



## Measuring soil particle density using the ultrasonic method

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Particle density is a fundamental soil physical parameter that represents the density of the solid soil particles (mineral and organic) and is expressed as the ratio of the mass to the volume of the solid. Particle density serves as input value in many models, such as soil compression and bearing capacity models. Particle density is often estimated rather than measured. In Estonia particle density is typically estimated based on soil organic matter content by Kitse's (1978) and Reppo's (1968) formulas for mineral and peat soils. The standard method for measuring particle density is the pycnometer method in which entrapped air is removed by vacuum or by boiling the soil-water mixture. The ultrasonic technology is widely used in chromatography for degassing of solutions and is easy to use. This ultrasonic energy can also be used for sweeping out the gaseous phase from the soil-water mixture, however the appropriate treatment time is not yet specified. The purpose of this study was to test the usability of ultrasonic energy in particle density determination as well to test different treatment time steps with ultrasonic path. We sampled 15 typical Estonian mineral soils with different texture and organic content. Also 3 peat soils were analysed. Particle density was determined by the pycnometer method and with ultrasonic bath. Soil organic carbon (SOC) content was determined by the Tjurin method and the soil organic matter content (SOM) was calculated as  $SOM=1.724SOC$ . The particle density values determined with the pycnometer method were compared to values measured with the ultrasonic bath with different time steps, as well as to calculated values according to Kitse (1978) and Reppo (1968). The applicability of formulas by Kitse and Reppo were tested by comparing the estimated particle densities with measured particle densities. Based on the results of this study it can be concluded that ultrasonic method is applicable for particle density determination and the most appropriate treatment time were proposed.

### References

Kitse, E., 1978. Mullavesi. Tallinn: Valgus, pp. 142.

Reppo, E., 1968. Píknometrítšeski analiz potšv i gruntov. Tallin. Isdat. Valgus, pp.134.