Selective Recovery Of Aluminium And Silver
From Electroplating Wastes

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ABSTRACT

In this study, sludge from an electroplating wastewater treatment facility was treated with acids to extract heavy and precious metals. Metals of interest in the study were Aluminium and Silver, which were relatively high in concentration in the sludge sample. Acids used in the study were Hydrochloric and Nitrile acid. Experiments were conducted at various temperatures and acid concentrations. It was observed that maximum Aluminium was extracted using a mixture of Hydrochloric and Nitrile Acid at a ratio of 3 to 1, known as the aqua regia phase. About 24% Aluminium, in the form of Aluminium Chloride aqueous solution was obtained at room temperature at these conditions. Maximum Silver, about 90%, in the form of Silver Nitrile aqueous solution was obtained when refluxed with Nitrile acid at a temperature of 110°C.

Keywords: Electroplating sludge, Aluminium, Silver, Hydrochloric Acid, Nitrile Acid, Aqua Regia

INTRODUCTION

Sludge is the residual solids generated from a wastewater treatment plant. The handling and disposal of sludges are of major environmental and economic concern these days. In recent decades, environmental issues have increasingly focused on sludge treatment as a more sustainable option of sludge handling. Metal sludges in Malaysia are mainly generated by electroplating industries. Electroplating sludges contain toxic heavy metals and have very high potential of polluting the environment. Metal sludges used to be discarded in the most convenient location available to the industry. The various methods included land disposal into lagoons on plant premises, in landfills or into public owned treatment works. By today’s standards, due to the scarcity of suitable land and also with more stringent regulations, each of these practices is excluded from consideration because of its adverse environmental effects. [1]

Some sludge generators opt for incineration, which helps reduce the magnitude of the problem by minimizing the final sludge volume to be disposed. However, incineration and land disposal do not destroy the metals in the sludge, which means that the metals in the sludge remain and will still pollute the environment. Furthermore, incineration adds to the existing pollution problem with the emission of hazardous material and gases to the environment.

Metals which enter the environment through soil and groundwater are taken up by plankton. It then moves up the food chain pyramid to plants and animals. Plants and animals are known to tolerate a certain amount of metals, because some metals serve as micronutrients to them in low concentrations. Examples are copper, nickel and iron. However, high concentrations of metals can be toxic to living organisms. Man, who is on top of the food pyramid, will receive the pre-concentrated metals from plants and animals. Therefore, not only the environment, but also we human beings will suffer the negative consequences of our own activities.

Realizing this fact, several sludge generators came up with a more environmentally friendly method - physical and chemical immobilization. [2] This method ensures that the hazardous elements are permanently trapped as highly insoluble compounds or encapsulated inside an inert matrix, so that they do not leach out and pollute soil and groundwater. This method may help reduce the pollution problem, but it would suffer when scrutinized for sustainability. Potentially usable elements, many of which are scarce and expensive, are forbidden for future use by virtue of the treatment. In fact, they are artificially rendered difficult to recover.