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How do the combined soil dispersion methods influence the particle size distribution results measured by laser diffractometer method?

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Particle size distribution (PSD) of soil is a fundamental soil physical property providing information about the size and distribution of soil mass fractions. PSD determines the specific surface area of the soils therefore also the most important soil physical and chemical phenomena (capillarity, ionic and molecular adsorption) on the interface. Soil structure or microbial activity of soils are also dependent on PSD.
The laser diffractometer based methodology (LDM) is more and more often applied for soil PSD determination. Advantages of LDM are the high speed, the good reproducibility and that it gives a continuous function as a result, so it can be more easily compared to the PSD data of different particle size classification systems and measurement methods. In case of LDM measurements, the preparatory methods (destruction of soil-forming binders, dispersion of elemental particles) have a prominent role, but uniform standardization is lacking yet in this field. During the pre-treatment the quality of the dispersant has a paramount importance for the comparability of PSD results.
In this study we investigate the effects of dispersant, solvents and sonification on LDM PSD of eight representative Hungarian soil samples. We used Calgon (sodium-hexametaphosphate and sodium-carbonate), as dispersant; solvents were tap water, distilled water and deionized water; ultrasound was used for 120 s, or not and Malvern Mastersizer 3000 laser diffractometer device with Hydro LV dispersing unit was applied. Although it is assumed that the parameters of various solvents and dispersants are taken into account in the background of LDM PSD measurement, the effects of the various dispersion processes have been observed. We found that using Calgon-solution generated secondary peaks in each soil suspension on the volume distribution curves in the range of 100–1000 μm. Exchangeable calcium content of soil or dissolved calcium content of tap water can form insoluble calcium phosphate precipitate. The combined dispersing effect of sonification and dispersing agent was different per soil sample groups and per solvents.