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Selected aspects of the soil particle size analysis by measuring the apparent weight of a float immersed in suspension

ABSTRACT

Although the basis for sedimentation methods of particle size distribution was developed more than 100 years ago, they are still being improved. One of the methods that eliminates to a large extent the drawbacks of the most commonly used sedimentation methods, while maintaining high accuracy of results, is the dynamometer method. The method was based on measurements of changes in apparent weight of a float suspended in sedimenting soil suspension. The aim of this study was to supplement the knowledge on the determination of the particle size distribution of soils, related to the newly developed dynamometer method. In this regard, three main aspects were analysed: the implementation of the dynamometer method in an device with a multi-station and automatic sample changer; the use of an iterative calculation procedure to reduce the influence of an increased initial suspension concentration on the results; the influence of organic matter removal on the results.

For the purposes of the study, basic soil analyses and repeatability analyses of particle size determination were carried out, the results were compared with those obtained using the pipette method, a comparative analysis of the measured content of individual fractions in soil mixtures and the calculated theoretical content was carried out, as well as an analysis of the magnitude of differences between samples with and without organic matter removal, and statistical analyses. In the study, optimum measurement parameters and an individual soil sample preparation methodology were developed.

It was found that the application of the multi-station automatic sample changer in the dynamometer method was characterised by high agreement with the results of the sedimentation method and high repeatability of the obtained results. The proposed iterative calculation method, using the correction of particle falling velocity based on the Batchelor equation, allows for the use in the measurements of the particle size distribution of suspensions with a volume concentration up to 0.0453. The removal of organic matter in soil samples may cause significant changes in the content of particular fractions measured by the dynamometer method. The direction and magnitude of changes for individual samples is irregular and difficult to predict. There is no unequivocal indication for the removal of organic matter when its content in the tested soil is at a low level.

KEY WORDS: particle size distribution, sedimentation methods, dynamometer method, soil particle sedimentation