UNIVERSITI TEKNOLOGI MARA

PURIFICATION OF DYE INDUSTRIES WASTEWATER VIA CRYSTALLIZATION: EFFECT OF OPERATION TIME AND SOLUTION CONCENTRATION

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Thesis submitted in fulfilment of the requirements for the degree of Bachelor Eng. (Hons) Chemical and Process

Faculty of Chemical Engineering

January 2018

AKNOWLEDGEMENT

I would like to thanks to Universiti Teknologi MARA Shah Alam (UiTM) because allowed me to achieve my dream to become student here. Thanks to my great supervisor Dr. Farah Hanim Ab Hamid for the guidance and assistance during the journey in completing this thesis. It could have not been possible to complete this thesis without the participation and motivation given by Dr. Farah Hanim Ab Hamid and not forgotten my families and also my colleges whom always be supportive and positive and thus give me a thousand of hopes to not giving up.

ABSTRACT

The high capacity of water consumption also results in high amount of wastewater produced and released to ecosystem and will affect the ecology. Purification of dye wastewater using crystallization, specifically freeze concentration technique provides more width to any process plants towards waste management. It is essential to introduce a new method of freeze concentration to overcome the weaknesses of conventional method, and therefore to enhance the wastewater purification development for a better quality of water treatment. Study of the effect of operation time towards effective partition coefficient, K and solute recovery, Y of methylene blue dye wastewater was performed using operation time from t = 5 minutes to 25 minutes. The result showed that effective partition coefficient increases with increasing time, also resulted in decreasing solute recovery of the solution. The effect of solution concentration towards K and Y values was also studied using initial solution concentration, C_0 = 300 mg/L to 700 mg/L and the results showed differently from other studies.

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1 INTRODUCTION

1.1 RESEARCH BACKGROUND

Water is a scarce resource since only 0.03% of the world reserves are available for human activities (Lu, Wang et al. 2017). The fast-growing population and increasing rate of economy naturally demands more usage of water. Nevertheless, the high capacity of water consumption also results in high amount of wastewater produced and released to ecosystem and will affect the ecology. Textile industries stand as one of the largest industry in the world. In textile industry, dying processes are the most polluted waste water affecting process regarding to the formation amount and the pollutants which are involved. The main characteristic parameter of the wastewater that appears at the end of the dying process is colour and the sources of that decomposed and colloidal formed colour are the dying substances used in those processes (Ramachandran and Kumarasamy 2013).

Effluents produced by textile industries are often strongly coloured and their disposal into receiving waters causes environmental damage, including significant impacts on the photosynthetic activity of aquatic plants due to reduced light penetration (Khlifi, Belbahri et al. 2010). Certain concentration of dye solution acts enough as the hindering for the aquatic organisms to acquire adequate oxygen supply and sunlight for living. Dyes include a broad spectrum of different chemical structures, primarily based on substituted aromatic and heterocyclic groups such as aromatic amine ($C_6H_5 - NH_2$), which is a suspected carcinogen, phenyl ($C_6H_5 - CH_2$) and naphthyl ($NO_2 - OH$). Many dyes are azo compounds ($-N - N -$), which are linked by an azo bridge (Talarposhti, Donnelly et al. 2001).

The COD content and different pH value of dye wastewater is surely degrading the lifespan of them living in such ecosystem. Even though treating dye wastewater is hard, especially when we deal with a large amount of wastewater filled with complex chemicals and pollutant, but it is not an option. It is still a challenge to photo catalytically cogenerate clean water and energy from dye wastewater owing to the relatively low photo catalytic efficiency of photo catalysts (Lee, Bai et al. 2013). Today's technology has benefitted us to help reducing the pollution of the unwanted waste to the environment. Physical-chemical process such as adsorption, photocatalytic