CHAPTER I

INTRODUCTION

At present, Thailand is continuously expanding industry which are causing enormous waste. Many industries have the process that uses water for both production and cleaning process. The important pollutants have found in effluent are organic content and heavy metal. The heavy metals in wastewater have many types such as copper, cadmium, chromium, lead, mercury, zinc, etc. Mercury is important pollutant in wastewater because it is very harmful to human and animal.

The major consumptive user of mercury is the chlor-alkali industry, using electrolytic cells (Patterson 1985). The second largest user is the electrical and electronic industry. Within the chemical and petrochemical industry, mercury compounds have found use as catalysts in plastics production and in hydrogenation and dehydrogenation, sulfonation, oxidation, chlorination, and acidolysis reactions. Mercury effluent data are summarized in Table 1.1.

Several methods have been proposed for mercury removal from wastewater. It can be classified into three groups, physical treatment, chemical treatment and physical-chemical treatment such as adsorption. Physical treatment is the method that is using physical process such as sedimentation, filtration, skimming. Chemical treatment is the method that is using chemicals to convert mercury to the form that is easy to remove such as reduction. The other method, adsorption is the most widely used for mercury removal. This method is the contacting aqueous phase with an adsorbent under suitable conditions. The adsorption method provides a high efficiency of mercury removal.

Many types of adsorbents are proposed for removal of mercury from aqueous phase such as activated carbon, resin and zeolites. There are several studies used activated carbon as adsorbent. But water after removal is contaminated with another heavy metals and acid-base value (pH) is higher than the allowable standard value. Therefore it would be beneficial to experiment that use some other waste materials like chitosan for this purpose. Chitosan is a partially acetylated glucosamine biopolymer and

mainly results from deacetylation of chitin. Chitin is produced in shells of crabs, shrimps, insects, cell wall of fungi and yeasts, etc (Goosen 1997). Chitosan can be produced cheaply because chitin is the second most abundant biopolymer in nature next to cellulose. It is also a known adsorbent for transition metals since the amine groups ($-NH_2$) on chitosan can serve as coordination sites for many metals such as Hg(II), Cu (II), Ni(II), Zn(II), Cd(II), Cr(III), Cr(VI), Pb(II), Co(II), Ag(I), Fe(III) and it is harmless to human. Application of chitosan is used in pharmaceutics, agriculture, cosmetics and food processing. And presently manufacture about shrimp frozen is promoted in Thailand, which is increased of waste of shrimp shell. So production of chitosan from shrimp shell can benefit the environment two-fold, one is increasing the cost of these waste products, two is to solve the water pollution if it can be used to eliminate or reduce the mercury content of the wastewater.

Table 1.1 Level of Mercury in Industrial Wastewater.

Waste	Mercury (ug/l)
Paper mill	20 - 34
Fertilizer mill	0.26 - 40
Smelting plant	20 - 40
Chlor-alkali plant	80 - 2,000
	4,600 - 5,100
	1,400 - 2,800
	3,000 - 8,000
	300 - 6,000
	21,500
Water-base paint	300
Paint and ink formulation	0 - 120,000
Acetaldehyde production	20,000
Fluorescent lamp production	2
Coal fly-ash pond effluent	2 - 3
Textile dyeing waste	15,000
Textile mill waste	11
Secondary lead battery recovery	0.66 (Total)
	< 0.20 (Soluble)
Rubber processing	0 - 720

The objectives of this experiment are study effective of degree of deacetylation of chitosan in removal of mercuric (II) chloride and phenylmercuric acetate. In addition, this research is also studying the pH value of solution and operating temperature that affect the adsorbents in removal mercury compounds. In the present study, chitosan 79%, 87% and 95% degree of deacetylation are used as adsorbent. Deionized water containing mercury compounds is used as the feed model. Mercuric chloride and phenylmercuric acetate are selected as mercury compounds in inorganic and organic forms respectively. Solution product is fixed mercuric ion with permanganate solution, persulfate solution, nitric acid and sulfuric acid that conform to ASTM D-3223 to obtain the inorganic form in aqueous phase before analyzed by atomic absorption spectrometry.