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Effect of different pretreatment procedures on the particle size distribution results

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For soil particle size distribution (PSD) laser diffraction is a widely used and fast method. Although the data results are input data for further measurements and modeling applications, there are just few papers highlighting the effect of the pretreatment techniques on the PSD results. According to the different standards there are distinct sample preparation procedures for laser diffraction, which contain chemical (using sodium hexametaphosphate, anhydrous calcium carbonate or hydrogen peroxide) and physical (using ultrasounds) dispersion techniques to remove the cementing agents and break down the aggregates.
To measure the effect of the sample preparation on PSD results 8 soil layer samples from typical Hungarian soil horizons were studied.
We applied the most commonly used international (Buurman et al. 1996; Van Reeuwijk 2002; Burt 2004) and national (Hungarian Standard, MSZ-08 0205-78 1978) sample preparation procedures with and without modifications, therefore 8 distinct sample preparation series were carried out for each soils.
The role of soil organic matter (SOM) content in the aggregate formation was analyezed on humic Arenosol sample. To measure the effect of carbonate as a cementing agent Loess and calcaric Arenosol sample was analysed. The effect of small particles as binder material was investigated by using Luvisol Clay and Red Clay samples. Solonetz, Chernozem, and 'Erubáz'(a shallow soil type influenced by high SOM content and the volcanic parent rock) were used to represent the interaction effects of at least two binders.
The pretreated soils were analyzed by the Horiba Partica LA-950 Analyser. The applied refractive indexes differ from each other (real part: 1.55-1.60; imaginary part: 0.10-0.50) according to the soil type and the pretreatment procedure. The dispersion medium was distilled water in all cases.
Hierarchical cluster analysis was applied to classify the measured PSD results. Results show that sample preparation is very important procedure, which highly affects the results of the PSD analysis. Although, there is no best, single preparation procedure for all kind of soils. The results highly depend on the soils types and the number and types of the binding agents, and also on the sequence of the pretreatment steps (carbonate or organic matter removal first). It is clearly seen that for those samples which have only one binder as an aggregating agent, and particularly for the calcium-carbonate boundd Loess sample, there is a significant difference between the distinct pretreatment methods. In contrast, in case of those soils, where the binding mechanisms are more miscellaneous, the effect of the pretreatment methods are less traceable, since none of them can disperse the sample adequately.
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