PFAS in Canadian Sludge Treatment and Biosolids



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PFAS - Emerging Contaminants: Why Now?



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1965-1975

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- Expensive: LC/MS/MS, SPE extraction, isotopically labeled internal standards
- Many compounds (20 40)
- 12,000+ PFAS compounds: targeted *versus* non-targeted analysis
- Labor-intensive

PFAS analytical methods are still evolving

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Since 2020, we have been studying PFAS fate in wastewater sludge handling system



High Solids Samples

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 The analysis of per- and polyfluoroalkyl substances in wastewater sludges and biosolids:

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Low Solids Samples

The Fate of 15 PFAS in Two Full-Scale Wastewater Sludge Handling Systems: An Interstage Mass Balance Analysis

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Since 2020, we have been studying PFAS fate in wastewater sludge handling system

- WRRF-A & WRRF-B
- Daily and weekly sample collection over 3-4 weeks

 \rightarrow 24 PFAS concentrations (ng/L & μ g/kg)

 \rightarrow TS, TSS, VS, VSS, pH

- Flow data provided by plant operators
- <u>PFAS concentration</u> & <u>flow data</u> & <u>TS</u> \rightarrow PFAS mass flows

PFAS Concentrations in Biosolids



PFAS Concentrations in Biosolids





PFAS Mass Flow in Liquid-Solid Separation & Sludge Blending



PFAS Mass Flow in Liquid-Solid Separation & Sludge Blending





PFAS Mass Flow in Liquid-Solid Separation & Sludge Blending



PFAS Mass Flow in Fermentation





PFAS Mass Flow in Anaerobic Digestors



PFAS Mass Flow in Anaerobic Digestors



PFAS Fate in Wastewater Sludge Handling System



PFAS Fate in Wastewater Sludge Handling System



PFAS Fate in Wastewater Sludge Handling System

- Solid-liquid separation and sludge blending do not affect PFAS mass flow
- Precursor degradation and PFAA formation in anaerobic digestors (AD)

 \rightarrow overall increase in PFAS mass flow

- The extent of PFAS degradation and formation in AD depends on SRT
- Long-chain compounds exit the system via the solid (i.e., cake) stream
- Short-chain compounds are recycled back to wastewater treatment

On-going Work: PFAS Fate in Composting



On-going Work: Total Organic Fluorine (TOF) in Biosolids









Region of Waterloo









