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If Water Drop Penetration Time tells us about the *kinetics* of soil water repellency, and Molarity of Ethanol Drop studies about the *energetics*, what is the relationship between the two measurements?

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Two measurements are commonly used to assess the water repellency of soils: a) the time taken for a drop of water to completely penetrate the soil, this is the Water Drop Penetration Time (WDPT) [1,2]; and b) the minimum molarity [3] (or % [4]) of ethanol in an ethanol-water mix (or the surface tension of this solution [5]) which allows a drop to penetrate the soil within a given (short) time, this is the Molarity of an Ethanol Drop value (MED). WDPT is a kinetic measurement while MED is essentially thermodynamic since it is related to the critical surface tension, i.e. the maximum liquid surface tension of a drop which will wet the soil.

MED tells us something about the initial energy state of the materials at the soil surface, and in combination with the surface tension of water gives information about the energy difference to be overcome for wetting to occur. WDPT tells us something about the rate at which the materials at the soil surface are reorganised from a state of water repellency to a state which allows wetting by water.

In many chemical systems the relationship between the rate constant for a process and the energy required for the process to occur, the activation energy, is given by the Arrhenius equation,

$k = A\exp(-E/kT)$

where k is the rate constant, A a pre-exponential factor, E the energy barrier, k the Boltzmann constant and T the temperature.

In this presentation we explore the relationship between WDPT and MED values using the Arrhenius equation, and examine how this relationship might be used to provide insight into the processes which occur as initially water repellent soils become wettable by water. Data is presented from both WDPT and MED experiments on a range of soils of varying water repellencies from locations around the world, together with studies of Solution Drop Penetration Time for a variety of soils of different repellencies with ethanol-water mixtures of different surface tensions.

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