

## CHAPTER 3

### EXPERIMENTAL

#### 3.1 Field sites

The sites for the present study comprise Mukim Klang, District of Sabak Bernam and the District of Teluk Intan. They are named as Site 1 (near Port Klang) and Site 2 (near Shahpadu Toll) - both in Mukim Klang, Site 3 (Sg. Lang) and Site 4, which is a landfill site (both in the District of Sabak Bernam) and Site 5 (in the District of Teluk Intan). Figure 3.1 depicts the landfill site at Sabak Bernam, Figure 3.2 depicts the drilling of a bore hole at Sg. Lang and Figure 3.3 presents a detailed map of the Mukim Klang sites.



Fig.3.1 Landfill site at Sabak Bernam.



Fig. 3.2 Bore hole drilling at one of the study sites, i.e. Site 3 (Sg. Lang).

### 3.2 Sampling

Soil samples were obtained using commercial drilling rig (Figure 3.2). Once the desired sampling depth was reached at 30–40 m from original ground level (O.G.L.), split spoon sampler tubes were used to collect soil samples. Where soils were relatively very soft, the thin-walled stationary piston samplers were used. The maximum amount of soil sample ( $= \frac{1}{4}$  kg) was collected at every 1.5 m depth and preserved immediately after being

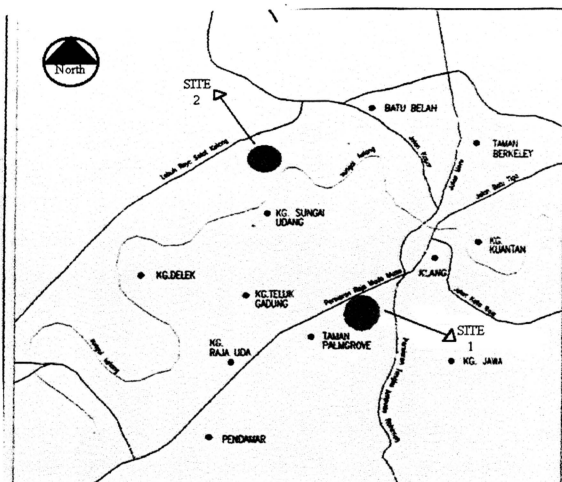


Fig. 3.3 Detailed map showing sites of study at Mukim Klang. Coloured spots indicate study sites.

recovered in bags or PVC and samples were refrigerated at  $4^{\circ}\text{C}$  during transport to the laboratories. Standard Penetration Test (S.P.T.) was carried out in accordance with test number BS1377 and it was carried out at 1.5 m intervals. The value of S.P.T as defined in BS1377 was reported together with the number of blow counts for each 75 mm penetration of the soil sampling tube. Figure 3.2 depicts work being done at one of the study locations. This is the method used at all study sites.

### 3.3 Derivation of interstitial water from soil

In the present study, for the purpose of deriving the interstitial water from the soil dug at the various sites, a “squeeze by rotation” method was used and the apparatus used is shown in Figure 3.4. Two layers of 8.0 mm millipore filters were used to prevent solid residues from entering the filtrate which was collected in polyethylene bottles. Further filtration was carried out when necessary. In order to ensure that sufficient amount of water samples were collected for chemical analysis, each soil column was divided into several depth intervals of 0 to 10 m, 10 to 20 m, 20 to 30 m, 30 to 40 m and 40 to 50 m.

### 3.4 Atomic Absorption Spectroscopy (AAS)

Elements such as calcium (Ca), ferum (Fe), cadmium (Cd), copper (Cu), manganese (Mn), zinc (Zn), lead (Pb) and nickel (Ni) were determined by the AAS technique. The instrumentation used was the Philips PU9200 Atomic Absorption Spectrophotometer.

All measurements were made at the respective wavelengths for the various elements as described in Table 3.1 using conventional hollow cathode lamps as light source and air-acetylene air-acetylene flame. The principle of AAS can be referred to Tong (1997).

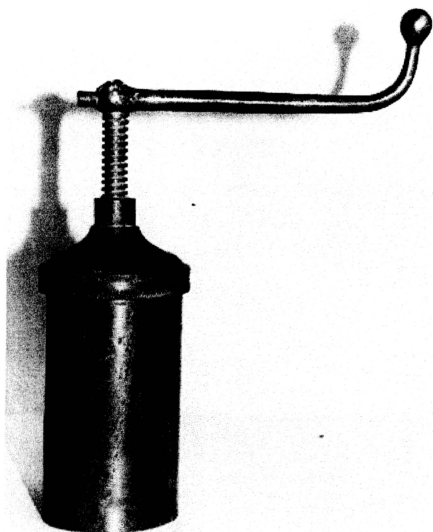


Fig. 3.4 Apparatus for "squeeze by rotation" method.

Table 3.1 Wavelength for elemental detection.

| Element | Wavelength<br>(nm) |
|---------|--------------------|
| Pb      | 283.0              |
| Cu      | 327.4              |
| Fe      | 372.0              |
| Ni      | 232.0              |
| Zn      | 213.9              |
| Cd      | 228.8              |

The steps involved in the AAS method is briefly shown in Figure 3.5.

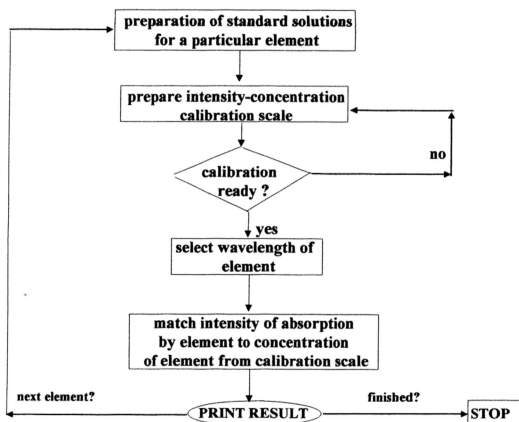


Fig.3.5 AAS method (brief)

All chemicals used in the analysis were of analytical reagent (A.R.) grade. Distilled water was used throughout. Calibration standards of the various elements were prepared

from commercially available standards (BDH, great Britain). Details of chemical analysis can be referred to Chan and Chin (1992).

### 3.5 Soil Properties

Soil properties pertaining to the present investigation are presented in Appendix A. The lithographic strata of the soils in the present investigation is comparable to that in Malacca (Mohd. Nazan Awang, 1992 and Kamaluddin bin Hassan, 1989).

### 3.6 Determination of the moisture content

The oven drying method is used. This method covers the determination of the moisture content of the soil as a percentage of its dry mass. For fine-grained soils, a thermostatically controlled drying oven capable of maintaining a temperature of 105 °C to 110 °C is required, together with the following:

- 1) A glass weighing bottle fitted with ground glass stopper or cap, or a suitable airtight non-corroding metal container, 50 mm diameter and 25 mm high.
- 2) A balance readable and accurate to 0.01 g.
- 3) A desiccator (200 mm to 250 mm diameter) containing anhydrous silica gel.

The weighing bottle or container was cleaned, dried, and weighed to the nearest 0.01 g ( $m_1$ ). A sample of at least 30 g of soil was crumbled and placed loosely in the container or the weighing bottle, and the lid or stopper replaced. The container or bottle and

contents are then be weighed to the nearest 0.01 g ( $m_2$ ). The lid or stopper is then removed, and the container or bottle with its lid and contents placed in the oven and dried at 105 °C to 110 °C. The period required for drying will vary with the type of soil and the size of sample. The sample shall be deemed to be dry when the differences in successive weighings of the cooled sample at intervals of 4 h, do not exceed 0.1 % of the original mass of the sample. The lid or stopper shall not be replaced while the sample is in the oven. After drying, the container or bottle and contents are removed from the oven and the whole placed in the desiccator to cool. The lid is replaced and the container or bottle and contents shall then be weighed to the nearest 0.01 g ( $m_3$ ). The moisture content of the soil,  $w$ , is then calculated, as a percentage of the dry soil mass, using the equation:

$$w = \frac{m_2 - m_3}{m_3 - m_1} \times 100 \%$$

where  $m_1$  is the mass of container (g);  $m_2$  is the mass of container and wet soil (g); and  $m_3$  is the mass of container and dry soil (g).



### 3.7 Determination of the pH value

The electrometric method is used. This method covers the electrometric determination of the pH value of a soil suspension. The following apparatus is required.

- 1) A pH meter fitted with a glass electrode and calomel reference electrode and covering the range pH 3.0 to pH 10.0. The scale shall be readable and accurate to 0.05 pH units.
- 2) A balance readable and accurate to 0.001 g.
- 3) Three 100 ml glass beakers with cover glasses and stirring rods.
- 4) Two 500 ml volumetric flasks.
- 5) A wash bottle, preferably made of plastics, containing distilled water.
- 6) A 3.35 mm BS test sieve.
- 7) A pestle and mortar or suitable mechanical pulverizer.

The following reagents are required. They are of recognized analytical reagent quality.

- 1) *Buffer solution*, pH 4.0. Potassium hydrogen phthalate in 5.106g was dissolved distilled water and diluted to 500 ml with distilled water. Alternatively, a proprietary buffer solution of pH 4.0 may be used.
- 2) *Buffer solution*, pH 9.2. Sodium tetraborate (borax), 9.54 g was dissolved in distilled water and diluted to 500 ml. Alternatively, a proprietary buffer solution of pH 9.2 may be used.

3) *Potassium chloride*. Saturated solution (for maintenance of calomel electrode).

The bulk sample obtained for testing is dried, crushed and passed through a 3.35 mm BS test sieve. The material passing the 3.35 mm BS sieve shall then be divided by successive divisions to produce a sample weighing 30 g to 35 g.

Sample of 30 g of soil obtained as described above is weighed into a 100 ml beaker and 75 ml of distilled water was added to it. The suspension was then stirred for a few minutes, the beaker then covered with a cover glass and allowed to stand for several hours, preferably overnight. It will be stirred again immediately before testing.

The pH meter is calibrated by means of the standard buffer solutions following the procedure recommended by the manufacturer. The electrodes are washed with distilled water and then immersed in the soil suspension. Two or three readings of the soil suspension will be made with brief stirrings in between each reading. These readings should agree to within  $\pm 0.05$  pH units. The electrodes will be removed from the suspension and washed with distilled water. The calibration of the pH meter will then be checked against one of the standard buffer solutions. If the instrument is out of adjustment by more than 0.05 pH units, it will be set to the correct adjustment until consistent readings are obtained. When not in use, the electrodes are left standing in a beaker of distilled water.