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Autoclaving as a mean of modifying the soil wettability characteristics

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Studies of soil water repellency have often attempted to isolate its hydrological impact by comparing responses of wettable and water repellent soils. It is, however, almost impossible to identify natural wettable and water repellent soils that are otherwise fully comparable. Furthermore no established methodology exists that allows changing a soil from wettable to water repellent (or vice versa) without affecting its chemical composition. Approaches used for rendering wettable soil (or sands) water repellent involve coating particles with hydrophobic or commercial water repellent spray. Heating soil to temperatures >300 ºC has been used to eliminate existing water repellency from samples, but this can permanently alter the composition of organic matter.

Here we report on a new technique for rendering wettable soil water repellent involving autoclaving. Autoclaving is commonly applied in medicine and biology for sterilization. It uses moist heat and pressure to destroy the bacteria, viruses and fungi. The same method has also been used in soil ecology studies for selective removal of certain micro-organisms.

In our study, soils at various moisture contents were autoclaved in sealed bags for 1hr at 121°C. The soils became water repellent and the degree of water repellency was found to be dependent on the original soil moisture content and the soil wettability remained unchanged even with further drying of the soil up to 105°C. No changes in soil wettability were found after autoclaving very dry or wet soils. Only at certain intermediate water contents was the soil able to switch to a hydrophobic state.

We suspect that the changes occurring during the autoclaving involve molecular orientation of hydrophobic and hydrophilic groups of soil organic matter, and moist heat and pressure cause the hydrophobic groups to be directed towards the outside of the soil particles which consequently repels water. Treatment of soil in this way presents a simple, inexpensive method of making a soil hydrophobic without changing its chemical composition. This has considerable potential for controlled experiments requiring both soils that differ only in terms of their degree of hydrophobicity.