

**DEVELOPMENT OF A TREATMENT METHOD FOR  
THE REMOVAL OF BASIC DYES IN REED & COIR  
DYEING INDUSTRY**

Hewa Palatuwage Ishani Dulangika Weerasinghe

198497A

Master of Science in Environmental Engineering and Management

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. I retain the right to use this content in whole or part in future works (such as articles or books)

.....

Date: 27/06/2024

H. P. I. D. Weerasinghe

The above candidate has carried out research for the PhD/MPhil/Masters thesis/dissertation under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of Supervisor: Dr.Piyal Aravinna

Signature of the Supervisor:

Date:

Name of Supervisor: Prof. Jagath Manatunge

Signature of the Supervisor:

Date:

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## ABSTRACT

Handcraft manufacturing using natural fibers is one of the important domestic industries in developing countries including Sri Lanka. Synthetic dyes are currently being used as coloring agents and basic dyes play a vital role in the dyeing process. The effluent with coloring agent is a major pollutant in small scale industries. Even though effective and efficient effluent treatment methods are applied by large-scale factories, small-scale domestic manufacturers are not concerned with effluent treatment in the coloring process, and they discharge industrial effluent of the dyeing process directly to the environment making a threat to the aquatic ecosystems. Therefore, introducing a low-cost small-scale effluent treatment system for the removal of industrial dyes is an essential need to safeguard the fauna in aquatic ecosystems.

Much research has been carried out for effective dye removal using physical, chemical and biological treatment techniques, and dye removal by adsorption is one of the most effective techniques among others. A wide range of locally available and effective adsorbents are tested and elimination studies described the equilibrium adsorption capacity based on isotherm studies.

In this study, a prototype, low-cost, effluent treatment system that uses rice husk charcoal as a sorbent was built up for the removal of Methylene Blue (MB), one of the major basic dyes that is applied in dyeing natural fibers. According to the laboratory studies, the removal capacity of MB by the sorbent is in the range of 19 – 22 g kg<sup>-1</sup> at neutral pH conditions. After adjustment of the pH of the influent to neutral, this system can be applied for the treatment of effluent containing MB in the range of 1-50 mg L<sup>-1</sup> and the system can be operated at the rate of 15 L h<sup>-1</sup> for 38 h maintaining level of MB of the treated effluent within 0.1 mg L<sup>-1</sup> which is 10% of the maximum permissible of MB stipulated by EU Directives.

**Key words:** *Basic dye treatment, adsorption, biosorption, cationic dye removal*

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## LIST OF ABBREVIATIONS

<b>Abbreviation</b>	<b>Description</b>
AC	Activated Carbon
BOD	Biological Oxygen Demand
CEA	Central Environmental Authority
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
EC 50	Half Maximal Effective Concentration
LC	Lethal Concentration
MB	Methylene Blue
RHC	Rice Husk charcoal
RHAC	Rice Husk Activated charcoal
SS	Stainless Steel
TSS	Total Suspended Solids
TDS	Total Dissolved Solids
USEPA	United State Environmental Protection Agency
uPVC	Un plasticized Vinyl Chloride