CHAPTER I

INTRODUCTION

1.1. Motivation

In general, natural water sources such as river, reservoir and groundwater, are used as the source of raw water to produce water supply. Natural water is contaminated with natural organic matter (NOM) especially, dissolved organic matters (DOM). DOM cause a problem in the water treatment process because it can react with chlorine that is commonly used to kill pathogens in the disinfection process to form disinfection by-products (DBPs) such as haloacetic acids (HAAs), haloacetronitrites (HANs), cynohalide, and trihalomethanes (THMs) (Marhaba and Washington, 1998; AWWARF, 1982). THMs consist of four compounds including chloroform, dichlorobromomethane, dibromochloromethane, and bromoform.

Chloroform and dichlorobromomethane are increasing the risk of cancer such as bladder cancer and colorectal cancer. DBPs are not only linked to cancer, but it may also be linked to heart, lung, kidney, liver, and central nervous system damage (John, 1998). In spite of that, it is important to reduce the level of DBPs in produced water supply prior to it being distributed to consumer. The successful technique that was commonly employed to reduce the level of the DBPs was to reduce the level of DOM prior to it being chlorination. In general, alum coagulation was utilized to reduce DOM in the raw water under the optimal dosage of coagulant and pH.

For the time being, Aung-Keaw Reservoir water, Mae-Kuang Reservoir water, and Mae-Sa river water are used as raw water to produce water supply for utility in the area of Chiang Mai University, Amphur Muang, and Amphur Mae-Rim, which are located in Chiang Mai province, respectively. These raw waters are to a considerable extent contaminated with domestic wastewater, animal excretion and other organic matters. These organic matters therefore can react with chlorine in the water treatment process to form THMs. Under this situation, THMs as a suspected human carcinogen may directly affect consumers. Therefore, there is a need to study

the removal of dissolved organic matters by alum coagulation in order to investigate the proper treatment for producing safe water supply to consumer.

1.2. Objectives

1. To remove hydrophilic and hydrophobic dissolved organic matters in natural waters by alum coagulation.
2. To determine the trihalomethane formation potential (THMFP) created from hydrophilic and hydrophobic dissolved organic matters.
3. To study the reduction of THMFP resulting from the removal of hydrophilic and hydrophobic dissolved organic matters.
4. To determine the suitable condition of alum coagulation for hydrophilic and hydrophobic dissolved organic matters reduction.
5. To investigate the relationship between hydrophilic and hydrophobic dissolved organic matters and THMFP.

1.3. Hypotheses

1. Dissolved organic matters consist of hydrophilic and hydrophobic dissolved organic matters.
2. Removal of hydrophilic and hydrophobic dissolved organic matters may be obtained by alum coagulation.
3. Hydrophilic and hydrophobic dissolved organic matters can react with chlorine to form disinfection by-products such as trihalomethanes.
4. Hydrophilic and hydrophobic dissolved organic matters are precursors of THMFP. Thus the reduction of hydrophilic and hydrophobic dissolved organic matters may reduce the THMFP.

1.4 Scopes of Work

1. Water samples taken from the two selected reservoirs and one river located on Chiang Mai province were studied.

2. Water samples were collected at one time for each raw water source by grab sampling.
3. Alum coagulation was performed with alum dosages varying from 0 to 100 mg/L and under controlled pH conditions of between 5.0 and 7.0.
4. The DAX-8 resin was used to fractionate the water samples into hydrophilic and hydrophobic fractions.
5. Three-dimensional fluorescence spectroscopy (Excitation-Emission Matrix, EEM) was applied for characterizing the hydrophilic and hydrophobic dissolved organic matter fractions

1.5 Benefits of this work

1. Hydrophilic and hydrophobic dissolved organic matters in natural waters were classified.
2. Trihalomethane formation potential (THMFP) of both hydrophilic and hydrophobic dissolved organic matters were observed.
3. Results from THMFP could be used to establish the THMs standard of Thailand in the future.
4. The reduction of dissolved organic matters and their THMFP was demonstrated.
5. The application of three-dimensional fluorescence spectroscopy (Excitation-Emission Matrix, EEM) to characterize the DOM was obtained.