UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF INTEGRATED KENAF CORE CELLULOSE NANOFILTRATION FLATSHEET MEMBRANE FOR BATIK WASTEWATER

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ABSTRACT

Batik Industry which is similar to Textile Industry is a popular industry in Malaysia. The industry produces wastewater that is high in color and pH, and commonly release to the nearby waterbody without any proper treatment. This practice contributed to water pollution at the nearby river. Previous studies show that color and pH are the dominant pollution in batik/textile wastewater while heavy metals are also present in the effluent. Generally, most water treatment plants utilize conventional water treatment system consists of processes such as aeration, coagulation and flocculation utilizing aluminum-based chemicals known as alum. Conventional method is insufficient to treat the batik wastewater. Therefore new treatment method is needed to overcome the problems. New recent treatment method in water purifying is the membrane technology. Membrane technology was proven to be the better solution in water supply treatment. In Malaysia, membrane technology is used in water treatment plant at Sungai Rumput and Kepong Water Treatment Plants that utilizes the Ultra Membrane Filtration Technology. Ultra-membrane filtration technology is a new technology that does not entail the use of chemicals during the treatment process and produces clean water of higher quality than other technologies. Since membrane is made of material polymer, solvents and additive, for a greener environment, this study was carry out to substitute the chemical additives with organic additives from kenaf plants. Kenaf was selected since it is a seasonal harvesting plant that matures in 4 to 6 months. Organic additive extracted from kenaf is the kenaf core cellulose. This kenaf core cellulose replaced the commonly chemical additives in membrane fabrication. Membrane made of additive kenaf core cellulose has higher pressure resistance compare to membrane made of additive from commercially produce cellulose. A filtration system made from kenaf core cellulose nanofiltration flat sheet membrane system (IKCNFM) was fabricated for this study and filtration results were compared with other conventional wastewater treatment method such as aeration, coagulation and flocculation. Comparison was made on the wastewater quality parameter of both raw and treated wastewater using few selected system namely IKCNFM only, aeration, aeration combined with IKCNFM, coagulation and flocculation, coagulation and flocculation combined with IKCNFM. Results of the filtration wastewater quality parameter comparison show that IKCNFM was able to remove 100% of Al, Cu, Mn, Pb and Zn from the wastewater sample. Others results are SS 74%, BOD 96%, COD 92%, As 79%, Fe 80%, color 60%, pH 30% and Hg 95%, The findings indicate that all wastewater treated using IKCNFM gave better results in-comparison to the conventional methods, thus it is proven that IKCNFM has succeeded in improving the wastewater quality of batik effluent.

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CHAPTER ONE
INTRODUCTION

1.1 OVERVIEW OF STUDY

Batik Industry is a popular industry in East Malaysia and well known as the producer of the finest batik designs in the region (Leigh, 2002). The use of multi-color and chemicals such as Sodium Silicate and Sodium Bicarbonate is prevalent to ensure the designed color remains permanent on the fabric. Batik industry use lot of water to remove wax and color during batik fabrication. In the process of soaking and cleaning the batik fabric, wastewater is discharged.

The wastewater generate from the batik cleaning process is considered as the main problem in the Batik Industry, where the wastewater is commonly released untreated to the nearby river or other water body. The untreated batik wastewater may contribute to the imbalance eco-system of water body in batik industry area. Batik wastewater contains a mixture of color, sodium silicate and sodium bicarbonate. The combination of Sodium Silicate (a white powder that is readily soluble in water) and Sodium Bicarbonate (aqueous solutions that are mildly alkaline) produce a highly alkaline solution effluent that commonly discharged to the water body. The alkaline solution pH value produced from the Sodium Silicate and Sodium Bicarbonate wastewater are usualy exceeding pH 10. Mercola (2010) stated that the water body with the pH value below 4 or above 10 will kill most fish and very few animals can tolerate water with a pH value below 3 and above 11. Based on this information, the proper treatment of batik wastewater prior entering nearby waterways is vital in ensuring the sustainability of local eco-system. Untreated or improper treatment of wastewater from the Batik Industry also may affect the fauna and flora in the eco-system of the river (Ahmad, Harris, & Seng, 2007).

Heavy metals such as lead (Pb), chromium (Cr), cadmium (Cd) and copper (Cu) are widely used to produce the color pigments of textile dyes. Textile dyes pollutants are being released to the environment at various stages of operation, therefore, it is necessary that the pollutants are treated before discharge into the waterways. Normala Halimoon and Rachel Goh Soo Yin (2010) has conducted a