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The effect of particle sizes toward resistivity and chargeability for earth material interpretation

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Abstract: The common method for subsurface modelling is using the geophysical electrical resistivity method via injecting the current to the subsurface to determine the resistivity and chargeability value of the earth material. There are multiple factors which may influence the result, such as the coarse grain, fine grain, type of soil, and water content. In this study, the effects of particle sizes i.e. coarse grain and fine grain towards the resistivity and chargeability value are assessed. The coarse grain consists of gravel and sand sizes, meanwhile fine grain consists of silt and clay sizes. The gravel size samples are being varied from sample sieve size passing 50 mm and retained at 37.5 mm, 28 mm, 20 mm, 11.2 mm, 6.7 mm, 5 mm and 2.36 mm. Meanwhile, the sand size samples are being varied from sample sieve size passing 2 mm and retained at 1.18 mm, 0.85 mm, 0.60 mm, 0.43 mm, 0.30 mm, 0.20 mm, 0.15 mm and 0.063 mm sieve. Whereas, for fine grain of clayey silt and silt clay are samples size passing 0.063 mm sieve. The devices used for the experiment are Terrameter LS2 and soil box to measure the resistivity and chargeability. The water used in this study has constant resistivity and chargeability of 102 Ωm and 0.41 ms, respectively. The resistivity values for the fully soaked gravels and sands range from 78 Ωm to 162 Ωm and 86 Ωm to 121 Ωm, respectively. The chargeability values for fully soaked gravels and sands ranges from 5.57 ms to 7.87 ms and 2.04 ms to 12.31 ms, respectively. The resistivity values of silty clay and clayey silt at liquid limit are 37 Ωm and 56 Ωm respectively. The chargeability values for the silty clay and clayey silt samples are 1.7 ms and 1.2 ms, respectively. The resistivity value decreased with decreasing particle size. Meanwhile, the chargeability value increased with decreasing size. Further increases of water content exceeding the liquid limit for fine grain i.e. fully soaked condition causes no substantial changes in resistivity and chargeability value as the value began to plateau.

Keywords: Resistivity, chargeability, coarse grain, fine grain

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