biomass residuals have been taken and converted to biochar, in addition to normal commercial coal purchased from the market. The two biomasses were Corn stovers (Cn) and Date Palm Leaf Midrib (DPLM) respectively. The two biomasses have been dried at 100  $^{0}$ C for One hour, and then carbonated to the biochar in a canister inside a muffle at 450  $^{0}$ C for two hours.

Activation took place to a part of the prepared biochar and the coal by immersing in a sulphuric acid 10% at 40-50  $^{0}$ C for one hour.

The physic-chemical properties of the adsorbent have been also accomplished by testing Scanning Electron Microscope SEM, Infra red (FTIR), X-Ray Diffraction and Zeta-potential measurements.

The results revealed that the absorbents were having high porosity surfaces, all consists of carbon mainly, and the activation process helps the adsorbent to have Sulpahte groups which played a great role in attaching the cationic dye to the negatively charged adsorbent.

The untreated and the treated biochars and coal have been used as an adsorbent to remove industrial dye (Methylene Blue) from water.

A suitable concentration of the dye (0.0001 M) has been prepared at lab and the biochar have been added to it consecutively at different pHs. The results determined the best adsorbent at different pHs which was the treated DPLM biochar at pH 10.

This biochar was used to complete the optimization experiments chemically to inspect for the best adsorbance conditions.

Optimization experiments included detection of the best contact time, dye volume, dye concentration and absorbent dose / dye ratio.

Finally, a real industrial waste water sample was used to detect the ability of the produced biochar. The sample was a mixture of dyes. The TD biochar had a great ability to remove the dye from it. This indicated that the adsorption may have taken place due to ionic attraction forces between the dye and the adsorbent.

At the end, the DPLM activated biochar appeared to have good adsorption ability, which can be used as a good alternative for different adsorption process in the water treatment field.

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# **Abbreviations**

# **Abbreviations**

Cn Corn Stovers

DPLM Date Palm Leaf Midrib

CHc Charcoal

Bcn Corn Stovers Biochar.

Bdp Date Palm Leaf Midrib Biochar

TBcn Treated Corn Stovers Biochar

TBdp Treated Date Palm Midrib Biochar

TCHc Treated Charcoal

MB Methylene Blue dye

FTIR Fourier-transform Infrared spectroscopy

SEM Scan Electronic Microscope

WQI Water Quality Index

PI Pollution Index

IBI International Biochar Initiative

MI Metal Index

DBPs Disinfection By Products

TGA Thermo Gravimetric Analysis

ATR Attenuated Total Reflection

NIR Near Infrared spectroscopy

NOMs Natural Organic Matters

AgNPs Silver Nanoparticles

CNT Carbon Nano Tubes

ZVI Zero Valent Iron

TD Treated Date