Impact of Heating Temperature on Water Repellency and Functional Group Alterations of Leaf Litter Ash from Japanese Cedar (*Cryptomeria japonica*) and Japanese Cypress (*Chamaecyparis obtusa*)

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Water repellency (WR) is a phenomenon where soil resists wetting due to the presence of organic matter (OM). Compositional and structural changes in this OM can alter the degree of WR, subsequently affecting the bio physicochemical properties of soils. Forest fires can transform biomass into ash with varying hydrophobicity levels, which in turn affect the soil hydrology by reducing water infiltration and disrupting moisture distribution. However, limited information exists on how temperature variations affect WR and functional groups of litter ash during heating. This study investigated the temperature influences on WR and functional groups in leaf litter ash of Japanese cedar (CED) and Japanese cypress (CYP). The litter of these two coniferous species are rich in hydrophobic resins and waxes to induce WR and are susceptible to wildfires. Leaf litter was heated at 100, 200, 300, 400, 500, and 600 °C for 20 min in a muffle furnace, with a control sample at 28 °C. The degree of WR (contact angle; θ) and functional group changes were measured with the molarity of ethanol droplet test and Fourier transform infrared spectroscopy (FTIR), respectively. The control samples of both species were highly water-repellent (θ = 125° and 119°) for CED and CYP, respectively. Litter WR decreased with increasing temperature to become wettable at 600 °C (θ = 90°). In FTIR analysis, three absorbance peaks of B, C, and E were recorded (wavenumbers = 3020–2800 cm^{-1}, 1640–1600 cm^{-1}, 1170–950 cm^{-1}, respectively), which consist of hydrophobic functional groups causing ash WR. These peaks disappeared at 300–400°C, parallel to the disappearance of ash WR. Simultaneously, peaks D and F (wavenumbers = 1400 cm^{-1} and 872 cm^{-1}, respectively) appeared, which may not cause ash WR. These findings highlighted the heating effect on WR and the functional groups of litter ash, providing insights into post-fire soil hydrology. To reflect real field conditions, further studies should focus on variations in oxygen availability, heating rates, and moisture conditions.

Keywords: Forest fires, Functional groups, Leaf litter ash, Temperature, Water repellency