CHAPTER 3

METHODOLOGY

3.1 Apparatus

3.1.1 pH meter

3.1.2 Rotary agitator

3.1.3 Magnetic stirrer

3.1.4 Constant head permeameter

3.1.5 Inductively Coupled Plasma (ICP) Spectrometer

3.1.6 Analytical balance 2 digit

3.1.7 X-ray Fluorescence (XRF) Spectroscopy

3.1.8 X-ray Diffraction (XRD) Spectroscopy

3.1.9 Refrigerator

3.1.10 Oven

3.1.11 Vacuum pump

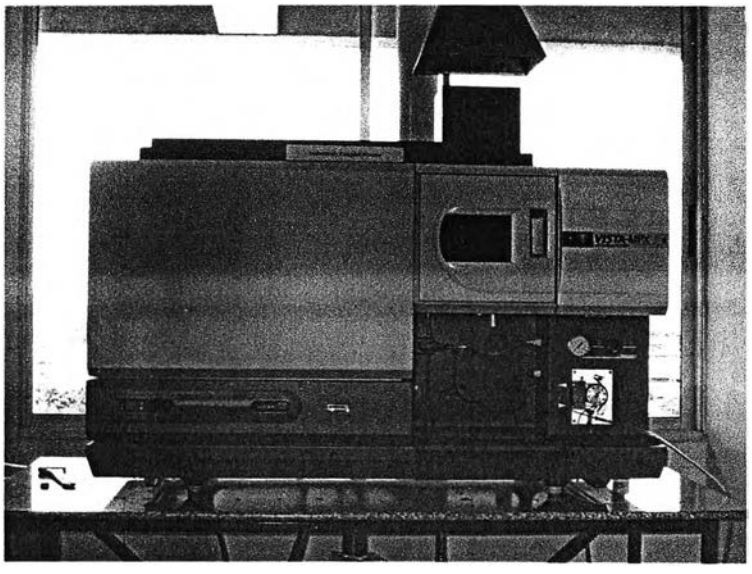

Figure 3.1 Inductively Coupled Plasma Spectrometer

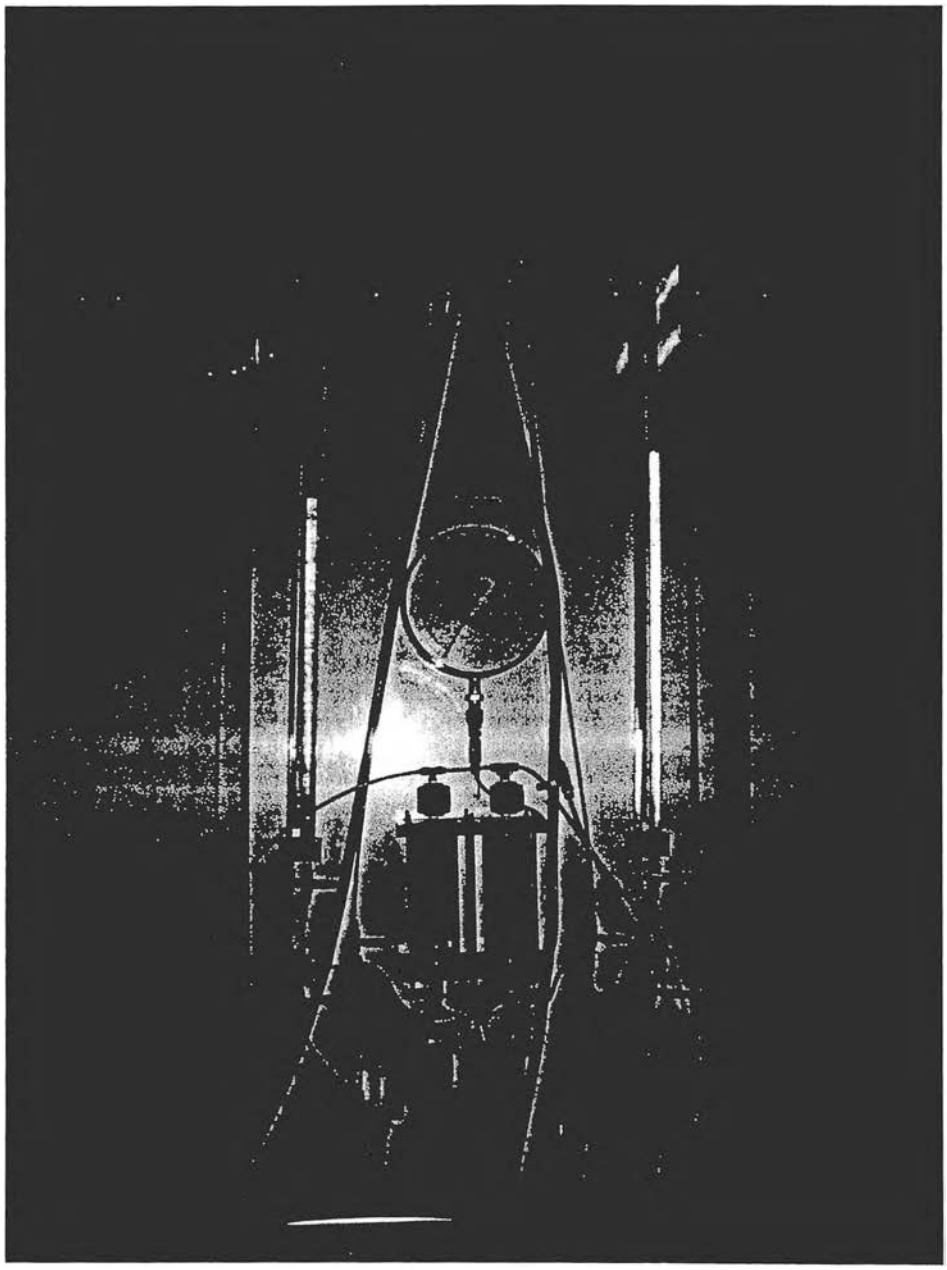

Figure 3.2 Constant head permeameter

3.2 Analytical Apparatus

The apparatus for analyzing leachability, heavy metals, chemical components, particle size, bentonite content, hydraulic conductivity, liquid limit and plastic limit are shown in Table 3.1 below.

Table 3.1 Analytical apparatus

Parameter	Method/Apparatus
Leachability	Extraction test according to the Notification of Ministry of Industry No. 6 (1997)
Heavy metals	Inductively Coupled Plasma (ICP) Method
Chemical components	X-ray Fluorescence (XRF) Spectroscopy X-ray Diffraction (XRD) Spectroscopy
Particle size	Particle Size Analysis
Bentonite content	Methylene Blue Procedure
Hydraulic conductivity	Constant Head Permeability Test
Liquid limit and Plastic limit	Liquid Limit Test and Plastic Limit Test

3.3 Materials

3.3.1 Test Materials: Spent foundry sand from spent foundry sand from SIAM NAWALOHA FOUNDRY CO., LTD and Magotteaux are selected for this study.

3.3.2 Solvents and chemicals: Tetrasodium Pyrophosphate ($Na_4P_2O_7$), Sulfuric acid (H_2SO_4), Methylene Blue

3.3.3 Glassware: Beaker, glass bottle, volumetric flasks, suction flasks, buret, pipet

3.3.4 Glass wool: Glass microfibre filter (GF/C)

3.3.5 Deionized water

All glassware used in this study was specially cleaned to minimize contamination. Glassware was washed with water and was soaked overnight with 10% Nitric acid. Then, it was washed with water and dried in an oven before use.

3.4 Method

Experiment procedures:

1. Spent foundry sand was collected from Siam Nawaloha Foundry and Siam Magotteaux Foundry

2. Spent foundry sand was analyzed for its toxicity by extraction test according to the Notification of Ministry of Industry No. 6 (1997)

3. After analysis and considered as non-hazardous, spent foundry sand was analyzed for chemical component by XRF and XRD, particle size by particle size analysis and bentonite content by methylene blue procedure

4. Spent foundry sand was tested for hydraulic conductivity by constant head permeability test and moldable by finding liquid limit and plastic limit

5. To determine the minimum bentonite content that can be compacted to achieve hydraulic conductivities, spent foundry sand that has hydraulic conductivity less than 10^{-7} cm/s, Liquid Limit greater than 20 and Plastic Index greater than 3 was mixed with pure sand to find the optimum ratio that still has good properties for hydraulic barrier layer (hydraulic conductivity, Liquid Limit and Plastic Index)

6. Spent sand that can not be molded was mixed with spent foundry sand from other factories to improve its properties

7. Conclude the relationship between % bentonite content and hydraulic conductivity

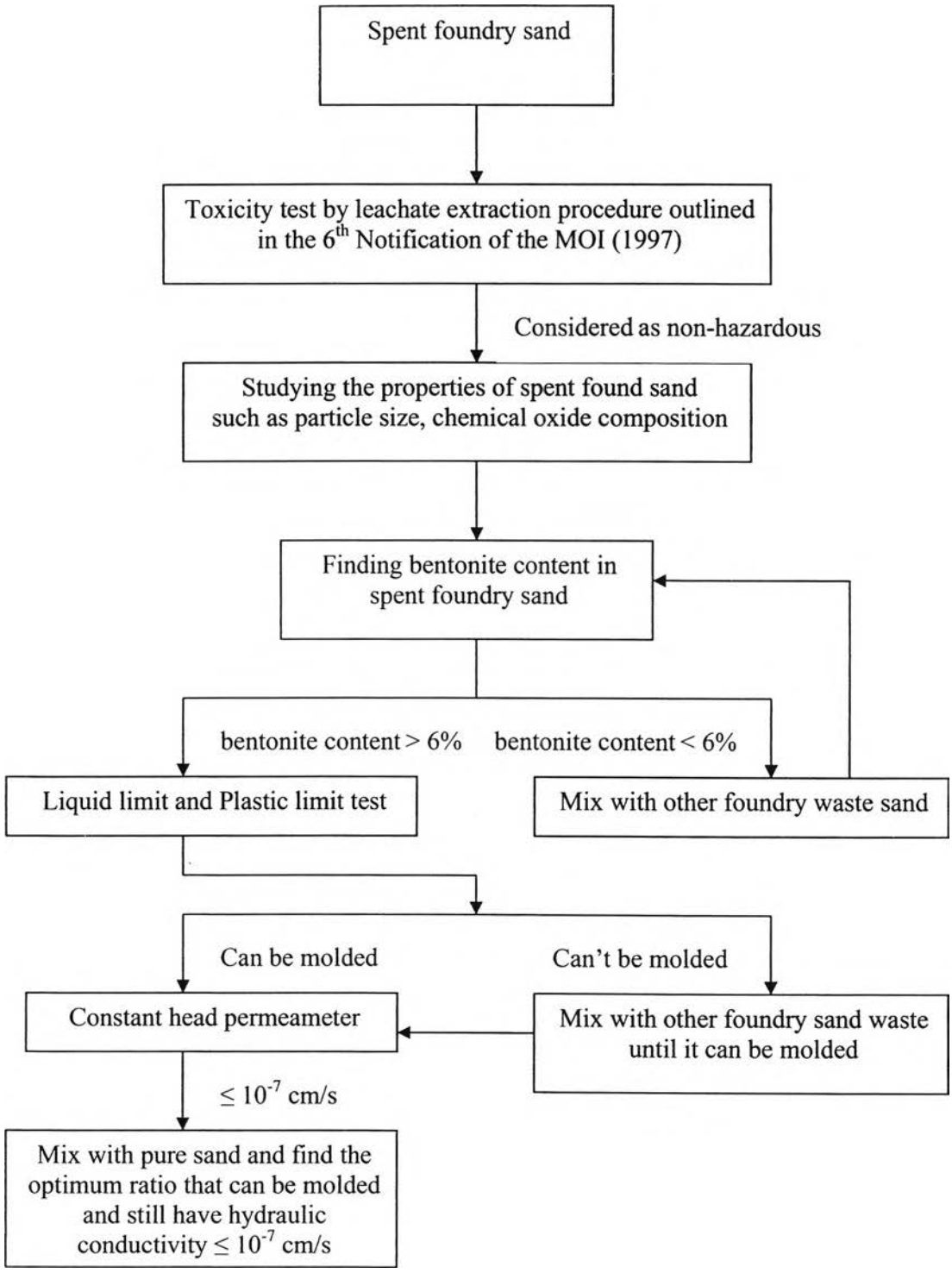

Figure 3.3 Scheme of the overall experiment procedure