

Title:

Investigation into the molecules present in freshwater leachate of soils affected by wildfire and fire retardant using ^{13}C NMR spectroscopy

Abstract:

Wildfire activity within British Columbia and North America has substantially increased within recent years. The 2023 fire season in British Columbia officially surpassed the 2018 season as the most destructive ever recorded in terms of area burned¹. Although there has been some recent research into the effects of wildfires, there remains a need for further studies on the use of fire retardant and its impact on groundwater quality. Soils affected by intense wildfire activity have been shown to contain aromatic compounds with nitrogen substituents², benzene dicarboxylic acids, tricarboxylic acids, and tetracarboxylic isomers (BPCAs)³. The scope of this research project is to investigate the analytical capabilities of ^{13}C NMR spectroscopy in determining the effects of fire-affected soils on water quality. One soil sample will be collected from a 2023 wildfire within the Kamloops regional fire district. Soil samples will be leached with treated water in an *in-situ* laboratory experiment replicating groundwater infiltration. Samples will be treated with increasing amounts of fire retardant to determine the potential impact on the pedosphere and hydrosphere. This research will primarily be carried out utilizing ^{13}C NMR spectroscopy techniques supplemented by Mass spectrometry.

References:

¹CBC Canada, The 2023 wildfire season is now B.C.'s most destructive on record — and it's only mid-July, 2023. <https://www.cbc.ca/news/canada/british-columbia/bc-wildfire-july-18-1.6909596#:~:text=Mary%27s%20River%20wildfire%20burning%20near,British%20Columbia%27s%20wildfire%20service%20says.&text=587-,The%202023%20wildfire%20season%20in%20British%20Columbia%20has%20officially%20surpassed,recorded%20according%20to%20area%20burned>. (accessed October 8, 2023)

²Thurman, E. M.; Yu, Y.; Ferrer, I.; Thorn, A. K.; Rosario-Otíz, L. F.. Molecular Identification of Water-Extractable Organic Carbon from Thermally Heated Soils: C-13 NMR and Accurate Mass Analyses Find Benzene and Pyridine Carboxylic Acids. *Environ. Sci. Technol.* **2022**, *54*, 2994-3001. DOI: 10.1021/acs.est.9b05230

³Chen, H.; Wang, J.; Ku, P. et al. Burn Intensity Drives the Alteration of Phenolic Lignin to (Poly) Aromatic Hydrocarbons as Revealed by Pyrolysis Gas Chromatography–Mass Spectrometry (Py-GC/MS). *Environ. Sci. Technol.* **2022**, *56*, 12678-12687. DOI: 10.1021/acs.est.2c00426