Vacuum Drying Soil Samples is a Low-Temperature Alternative to Conventional Oven Drying When Determining Soil Water Repellence

ENOCH V. S. WONG[1], PHILIP R. WARD[2], MATTHIAS LEOPOLD[1], DANIEL V. MURPHY[1], LOUISE BARTON[1]

[1]SoilsWest, UWA School of Agriculture and Environment, Faculty of Science, The University of Western Australia, 35 Stirling Highway, Crawley, Western Australia 6009, Australia
[2]CSIRO, Private Bag No 5, Wembley, Western Australia 6913, Australia

Conventional oven drying of soil at 105˚C is known to denature soil enzymes, oxidise soil organic compounds and cause inconsistent soil water repellency (SWR) as SWR is known to be due to soil organic compounds. Air-drying (40˚C) or temperatures intermediate between air-drying and 105˚C can be used when measuring SWR; but this is slower, and the resultant soil water content is not equivalent to soil dried at 105˚C. Other drying techniques that avoid high temperature, such as freeze-drying, are expensive. Here we investigated a low-temperature (20˚C) soil drying technique to generate soil water contents equivalent to those achieved by conventional oven drying (105˚C). The effect of drying temperature, plus aeration status (oxic or anoxic), on SWR was also investigated. We hypothesised SWR decreases under oxic, but not anoxic drying conditions, due to oxidation of soil organic compounds. A water repellent sandy soil was dried by either low-temperature (20˚C) vacuum drying or conventional oven drying (105˚C) for two days (no change in mass thereafter), and under either oxic or anoxic conditions. The gravimetric water content and SWR [using molarity ethanol droplet test (MED)] of each of the drying treatments was determined. We obtained equivalent soil water content (n=41 replicates; ~4.19% gravimetric soil water content; $P>0.05$) for both vacuum and oven drying technique. However, the SWR for the oven dried soil under oxic condition was significantly lower than the vacuum dried soil (n=5 replicates; $P<0.05$; Fisher's least significant difference=0.14; from ~MED 1.58 to 1.34). No significant change in SWR ($P>0.05$) was found between vacuum or oven dried soil when investigated under anoxic conditions. We recommend vacuum drying (20˚C) soils under anoxic conditions when assessing SWR. Investigations of soil organic compounds, typically the temperature sensitive dissolved organic compounds, should consider low-temperature vacuum drying under anoxic conditions as an alternative to conventional oven drying so as to avoid oxidation of soil organic compounds.