Modification of soil wetting properties always involves the interface chemical composition

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Soil wetting properties, usually quantified by contact angle (CA), depend on the chemical composition of the soil particle interface layer that differs from that of the underlying mineral. X-ray photoelectron spectroscopy (XPS) with only shallow analysis depth identified the CA to respond on the surface O/C ratio. Both parameters were found to be negatively exponentially correlated and increasing CA along a soil chronosequence could be explained by a decreasing O/C ratio [1]. Here, CA was artificially modified. Sandy soils were treated at 80°C, subsequently wetted and the structure of the wetted state preserved by shock-freezing and freeze-drying. 80°C-treatment increased CA to >110°, while for the wetted state CA distincly decreased to <80°. Both modifications may be explained by conformational changes within the structure of organic compounds and specifically the orientation of non-polar functional groups with respect to pore space. XPS spectra revealed a decreased O/C ratio at 80°C-treatment and an increased O/C ratio at water treatment. C speciation indicated CA to be positively correlated with non-polar (C-C, C-H)-species [2]. Incubation of soil microaggregates (SMA) derived from silty soil induced subcritical water repellency in the originally wettable material that actually resulted in a slightly decreased O/C ratio. Further, fitted amounts of non-polar (C-C, C-H)-species supplemented the positive correlation found for the sandy soils (CA range 40-130°) in the small CA domain (CA range 9-25°). The results presented here not only confirm the negative correlation between CA and surface O/C ratio [1], but as well could demonstrate that changes in CA always were coupled with changes in interface chemical composition [2]. Moreover, this was found to be valid for distinct changes (sandy soils) and only slight changes (SMA) in CA.

[1] Woche *et al*. (2017) *Sci. Rep* **7**, 1-8. [2] Bachmann *et al*., in prep