PHYSICO-CHEMICAL PROPERTIES OF BASALT SOILS FROM KUANTAN, PAHANG

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Some 20 basalt soil samples from the Kuantan area were analysed for their physico-chemical properties. The physical properties of the soils analysed are: relative density, water content, the Atterberg Limits, grain size distribution, and compaction properties. The chemical properties analysed involved the pore fluids chemistry, whereby the pore fluids of the soils were first extracted using the "Saturation Extract" method and then subsequently analysed for pH, conductivity, cation (Na^+, K^+, Ca^{2+}, Mg^{2+}) concentrations,

and anion (SO_4^{2-}, Cl^-, CO_3^{2-}, HCO^{3-}) concentrations. The results of the analyses are summarised in Table 1.

The results show the following characteristics for the basalt soils: relative density is high with most values > 2.7; water content is generally high with wo>30% indicating high adsorption of water; liquid limits can attain high values in excess of 50%; grain size comprises the whole range from G (gravel) to C (clay) but is predominantly fine-grained (M/C), ; the fines fraction of the soils are classified under ML-MH soils, i.e silts with low-high plasticity. Surprisingly the compacted maximum dry densities show rather low values ranging from 1.22-1.60 g/cm^3 in spite of the fact that basalt soils generally make good embankment fill materials. The low g dmax values could be attributed to the rather high optimum moisture contents of the soils (wopt=29.0-47.5%).

Results for the pore fluids chemistry indicate the following: pH is on the acidic side (< 7); conductivity is low, reflecting the low cations contents of the pore fluids; cations Na^+, K^+, Ca^{2+}, Mg^{2+} are generally low in concentrations, with K^+, Ca^{2+}, and Mg^{2+} having values of < 5 ppm. Interestingly enough, there appears to be a distinct predominance of Na^+ concentrations. As such , the ratios of monovalent cations ($Na^+ + K^+$) versus divalent cations ($Ca^{2+} + Mg^{2+}$) show high values ranging from 3-17, with a few values being in excess of 100, thus indicating the high dispersivity of the basalt soils. Anions Cl^-, CO_3^{2-}, and HCO^{3-} were not detected, while SO_4^{2-} shows considerable values of 35-122 NTU.

Although in the field the soil profile shows 3 distinct layers or horizonations having colours ranging from (top to bottom) dark brown, red, to purple, it would appear from the test results obtained that the physico-chemical properties of the soil samples taken from these 3 horizons do not show any significant differences or variations from one another, contrary to expectations. Moreover, some of the physico-chemical properties of the basalt soils taken from the same layer/horizon also appear to plot in 2 distinct clusters — the reasons for this are not entirely clear.