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Pyrogenic organic matter accumulation after density and particle size fractionation of burnt Cambisol using solid-state nuclear magnetic resonance spectroscopy

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Fires lead to formation of the pyrogenic organic matter (PyOM) which is quickly incorporated into the soil. The charring process involves chemical alterations of the litter material, where biologically available structures are transferred into aromatic polymers, such as black carbon (BC) and black nitrogen (BN).

In order to reveal the medium term fate of BC and BN in soils, the top 5 cm of A horizons from unburnt, single and double burnt Cambisols of the Sierra de Aznalcóllar (Southern Spain) were collected 7 year after an intense fire and separated according to their density and their size (Golchin et al., 1994; Sohi et al., 2001). The density fractionation yielded in the free (fPOM), occluded particulate organic matter (oPOM) and the mineral-association organic fraction (MAF) and was performed using a sodium polytungstate solution with a density of 1.8 g cm-3. The MAF was further separated into the sand (2 mm to 63 μm) and coarse silt (63 to 20 μm) and fine fraction (< 20 μm) by wet sieving. Organic carbon (Corg) and total nitrogen (Nt) were determined by dry combustion (975°C). The chemical composition was examined by solid-state 13C and 15N NMR spectroscopy.

The 13C and 15N NMR spectra of all fPOM and oPOM fractions are dominated by signals assignable to O-alkyl C followed by resonance lines of alkyl C. The spectra indicate that fPOM is mainly composed of undecomposed plant debris whereas oPOM is rich in unsubstituted-aliphatic material. The lack of intensity in the chemical shift region from 160 to140 ppm in the spectra of the small size fractions reveals the absence of lignin residues. This, their low C/N ratios and the clear 13C-signal attributed to carboxylic C allows the conclusion that this fraction mainly composed of microbial residues. Former studies evidenced that aromaticity of the burnt bulk soil decreased with elapsing time after the fire. The present investigation revealed that most of the remaining aromatic C accumulated in the POM fractions, which is in contrast to other studies showing a preferential recovery of BC in the fine particle size fractions. Possibly, the poor interaction between PyOM and the mineral phase in the studied soils contributes to the observed low biochemical recalcitrance of their BC and BN.

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REFERENCES
Golchin, A., Oades, J., Skjemstad, J., Clarke, P., 1994. Soil structure and carbon cycling. Soil Research 32, 1043-1068.
Sohi, S.P., Mahieu, N., Arah, J.R.M., Powlson, D.S., Madari, B., Gaunt, J.L., 2001. A procedure for isolating soil organic matter fractions suitable for modelling. Soil Science Society of America Journal 65, 1121.