

CHAPTER 1

INTRODUCTION

1.1 Background of Study

The massive uses of dyes industrially especially in the textile industry has caused concerns over time. In Malaysia, especially in the East Coast of Peninsular Malaysia, is well-known with their textile industry. The Tenun industry in Pahang has been recognized and established as Tenun Pahang Royal. In order to produce a quality made and attractive tenun fabric, the dyes' molecules used are designed to deliver a permanent colour to the fabrics. In the dyeing process, fabric are mixed with solution containing specific dyes and particular chemical material. After dyeing, both fibre molecules and dye molecules will have an uncut chemical bond. As a result, bright coloured and perennial fabric with high dye concentration are produced.

Unfortunately, brightly coloured, water-soluble reactive and acid dyes are the most problematic, as they tend to pass through conventional treatment systems (Willmott et al., 1998). Thus, this act will eventually resulted in pollution to the surrounding environment. This pollution is considerably dangerous and toxic due to dye content which includes high concentration of colours, large amount of suspended solids, and high chemical oxygen demand (Kim et al., 2004).



Figure 1.1 : The dyeing of fabric process
Source : <http://www.thebatikboutique.com/>

Most of the Tenun industries do not prepare and provide of any pre-treatment before discharging the effluent into the stream and river. The untreated wastewaters are aesthetically unpleasant and toxic which will greatly affect and pose environmental problems. The effluents commonly contain an amount of pollutants and contaminants.

In several countries including Malaysia, environmental laws and regulations are enforced in order to control the pollution caused by industries. A certain criteria and standard of the effluent have to be met before releasing the effluents to the streams, rivers or surrounding. Hence, for protecting the environment and meet the stringent government law, many researchers try to find an effective and economical way of dye-containing wastewater treatment.

As a resolution to this problem, studies are done based on three categories, namely chemical, physical, and biological methods. At present, the main methods of textile dye-containing wastewater treatment are physical and chemical means as shown in Table 1.1.

Physical/chemical method	Advantages	Disadvantages
Fentons reagent	Effective decolourisation of both soluble and insoluble dyes	Sludge generation
Ozonation	Applied in gaseous state: no alteration of volume	Short half-life (20 min)
Photochemical NaOCl	No sludge production Initiates and accelerates azo-bond cleavage	Formation of by-product Release of aromatic amine
Cucurbituril	Good sorption capacity for various dyes	High cost
Electrochemical destruction	Breakdown compounds are non-hazardous	High cost of electricity
Activated carbon	Good removal of wide variety of dyes	Very expensive
Peat	Good adsorbent due to cellular structure	Specific surface area for adsorption are lower than activated carbon
Wood chips	Good sorption capacity for acid dyes	Requires long retention times
Silica gel	Effective for basic dye removal	Side reactions prevent commercial application
Membrane filtration	Remove all dye types	Concentrated sludge production
Ion exchange	Regeneration: no adsorbent loss	Not effective for all dyes
Irradiation	Effective oxidation at lab scale	Requires a lot of dissolved O ₂
Elektrokinetic coagulation	Economically feasible	High sludge production

Figure 1.2 : Advantages and disadvantages of physical and chemical methods of dye removal

Source : <https://www.researchgate.net/publication/271758811>

Conventional techniques for removing dyes in wastewater are difficult, costly and time consuming. With the current technologies, it is not capable to remove all classes of dyes. In order to do that, several technologies are combined to achieve satisfactory results, the decolourization efficiencies. Among the three methods, chemical, physical and biological methods, the most preferable and frequently used is the physical method which involves adsorption. Adsorption is a method which have higher possibility to remove the dye pollutants from aqueous system completely. Therefore, more researcher and scientists are focusing on this mechanism by searching and developing highly efficient and effective adsorbent.