UNIVERSITI TEKNOLOGI MARA

PURIFICATION OF DYE INDUSTRIES WASTEWATER VIA CRYSTALLIZATION: EFFECT OF OPERATION TEMPERATURE AND SOLUTION FOW RATE

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Thesis submitted in fulfillment
of the requirements for the degree of
Bachelor of Engineering (Hons) Chemical

Faculty of Chemical Engineering

January 2018

ABSTRACT

Dye industry is one of the industries that generates huge amount of wastewater and contributes to environmental devastation. Various ways have been used in wastewater treatment to make it less harmful. This study aimed to purify dye industries wastewater via a method of crystallization known as progressive freeze concentration (PFC). PFC is a crystallization process that forms only one single block of ice making it easier to be separated with the mother liquor solution. The effect of operation temperature and solution flow rate (stirring speed) was investigated in this study. The performance analysis was carried out by using simulated solution and was evaluated by the value of effective partition constant, K and percentage of ice purity. It was found that at temperature of -8˚C, the K value obtained of 0.2615 was the lowest with the highest percentage of ice purity of 71.55%. It was also notable that the best stirring speed to achieve highest efficiency was at 350 rpm with a K value of 0.3343 and ice purity percentage of 62.69%.

ACKNOWLEDGEMENT

Firstly, my greatest gratitude is to the Almighty for giving me the opportunity to complete this thesis for my degree journey. I would like to express my gratefulness towards my supervisor, Dr. Farah Hanim Ab. Hamid for without her guidance and assistance, I would not be able to conduct my research properly. A special thanks goes to Ms. Noorashikin of Applied Science Faculty for providing the facilities, knowledge and assistance.

I would also like to address my appreciation towards all the laboratory staffs of Chemical Engineering Faculty for providing facilities and gave full cooperation during my research period. Huge thanks to my friends who have helped me a lot during this journey.

This thesis is a dedication towards my parents, Mohd Ibrahim Hashim and
whom are my biggest supporter and motivator, for without their prayers and support, I would not be able to complete this thesis. Alhamdulillah.

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INTRODUCTION

1.1 BACKGROUND STUDY

Dyeing process has been very crucial towards many industries such as textile, food, plastic, paper, cosmetics and many more. The earliest written record of the use of dyestuffs dates back to 2600 BC in China (Druding, 2017). Ever since that, dyestuffs have been widely used all over the world and emerged into many industries. Dyes of plant and animal origins traditionally were used on textiles in Central Asia prior to the advent of modern synthetic organic colorants (Chen et al., 2016). The most common dye application that is familiar in our daily life is fabric dyeing. The color on the shirt people are wearing comes from dye. However, most people do not know what dye actually is. Dye is a substance used to impart color to textiles, paper, leather and other materials such that the coloring is not readily altered by washing, heat, light, or other factors to which the material is likely to be exposed. In order for a substance to be called as dye, it must have a retaining power on the substrate which the colored compound is applied.

There are many classifications of dyes such as acetate rayon dyes, acid dyes, azoic dyes, basic dyes, direct dyes, mordant or chrome dyes, lake or pigment dyes, sulfur or sulfide dyes and vat dyes. To make up dye, a correlation of chemical structure with color is accomplished by using a chromogen-chromophore with auxochrome. Chromogen is a substance that can be readily converted into a dye or other colored compound. It is an aromatic structure that contains containing benzene, naphthalene, or anthracene rings. While chromophore is an atom or group whose presence is responsible for the color of a compound. It is represented by radicals; e.g. azo (-N=N-); carbonyl (=C=O); carbon (=C=C=); carbon-nitrogen (>C=NH or -CH=N-); nitroso (-NO or N-OH); nitro ($-NO_2$ or =NO-OH); and sulfur (>C=S, and other carbon-sulfur groups) which will form a basis for the classification of dyes when coupled with chromogen. Auxochrome is the element that