UNIVERSITI TEKNOLOGI MARA

A COMPARISON OF NEWLY INVENTED PLANT-BASED COAGULANT (DRAGON FRUIT'S FOLIAGE) WITH COMMERCIAL COAGULANTS FOR TREATMENT OF LATEX ONCENTRATED EFFLUENT

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Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

In the event that my thesis to be found to violate the conditions mentioned above, I voluntarily waive the right of conferment of my degree and be subjected to the disciplinary rules and regulations of Universiti Teknologi MARA.

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ABSTRACT

This study investigated the effect of coagulation process on wastewater from latex concentrate industry. The coagulation performances of dragon fruit's foliage which was a newly invented plant based coagulant and commercial coagulants such as alum, ferric chloride, polyaluminium chloride, magnesium chloride, ferrous sulfate, ferric sulfate and calcium hydroxide were studied using a jar test. The study also compared different dosages and pH values of the coagulation processes. The analysis of dragon fruit's foliage was also studied. The results revealed that the percentage removals in terms of COD, SS and turbidity of commercial coagulants (alum, ferrous sulfate, calcium hydroxide, PAC, ferric chloride and ferric sulfate) have been found to be around 97-99%, 94-97% and 99% respectively, whereas the newly invented plant-based coagulant at the same dosage of 300 – 600 mg/L demonstrates the same performances as any commercial coagulants. All the coagulants used give high percentage of BOD removal which is from 1327 mg/l before treatment to below 100 mg/l after treatment except for dragon fruit coagulants which gives 173.67 mg/L. However, others parameters such as sulfate, NH_3-N and several heavy metals are in compliance with standard B set by Department of Environment, Malaysia . The study has proven the existence of alum compound in the dragon fruit's foliage under the X-Ray Diffractometer (X-RD) analysis and therefore the dragon fruit's foliage can be used as a coagulant and has a great potential as a new plant-based coagulant in latex concentrated wastewater treatment.

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CHAPTER 1

INTRODUCTION

Malaysia is the third world's largest Natural Rubber (NR) producer but Malaysia's latex glove industry is the world biggest (Reuters, 2005). Since it was introduced by British colonial in 1800's, this commodity had been contributed a huge amount of income into Malaysia's economy which amounted RM 7876.6 million in 2004 (Malaysian Rubber Board & Malaysian Industrial Development Authority, 2005). However, the effluents generated from this industry create a major impact on the environment. It is estimated that about 100 million liters of effluent are discharged daily into stream and rivers from the rubber processing factories in Malaysia with organic loads equivalent to about 4.5 million people (Sestry et al., 1995). The average daily water consumption of the factory is about $3347m^3/d$, majority of which is released as wastewater (Leong et al., 2003).

In Malaysia, the rubber industries can be categorized into three main sectors which each of these sectors contributes a significant amount of waste, namely upstream (plantation), midstream (raw rubber processing) and down stream (rubber product manufacturing)(Sulaiman et al., 2002). However, only waste from the midstream activities, which involve production of latex concentrate, will be covered in this study due to its highly pollutant contaminations. The effluents from latex concentrate are generated when field latex is separated into two main products, namely latex concentrate and skim latex by using centrifugation method through a centrifuge machine. Untreated latex concentrate effluent comprises a large quantity of water for washing and cleaning of raw materials, small amount of uncoagulated latex and serum (protein, carbohydrate, lipids, carotene, salt, etc.) (Agriculture Research and Advisory Bureau, 2005). It has also been identified that the effluent from latex concentrate factories contains high level of sulphates, which are originated from sulphuric acid used in the