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REMOVAL OF REACTIVE DYES USING MICELLAR SOLUBILIZATION FOLLOWED BY COAGULATION AND FLOCCULATION PROCESS

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ABSTRACT

Wastewater produced from dyeing process become an environmental threat to conserve biodiversity. Performance of conventional method for removing dyes like coagulation and flocculation is either high in cost operation or insufficient to meet effluent limits. Previous study discovered that a combination of membrane filtration with micellar solubilization such as micellar-enhanced ultrafiltration (MEUF) was quite efficient, however, the use of membrane was prone to cause fouling. Because of that, the aim of this research is to study the effectiveness of biodegradable plant-based surfactant, known as palm based esterquat (PBE) in removing Reactive Blue 4 (RB4) from synthetic wastewater via micellar solubilization followed by coagulation and flocculation process. The effect of PBE surfactant concentration and pH on RB4 removal efficiency were observed. In order to create an environmental-friendly and economical process, comparison between micellar solubilization and coagulation-flocculation process were discussed. Results from the studies revealed that RB4 was completely removed from synthetic wastewater at pH 4 via micellar solubilization followed by coagulation and flocculation with PBE surfactant concentration of 150 mg/L. Statistical analysis via multi linear regression shows that R^2 and adjusted R^2 for micellar solubilization were 0.968 and 0.886 whereas for coagulation and flocculation process were 0.902 and 0.412, respectively. Regression statistics and ANOVA verified that regression expression accounts for variability in the response variable.

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TABLE OF CONTENT

CHAPTER ONE
INTRODUCTION

1.1 Research Background

In the era of modernization and globalization, development of textile industry increases tremendously due to high demands on clothing and fabrics. This is because of rapid growth of human populations day by day as clothes are certainly a need for comfort, identification and protection. A diversity in clothing colour is vital for the textile industry as it is key for customer preferences. Therefore, multiple colour of dyes are used in processing and production of textile industry. Apart from the textile industry, dyes are also used in other industries like coatings, paper and pulp, paints, polymers, detergents and cosmetics, just to name a few.

Generally, dyes can be categorized into various classes and types, but the most preferable in the textile industry is reactive dyes due to its usability, low energy utilization and variety in colours. This type of dyes is crucial in process of colorization of cellulosic and wool fibers. During dyeing stage, reactive groups of dyes form covalent bonds with fiber polymer and then act as an integral part of the material (Singh & Verma, 2017). When the dyeing process is completed, the material is washed off to remove any extra dyes that failed to absorb to its surface during the reaction process. At the end of the process, unfixed dyes which are soluble in water are discharged through wastewater streams.

According to Huang *et al.* (2012), wastewater produced from dyeing process can be a primary pollutant since remaining dyes in industrial effluents can cause critical problems, which can affect humans health and environment (Huang *et al.*, 2012). Even though dyes consist of bright and attractive colours but in fact, they can be toxic and carcinogenic to human only if someone consumes high amounts of these substances due to its chemical structure. Dyes can prevent sunlight from penetrating through water and this condition may destroy aquatic ecosystems. Consequently, the environment is slowly destroyed due to continuous removal of wastewater from this dye production industries.