

# CHAPTER 1

## INTRODUCTION



### 1.1 Motivation

Nowadays, water shortage is the main problem for many industrial estates in Thailand, especially for the industries located in the Bangkok Metropolitans and highland area; furthermore, the government has made more stringent restrictions with regards to withdrawal of ground water for industrial applications (Visvanathan and Cippe, 2000). Accordingly, using reclaimed wastewater is one of the options that can relieve this problem.

Trihalomethanes (THMs) are the by-products of water chlorination. In the chlorination process, which is commonly used for disinfection, chlorine can react with humic substances in the natural organic matter (NOM) to form THMs. THMs represent structural variation of the methane molecule ( $\text{CH}_4$ ) in which hydrogen atoms are substituted by four halogen atoms (F, Cl, Br, or I). The common species of THMs generally formed in the water supply are chloroform ( $\text{CHCl}_3$ ), bromodichloromethane ( $\text{CHBrCl}_2$ ), dibromochloromethane ( $\text{CHBr}_2\text{Cl}$ ) and bromoform ( $\text{CHBr}_3$ ). Chloroform ( $\text{CHCl}_3$ ), the most well known THMs, not only causes a central nervous system depression, but also causes hepatotoxicity, nephrotoxicity, teratogenicity and carcinogenicity. Thus, the USEPA has issued a limit on the concentration of THMs in American drinking water supplies not to exceed  $80 \mu\text{g/L}$  and may be lowered to  $40 \mu\text{g/L}$  in several years (USEPA, 1998).

In highland area, the Northern Region Industrial Estate in Lumphoon Province, which is currently consuming more than 10,000 cubic meters per day of water supply, is facing water shortage problem, thus, a plan for using treated industrial estate wastewater after reclaimed process as raw water for water supply plant is designed so as to cope this problem. However, to relieve one problem may create another problem since carcinogenic substance, THMs, may be formed in such produced water supply.

Therefore, as stated previously, it is interesting to investigate THMFP in treated industrial estate wastewater and reclaimed water including its reduction by coagulation.

## 1.2 Objectives

- To investigate THMFP in treated industrial estate wastewater and reclaimed water.
- To examine the reduction of THMFP in reclaimed water by coagulation.
- To determine surrogate parameters for NOM in treated industrial estate wastewater and reclaimed water.

## 1.3 Scopes of This Work

- Treated industrial estate wastewater of Northern Industrial Estate in Lumphoon Province, Thailand was selected as raw water in this study.
- The laboratory experiments were carried out in jar-test unit using alum and ferric chloride as coagulants.
- Four THMFP species, including chloroform ( $\text{CHCl}_3$ ), bromodichloromethane ( $\text{CHBrCl}_2$ ), dibromochloromethane ( $\text{CHBr}_2\text{Cl}$ ) and bromoform ( $\text{CHBr}_3$ ) were investigated.
- Ultraviolet absorbance at wavelength 254 nm (UV-254), total organic carbon (TOC), dissolve organic carbon (DOC), specific ultraviolet absorbance (SUVA), and THMFP were considered as NOM surrogate parameters.

## 1.4 Advantages of This work

- To obtain THMFP data in treated industrial estate wastewater and reclaimed water.
- To know the possibility of THMFP reduction in reclaimed water by coagulation.
- To present surrogate parameters for NOM in treated industrial estate wastewater and reclaimed water.