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Thermal analysis to derive energetic quality parameters of soil organic matter?

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Many studies have dealt with thermal analysis for characterisation of soil and soil organic matter. It is a versatile tool assessing various physicochemical properties of the sample during heating and/or cooling. Especially the combination of different detection methods is highly promising. In this contribution, we will discuss the combination of thermogravimetry (TGA) with differential scanning calorimetry (DSC) in one single thermal analysis device. TGA alone helps distinguishment of soil and soil organic matter fractions with respect to their resistance towards combustion and allows a quantitative assignment of thermolabile and recalcitrant OM fractions. Combination with DSC in the same device, allows determination of energy transformation during the combustion process. Therefore, it becomes possible to determine not only the calorific value of the organic matter, but also of its fractions. We will show the potential of using the calorific values of OM fractions as quality parameter – exemplified for the analysis of soils polluted with organic matter from the olive oil production. The pollution history of these samples is largely unknown. As expected, TGA indicated a relative enrichment of the labile carbon fraction in contaminated samples with respect to the controls. The calorific values of the thermolabile and the recalcitrant fractions differ from each other, and those of the recalcitrant fractions of the polluted samples were higher than of those of the unpolluted controls. Further analyses showed correlation of the calorific value of this fraction with soil water repellency and the carbon isotopic ratio. The synthesis of our current data suggests that the content of thermolabile fraction, the isotopic ratio and calorific value of the recalcitrant fraction are useful indicators for characterizing the degree of decomposition of OMW organic matter. In this contribution, we will further discuss the potential of using the energetic parameters a quality parameter for soil organic matter.