CHAPTER I

INTRODUCTION

1.1 Statement of problem

Arsenic is known as a toxic element, its contamination in drinking water causes serious problems. It can cause immediate poisoning and death. The effect of arsenic to health can include thickening and discoloration of the skin, numbness in hands and feet and blindness. Arsenic is linked to cancer of bladders, lungs, skin, kidney and liver [1, 2].

Nowadays, there are many productions that use arsenic compounds in process such as electronics, livestock, pesticides, wood preservation and metallurgy [3]. If the wastewater treatment process of these productions has improper handling for arsenic waste, arsenic can contaminate in ground-water and surface environment. Arsenic in these environments is considerably concerned to population who obtains a majority of their drinking water from wells. Additionally, arsenic is found in inorganic (arsenite, As(III) and arsenate, As(V)) and organic species (monomethylarsenic acid, (MMA) and dimethylarsenic acid, (DMA)). Both types are soluble in water [4]. Therefore, the World Health Organization (WHO) and United States Environmental Protection Agency (USEPA) have specified the maximum contaminant level (MCL) for arsenic in drinking water as 0.01 mg/L [5], while the Ministry of Science and Technology of Thailand has regulated MCL of arsenic in wastewater from industries as 0.25 mg/L before being released into the environment [6]. For this reason, the removal of arsenic from contaminated water is very important.

The removal methods of arsenic in wastewater include flocculation, oxidation-precipitation, adsorption, ion-exchange, reverse osmosis and electrodialysis [7]. In this research, we are interested to use an adsorption technique to decontaminate arsenic from water because it is an easy and cost-effective method. During the past, researchers have demonstrated a use of modified solid residuals from many industrial sources as sorbents for arsenic removal from water such as red mud sludge [8, 9], slag [10], and fly ash [11].

Sludge from tap water production (STWP) is a by-product of water treatment process. This solid waste contains mainly aluminium and iron hydroxides remaining from coagulation process during water treatment. Aluminium and iron hydroxides can strongly adsorb some anionic species [12]. Besides the sludge is generated in large amount per day and eradicated by landfill or application in agriculture [13, 14]. Consequently, the recycle of this solid waste as alternative adsorbent is worth before disposal, because heavy metals cannot be eliminated from the environmental. Therefore, this work has focused in using STWP as an alternative low-cost adsorbent for the removal of arsenic from water. The adsorption characteristics of arsenite, arsenate and dimethylarsenic acid were investigated. The STWP as the low-cost arsenic adsorbent in this research has been received from the Metropolitan Waterworks Authority, Thailand.

1.2 Objective and scope of the research

Firstly, the sludge from tap water production (STWP) was characterized. Thereafter, STWP was used as arsenite, arsenate and dimethylarsenic acid adsorbent in aqueous medium system. In batch study, parameters affecting arsenic adsorption at room temperature including pH of solution, initial concentration of arsenic and contact time were studied. The effect of competing anions, such as sulphate and phosphate was evaluated. Moreover, a column system was carried out to investigate the effect of flow rate and to construct breakthrough curve. Finally, STWP was applied to real industrial wastewater treatment.

1.3 Benefits of this research

The sludge from tap water production (STWP) was recycled as the alternative low-cost adsorbent for the removal of arsenite, arsenate and dimethylarsenic acid in wastewater.