INDIRECT PLANT-BASED SURFACTANT IMPREGNATED ACTIVATED CARBON FOR ADSORPTION

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ABSTRACT

Activated carbon is widely used in removing toxic substances and contaminants in wastewater. However, removal of metals and inorganic wastes is nearly inefficient when using activated carbon-based adsorption as it removes organic compounds. Surface modification and impregnation method were used to improve surface adsorption and to produce high selectivity to carbon. In this study, surfactant is used to impregnate with the activated carbon to improve the adsorption efficiency and the reaction itself. Indirect impregnation was selected to modify the surface of activated carbon with surfactant in removing 25 ppm of RB4 dye. Various parameters such as surfactant loading, operating temperature and initial pH of the solution were studied to obtain an optimum condition for adsorption of Reactive Blue 4 dye. The best condition of 135 mg/L of surfactant loading at 60°C in weakly acidic condition has been achieved with maximum percentage of 71.47% removal efficiency in 4 hours of treatment. It was observed that modification of activated carbon by indirect impregnation with surfactant has effectively removed RB4 dye because of the strong interaction between the activated carbon and surfactant that increased the number of active site on the surface.

Keywords: *Activated carbon, Adsorption, Reactive dye, plant-based surfactant, and indirect impregnation.*

CHAPTER ONE
INTRODUCTION

1.1 TEXTILE INDUSTRY WASTEWATER

The textile industry is commonly known as one of the energy and water consuming industries that cause intense pollution. The quantity of wastewater from the textile industries have been increasing as the demand growing but it contains many harmful dyes that could cause health problems including Reactive Blue 4 (RB4). This dye classified as a reactive dye and azo type as its chemical class. The chemical structure of azo dyes includes of a group of double bond of Nitrogen, N atom conjugated with aromatic systems, and when joined to molecules they become monoazo, diazo or polyazo dyes (de Souza et al., 2010). According to Parsa et al., (2014), azo dyes make up the biggest class of dyes and mostly used in textile and food industries, and also widely utilized to colour solvents, wool, leather, paints, varnishes, paper, plastic, medicine, and cosmetics.

This industrial effluent is a major source of polluted water and the release of this wastewater into the river can cause serious health and environmental problems. In general, the dyes give a huge impact to the aquatic life in terms of toxicity while referring to Salleh et al. (2011), it can cause severe damage to human beings, such as dysfunction of kidneys, reproductive system, liver, brain and central nervous system. Due to these problems, wastewater requires an appropriate treatment before releasing into the river. In order to treat textile effluents, there are several technologies that have been widely used which are physical, chemical and biological method (Chakraborty et al., 2005). All methods have been improved by varying in effectiveness, economic cost, and environmental impact.

There are few methods to treat the dye before being discharge such as adsorption, precipitation, chemical degradation, advanced oxidation process, biodegradation and chemical coagulation. Even though these methods have been widely utilized, they still have several disadvantages. The biological methods needed longer time and they are usually less efficient in removal of dyes that have highly structured polymers with low biodegradability and it also cannot to apply to all textile waste water due to the toxicity of most commercial