CHAPTER 3

METHODOLOGY

3.1 The selected raw water sources and waterworks

Two small waterworks using raw water form Aung-Keaw and Mae-Hia reservoirs were selected as the sources of water samples over the entire period of study which were approximately between Oct 2002 and Feb 2003. Aung-Keaw reservoir as shown in Figure 3.1 is currently serving as a major raw water supply source for Chiang Mai university waterwork at main campus (Hauy-Keaw campus), whereas Mae-Hia reservoir as illustrated in Figure 3.2 is presently utilized as a source of raw water supply for Chiang Mai university waterwork at new campus (Mae-Hia campus), which is located approximately 4 kilometers far form Hauy-Keaw campus.

3.2 The study in actual plant waterworks

The aim of this part was to determine THMFP in raw water and in water supply produced from the actual plant waterworks including characteristics of raw water in both Aung-Keaw and Mae-Hia reservoirs. The water sampling points from the actual plants of selected waterworks as mentioned in section 3.1 and analytical parameters in this study were illustrated as shown in Figure 3.3.

3.3 The study in Jar-Test experiments

3.3.1 Samples and analytical parameters in Jar-Test experiments

Generally, proper pH and coagulant dosage required for coagulation of particular water are obtained from Jar-Test experiments. The Jar-Test procedure including types of water samples and analytical parameters in this study are demonstrated in Figure 3.4.

a) Aung-Keaw reservoir

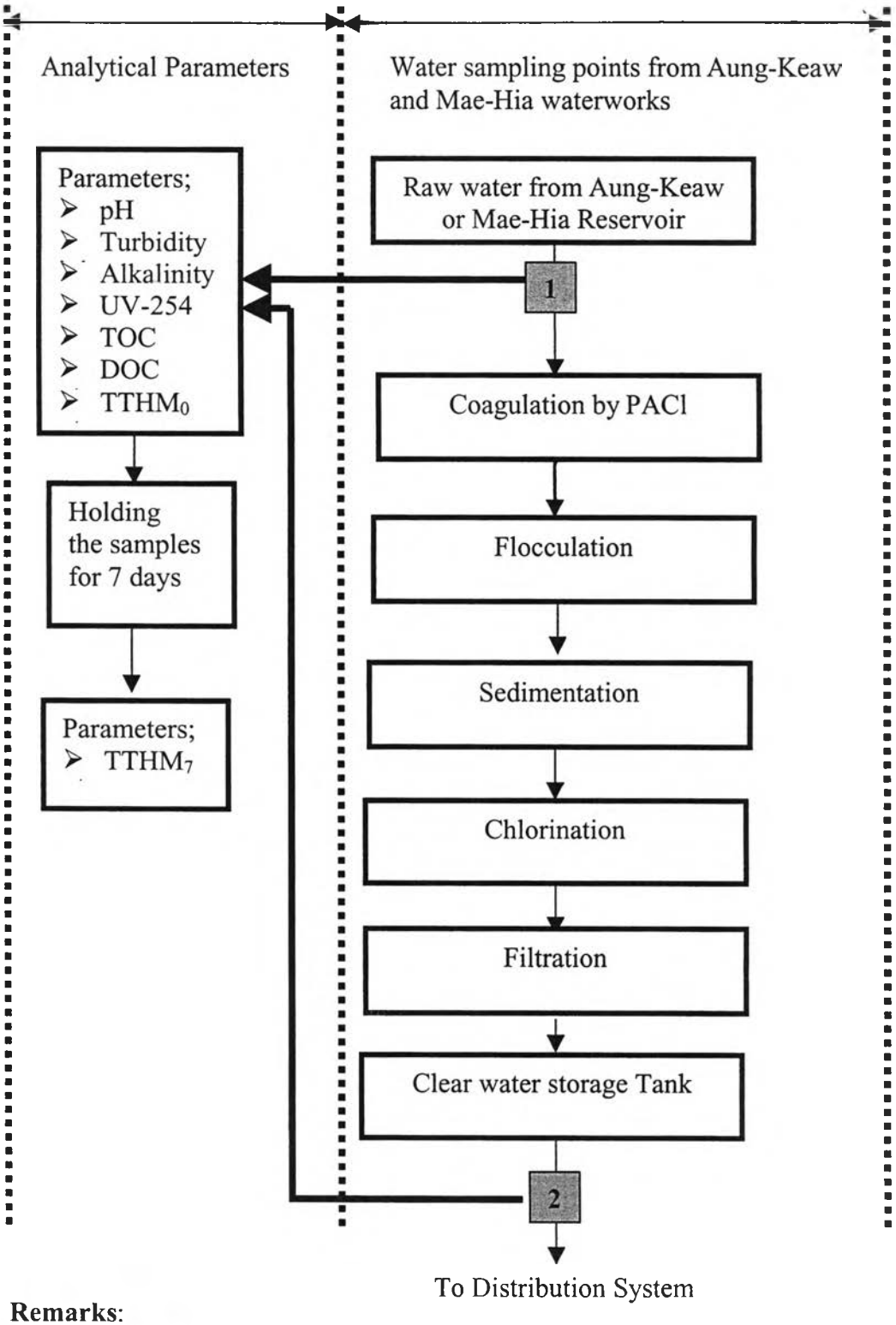
b) Aung-Keaw waterwork

Figure 3.1 Aung-Keaw Reservoir and waterwork in Chiang Mai University main campus. (Houy-Keaw campus)

c) Mae-Hia reservoir

d) Mae-Hia waterwork

Figure 3.2 Mae-Hia Reservoir and waterwork in Chiang Mai University new campus (Mae-Hia campus)



Remarks:

1 and 2 = The sampling points

THMFP = $TTHM_7 - TTHM_0$

Figure 3.3 Water sampling points and analytical parameters in the actual plant waterworks

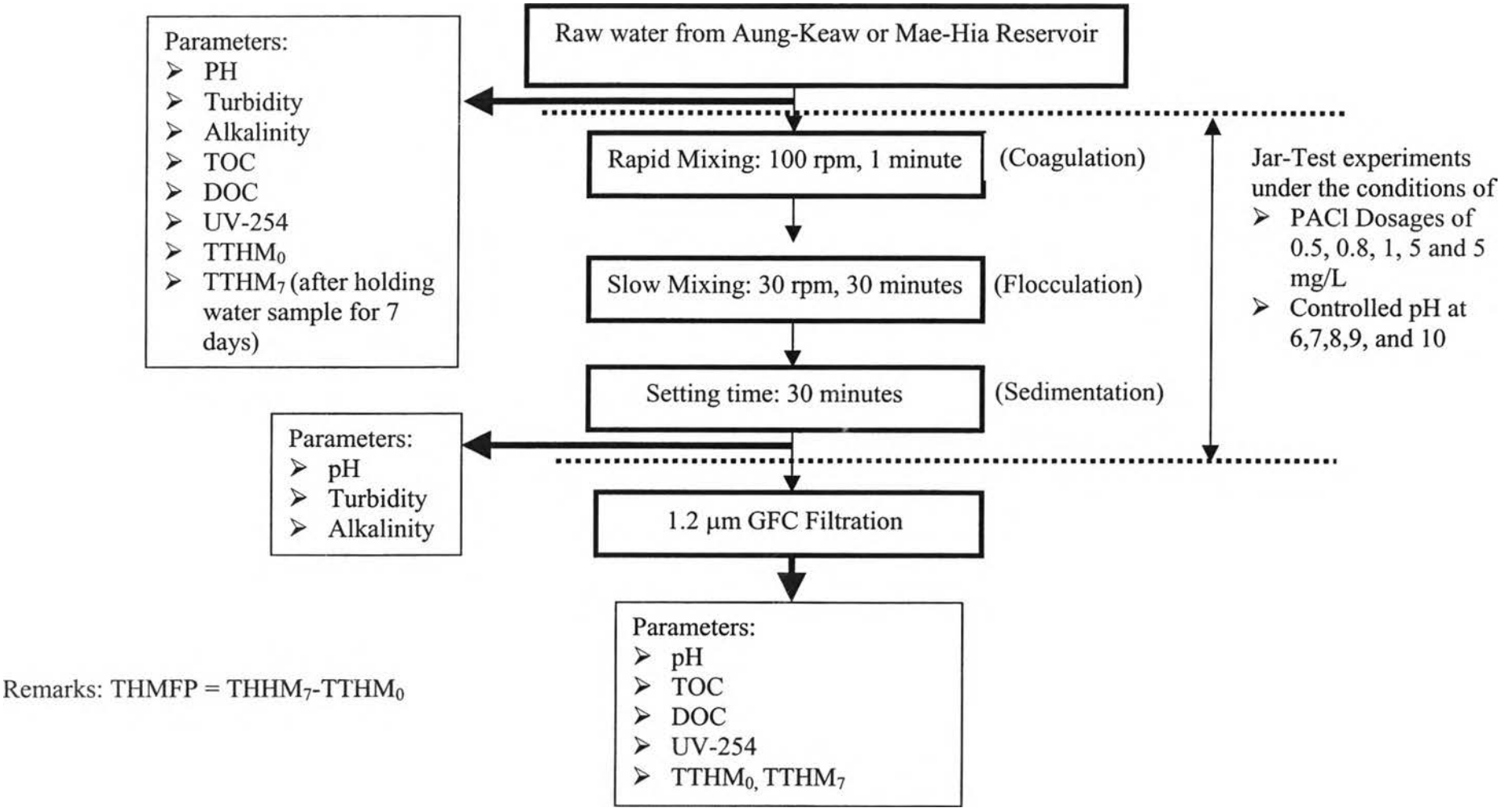


Figure 3.4 The Jar-Test procedure, types of water samples and analytical parameters in Jar-Test experiments

3.3.2 The Jar-Test Conditions

The jar-test experiments were carried out under the conditions of different PACl dosages and various controlled pH as depicted in Table 3.1.

Table 3.1 The experimental jar-test conditions

Coagulant	Coagulant dosage (mg/L)	Controlled pH
PACl (poly aluminum chloride)	0, 0.5, 0.8, 1, 3 and 5	6,7,8,9 and 10

3.3.3 Coagulant

Liquid PACl (Polyaluminum chloride) was served as coagulant in the experiments. The properties of PACl used in this study were briefly described as follows:

Code name	:	PACl
Appearance	:	Liquid
Al_2O_3	:	10-11%
pH	:	3.5-5 (at 1% wt/V)
Specific gravity	:	1.256

3.4 Analitycal Methods and Instruments

3.4.1 pH

The pH was directly measured by Horiba pH-meter, Model D-13E with an accuracy of ± 0.01. The pH meter was calibrated daily with buffer solution at pH 4.00 and 7.00.

3.4.2 Turbidity

Turbidity was direct measured by using HACH, 2100 Turbidity Meter.

3.4.3 Alkalinity

Alkalinity was determined in accordance with standard method 2320, section 2320B, Titration Method.

3.4.4 UV-254

UV-254 was measured in accordance with standard method 5910B, Ultraviolet absorption Method. The samples were filtered through a prewashed 0.45 μm cellulose acetate membrane prior to measurement (Appendix).

3.4.5 TOC and DOC

TOC and DOC were analyzed in accordance with standard method 5310, Total Organic Carbon (TOC) and section 5310C, Persulfate-Ultraviolet Oxidation Method. Water samples were filtered through glass-fiber filter of nominal pore size (1.2 μm) prior to TOC analysis. With refference to DOC determination water samples were filtered through a prewashed 0.45 μm cellulosed acetate membrane before analysis.

3.4.6 Trihalomethanes

Trihalomethans species such as chloroform, dichlorobromoform, dibromochloroform and bromoform were determined in accordance with standard method 5710 and 6232B, Formation of Trihalomethane and Other Disinfection By-Products and Liquid-Liquid Extraction Gas Chromatography Method (Appendix A).

The summary of analytical methods and instruments used in this study were presented in Table 3.2.

Table 3.2 Analytical methods and instruments

Parameter	Analytical Method	Standard	Analytical Instruments
pH	Directed measurement	-	Horiba pH-meter, Model D-13E
Turbidity	Directed measurement	-	HACH, 2100 Turbidity Meter
Alkalinity	Tritation Method	Standard method 2320B	-
UV-254	Ultraviolet Absorption Method	Standard method 5910B	Perkin-Elmer Model Lambda 25, UV/VIS spectrometer
TOC	Persulfate-Ultraviolet Oxidation Method	Standard method 5310C	O.I. analytical 1010 TOC analyzer
DOC	Persulfate-Ultraviolet Oxidation Method	Standard method 5310C	O.I. analytical 1010 TOC analyzer
Free chlorine residual	Colorimetric Method	Standard method 4500-Cl G	Perkin-Elmer Model Lambda 25, UV/VIS spectrometer
$TTHM_0$	Formation of Trihalomethane and Other Disinfection By-Products and Liquid-Liquid Exraction Gas Chromatography method	Standard method 5710 and 6232B	Agilent 6890 Series Gas Chromatography with ECD detector
$TTHM_7$	Formation of Trihalomethane and Other Disinfection By-Products and Liquid-Liquid Exraction Gas Chromatography method	Standard method 5710 and 6232B	Agilent 6890 Series Gas Chromatography with ECD detector