PREPARATION OF CHEMICALLY TREATED RAMBUTAN (*NEPHELIUM LAPPACEUM L.*) PEEL FOR THE REMOVAL OF BASIC AND REACTIVE DYES FROM AQUEOUS SOLUTION

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3. Disamping itu juga, puan perlu berusaha untuk membentang dan menerbitkan kertas kerja di dalam prosiding atau jurnal yang berindeks Scopus / ISI atau mempatenkan kerja penyelidikan puan sebagai salah satu hasil utama penyelidikan.

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5.0 REPORT

5.1 PROPOSED EXECUTIVE SUMMARY

Due to the high quantities of water used in the dyeing processes, the textile industry has become one of the greatest sources of liquid effluent that contaminated with various kinds of dyes including basic and reactive dyes. The liquid effluent may cause damage not only to aquatic life, but also to human beings. For the last few years, adsorption technique appeared to offer the best prospects over other conventional methods and proved itself as one of an effective and attractive process for the treatment of dyes containing wastewater. However, cost-effective alternative technologies or adsorbents for this purpose are needed. Therefore, this study investigates the potential use of rambutan (Nephelium lappaceum L.) peel as low cost adsorbent for the removal of both basic (Methylene Blue) as well as reactive (Remazol Brilliant Blue R) dyes from aqueous solution. The sorption properties of the sorbents will be enhanced using hydrochloric acid (HCl) and sodium hydroxide (NaOH) with different impregnation ratio (IR). The treated and untreated rambutan peel will be characterized through Fourier Transform Infrared (FTIR). The effects of various operating variables such as adsorbent dosage, solution pH, initial dye concentration and temperature on adsorption equilibrium, kinetics and thermodynamic for the removal of Methylene Blue and Remazol Brilliant Blue R will be studied. It is expected that rambutan peel is capable to remove both basic as well as reactive dyes from aqueous solution and thus it might be served as cheap non-conventional sorbents in wastewater treatment.

5.2 ENHANCED EXECUTIVE SUMMARY

Commercially available adsorbents are still considered expensive due to the use of non-renewable and relatively expensive starting material such as bituminous coal. Therefore, this study investigates the potential use of tropical fruit waste such as rambutan peel (RP) that available in Malaysia, as the precursor for the preparation of chemically treated adsorbent which can be applied for the removal of two types of dyes, which are basic Methylene Blue (MB) and reactive Remazol Brilliant Blue R (RBBR) from aqueous solution. Impregnation with hydrochloric acid (HCl) and sodium hydroxide (NaOH) was used in order to modify the surface characteristics of the prepared adsorbent. In this study, adsorption of MB and RBBR dye by NaOH-treated rambutan peels (N-RP) and HCl-treated rambutan peels (H-RP) were examined. The adsorption experiments were carried out under different conditions of initial concentration (25–500 mg/L), solution pH 2–12 and adsorbent dose (0.05–1.0 g). The influence of these parameters on the adsorption capacity was studied using the batch process. MB and RBBR adsorption uptake were found to increase with increase in initial concentration and contact time. The MB adsorption was unfavourable at pH<4 whereas RBBR adsorption was favaourable at pH>4. Langmuir, Freundlich and Temkin isotherm models were

used to illustrate the experimental isotherms and isotherms constant. The equilibrium data were best represented by Langmuir isothem model, showing maximum monolayer adsorption capacity of 231.34 and 112.69 mg/g for MB and RBBR dye, respectively. The rates of adsorption were found to obey the rules of pseudo-second order model with good correlation for both dyes. The result suggested that the N-RP and H-RP would be an excellent alternative for the removal of MB and RBBR dye by adsorption process.

5.3 INTRODUCTION

Methylene blue (MB), which is classified as a basic dye has wider application including coloring paper, temporary hair colorant, dyeing cottons, wools, coating for paper stock, etc. (Kumar et al., 2004). Though methylene blue is not strongly hazardous but on inhalation, it can show various harmful effects. It can give rise to short periods of rapid or difficult breathing while ingestion through the mouth produces a burning sensation and may cause nausea, vomiting, diarrhea, and gastric. Accidental large dose creates abdominal and chest pain, severe headache, profuse sweating, mental confusion, painful micturation, and methemoglobinemia (Ghosh and Bhattacharyya, 2001).

On the other hand, reactive dyes are used in textile dyeing industries due to their superior fastness to the applied fabric, high photolytic stability, high solubility and resistance to microbial attack (Xie et al., 2011). Remazol Brilliant Blue R (RBBR) is a reactive dye, frequently used as a starting material in the production of polymeric dyes. It represents an important class of toxic and recalcitrant organopollutants (Mechichi et al., 2006). They consist of a chromophore and a functional group that binds the dyestuff to the fiber (Al-Degs et al., 200). The functional group also binds to water and cause hydrolysis. Hence, 10-50% of the dye remains in the dye bath wastes, and are highly recalcitrant to conventional wastewater treatment processes (Aksu and Çagatay, 2006). Discharge of these wastewaters into receiving streams causes damage not only to aquatic life but also to human beings (Baskaralingam et al., 2007). Therefore, the removal of MB and RBBR from wastewater before discharging to the environment is necessary and very important.

The techniques for removing dyes in wastewater can be divided into three main categories which are physical, chemical and biological methods. Among the three methods, physical method of adsorption is known to be the most efficient method especially if the adsorbent is inexpensive and exhibits high adsorption capacity suitable for removing the dyes from wastewater (Ahmad and Alrozi, 2010). Activated carbon as an adsorbent has been widely investigated for the adsorption of basic and reactive dyes (Ahmad and Alrozi, 2010; Hameed et al., 2007; Tan et al., 2007), but the running costs are high with the need for regeneration after each sorption cycle limits its commercial application (Gong et al., 2005). Due to economic reasons, low-cost alternative adsorbents were investigated especially from