

UNIVERSITI TEKNOLOGI MARA

**SULPHATE REMOVAL IN SILICA SLUDGE
VIA MIXTURES OF HYDROGEN PEROXIDE
AND HYDROCHLORIC ACID SOLUTION**

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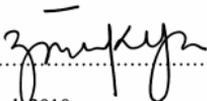
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ABSTRACT

Solid waste disposal becomes an increasingly serious problem due to rapid growth in industrial sector. Most of the industrial solid wastes are classified as scheduled waste, which are highly contaminated with heavy metals and toxic compounds. Scheduled waste must be disposed according to the procedures laid in the Environmental Quality Act 1974 in order to ensure health and safety of the public, nature and its habitat. Sulphate is one of the chemical compounds, which produces toxic gas, hydrogen sulphide during biological reduction process by organisms. The focus of this study is to remove the sulphate compound from industrial solid waste, i.e. silica sludge. The characteristics of silica sludge were identified before and after treatment process. The results show that the silica sludge contains more than 6% of sulphate. Under a laboratory scale, the research involves identifying the effectiveness of chemicals such as hydrogen peroxide and hydrochloric acid on the desulphurisation process. A different concentration of chemicals, reaction times, temperature, and mixture ratio were applied to investigate the best condition for desulphurisation process. The best condition achieved for mixture of 10% HCl and 6% H₂O₂, at ratio 70 to 30 at reaction temperature 100°C with reaction time 3 hours. About 96.6 % of sulphate was removed from scheduled waste. The weight percent of sulphate removed from silica sludge increased with the increasing of temperatures and reaction times. At the same time the treatment successfully removed heavy metals contains in silica sludge. All the results were further analysed with the usage of the TCLP Test, X-ray Diffraction (XRD) and Fourier Transform Infra-red (FTIR) which confirms the reduction of sulphate and heavy metals after desulphurisation with HCl and H₂O₂.

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CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The world today is facing an extreme devastation such as floods and global warming. One of the phenomenal caused by human is pollution. Usually the effects are immediate and these in the long run will affect the whole organism and its environment. A changed reaction may lead to the production of gaseous such as hydrogen sulfide which is poisonous to man and also the destruction of household properties.

Rise in productivity of the industrial and agricultural sectors lead to increase in the usage of more raw materials and thus, increasing the production of waste such as solid, water and gaseous waste. Also, the production of solid waste such as slag, sludge or fly ash with high heavy metal contents can lead to pollution of soils or aquatic systems (Arevalo et al., 2002). The cost to treatment of these waste are more than Ringgit Malaysia One Thousand per Metric Tonne and this lead to neglecting the treatment of this waste by irresponsible groups. Selangor, Pulau Pinang and Johor are the major states in Malaysia that have the highest number of factories. In Selangor only, about 8000 premises have been identified as process-based factories. These factories are processing various products, which are known as wet-based processing and dry-based processing. Some factories are equipped with pollution-controlled device that can detect the amount of pollution that has been pumped out to the