UNIVERSITI TEKNOLOGI MARA

COMPETITIVENESS OF REMOVING HEAVY METALS IN INDUSTRIAL EFFLUENT BY USING HYDROXIDE PRECIPITATION VERSUS SULPHIDE PRECIPITATION

HANIN NAZHIFAH BINTI SYAHJIDAN

NURUL SHAHIRAZNI BINTI MOKHTAR

SITI NOR HAZLIYANA BINTI KASMURI

Project submitted in fulfillment of the requirement for the degree of

Bachelor in Environmental Health and Safety

(Hons.)

Faculty of Health Sciences

July 2020

ACKNOWLEDGEMENT

In the name of Allah, The Most Gracious, The Most Merciful.

Assalamualaikum and Alhamdulillah, all praise to Allah S.W.T The Supreme Lord of the Universe. Peace and blessing to Nabi Muhammad S.A.W., all prophets and their families. I praise Allah S.W.T. for the strength and His blessings in completing my study.

Thousands of thanks and love to our parents for their support and encouragement through thick and thin of my study. My deepest gratitude and appreciation to my dearest supervisor, Siti Rohana Bt Mohd Yatim who spent her time and efforts in guiding and advising from the beginning till the end of my research journey. Not to forget, I would like to thank all the lecturers in Department of Environmental Health and Safety, Faculty of Health Sciences who always share their thoughts, knowledge and advice throughout my study in UiTM Puncak Alam. Only God can reward all of you with goodness.

My sincere thanks and appreciation go to all the staff from the department and laboratory who gave their full cooperation and assisted me in many ways throughout my study. A special thanks to my friends from HS243 who always give me support and motivation while completing my study. May our friendship lasts forever. Lastly, I would like to thank everyone who involved directly and indirectly in this study. Thank You.

TABLE OF CONTENTS

ABSTRACT

Rapid industrialization activities in the country contributed to pollution included the electroplating industry activities which is the effluent wastewater contained high concentration of heavy metals that poses potential health risks to the public. Pollution of heavy metals in water body may cause serious health effects to the human such as cancer, organ damage and also death, in extreme cases. This problem lead to unpredictable impact to the environment, public health, and economic direct or indirectly. This experiment was conducted to determine the efficiency of removal heavy metals which are copper (Cu), zinc (Zn), aluminium (Al), nickel (Ni) and chromium trivalent (Cr III) by using hydroxide precipitation and sulphide precipitation. The pH selection and coagulant dosage play important role to enhance the removal of heavy metals. The optimum pH and coagulant dosage were determined via a jar test for both types of samples. The coagulant used in the experiment were ferric chloride ($FeCl_3$) and poly aluminium chloride (PAC) as coagulant booster to enhance the process. Jar test was conducted on two different type of chemical precipitation which is hydroxide precipitation by using sodium hydroxide (NaOH) and sulphide precipitation by using sodium sulfide (Na_2S). In order to remove chromium trivalent, sodium metabisulfite was used to reduce chromium hexavalent to chromium trivalent. The findings in this study shows that sulphide precipitation removed heavy metals more efficient compare to hydroxide precipitation based on the removal of turbidity. Besides the removal of heavy metals, the total suspended solid (TSS) and chemical oxygen demand (COD) also shows a decrease after the precipitation treatment. Thus, this study can be used to treat industrial effluent that contained heavy metals.

Keywords: *hydroxide precipitation, sulphide precipitation, optimum pH, optimum coagulant dosage*

CHAPTER ONE

INTRODUCTION

1.1 RESEARCH BACKGROUND

Industrial effluent can be defined as any waste that generated from manufacturing process such as electroplating, iron and steel industry, textile industry and mining operation either in the form of liquid or wastewater including the treatment of water or any activity that occur at any industrial premises in accordance to the Industrial Effluent Regulations (IER) 2009. The effluents produced from the industries are usually acidic and can contain suspended solids, oil and grease, ammoniacal nitrogen and various types of heavy metals such as copper, nickel, cadmium, silver, zinc, and lead. Gunatilake (2015) comprehensive review concluded that heavy metals can cause serious health effects to the human such as cancer, organ damage and also death, in extreme cases. As the heavy metals tend to accumulate in the living organisms and highly in toxicity, this research will focus on the removal of the heavy metals in the plating process (Fu & Wang, 2011). There are two main sources of heavy metal that can be found in wastewater effluent which is natural and human sources. Volcanic activities, soil erosion, and aerosol particles are the main natural sources of heavy metal pollutants in the wastewater effluent (Akpor, 2014). Many recent studies (Akpor, 2014; Fu & Wang, 2011) have shown that the human sources of heavy metals in wastewater effluent are electroplating, mining, nuclear power and metal finishing.

Metal plating is a process of electrolysis where a thin protective layer of metal will be deposited at the electrodes. Metal plating process is used to protect the metal surface in term of corrosion. Up to now, a number of studies have found that metal plating process is one of the sources of heavy metals in wastewater (Alkasrawi *et al.*, 2014; Renu *et al.*, 2017). The commonly type of heavy metals found in the discharge of electroplating process are chromium (Cr), cadmium (Cd), iron (Fe), copper (Cu),