BATCH ADSORPTION STUDY FOR THE REMOVAL OF TEXTILE DYES FROM AQUEOUS SOLUTIONS USING *Pandanus Amaryllifolius* (RAMPE) LEAVES.

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Degree of Master of Science

Department of Civil Engineering

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DECLARATION

"I declare that this is my own work, and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out research for the Masters under my supervision.

Name of the supervisor : Prof. B. M. W. P. K. Amarasinghe

Signature of the supervisor : Date:

DEDICATION

This thesis is dedicated to my loving parents, who were the strength to carry on this research experiment from beginning to end by supporting me in every way possible.

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Abstract

With the development of the manufacturing industry in recent days, there are obvious advantages and some disadvantages to human beings. One of the leading disadvantages is environmental pollution. Water pollution continues due to the continual uncontrolled largescale release of dyes to water bodies mainly from the textile industry effluents. These dyes can threaten directly and indirectly human, plant and animal life.

This research is focused on removal of selected textile dyes methylene blue, crystal violet, congo red, reactive red and reactive black B via adsorption. The adsorbent was dried leaf powder of flavouring plant *Pandanus amaryllifolius*, widely famous as *'rampe'*. Rampe leaves powder was chosen as the adsorbent due to its wide availability, simplicity in preparation and mainly due to its ability to remove poisonous substances.

Batch adsorption experiments were carried out at room temperature to investigate the adsorption capacity, kinetics of adsorption and equilibrium data. The analytical instrument UV-Visible Spectrophotometer was used to determine the dye concentrations.

Batch test results showed that the adsorbent removes Methylene blue, Crystal violet, Congo red up to 95%, 90%, and 81%. However, reactive red and reactive black B dyes did not show significant removal. Kinetic studies showed that the adsorption followed the pseudo-second order kinetic model. According to the intraparticle diffusion model, adsorption happened with two steps for all three dyes. The equilibrium data comply with Langmuir isotherm with maximum adsorption capacities of 38.46, and 20.33 mg g^{-1} for methylene blue and crystal violet respectively. Congo red complied with Temkin isotherm. FTIR and SEM analysis of the adsorbent before and after adsorption revealed MB, CV, and CR were adsorbed to PALP with chemisorption by creating hydrogen bonds and significant amount of the mass transfer were happened through papillose cells on the leave surface.

Keywords: Batch adsorption; *Pandanus amaryllifolius* leaves; Textile dye

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LIST OF ABBREVIATIONS

Abbreviation	Description
AC	Activated Carbon
AFO	Avrami factionary Order
ATR	Attenuated Total Reflection
BET	Brunauer Emmett Teller
BOD	Biochemical Oxygen Demand
CL_{50}	Limited Concentration
COD	Chemical Oxygen Demand
CR	Congo Red
CV	Crystal Violet
EDTR	Endothermic Reaction
ELM	Elovich Model
EXTR	Exothermic Reaction
FIM	Freundlich Isotherm Model
FSIM	Fritz Schlunder Isotherm Model
FTIR	Fourier Transform Infrared
HIM	Hill Isotherm Model
IMR	Impregnation Ratio
IR	Infra-Red
KCIM	Koble-Corrigan Isotherm Model
LC_{50}	Lethal Concentration for kill 50% of population
LIM	Langmuir Isotherm Model
MB	Methylene Blue
MBR	Membrane Bio Reactor
MWCNT	Multi Walled Carbon Nanotubes
NSP	Non-Spontaneous Process
PALP	Pandanus Amaryllifolius Leaves Powder
PFO	Pseudo First Order

PSO	Pseudo Second Order
PTFE	Poly Tetrafluoroethylene
RBB	Reactive Black B
RPIM	Redlich Peterson Isotherm Model
RPM	Rounds Per Minute
RR	Reactive Red
SEM	Scanning Electron Microscope
SIM	Sips Isotherm Model
SP	Spontaneous Process
TIM	Temkin Isotherm Model
TOC	Total Organic Carbon
TSS	Total Suspended Solids
UV	Ultraviolet

LIST OF APPENDICES