



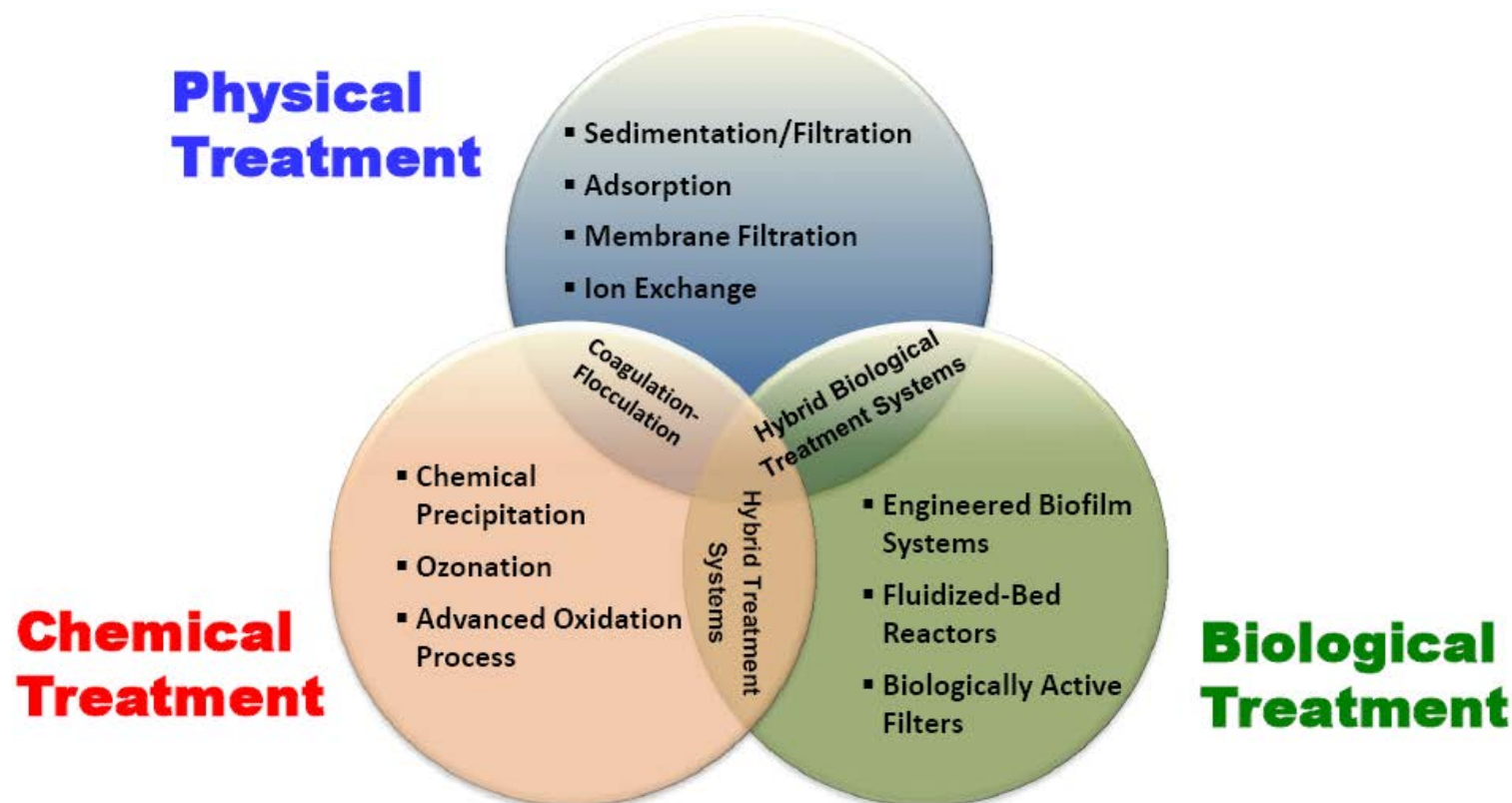
FTIR complementing produced water characterization

Chris Swyngedouw
WaterTech 2014

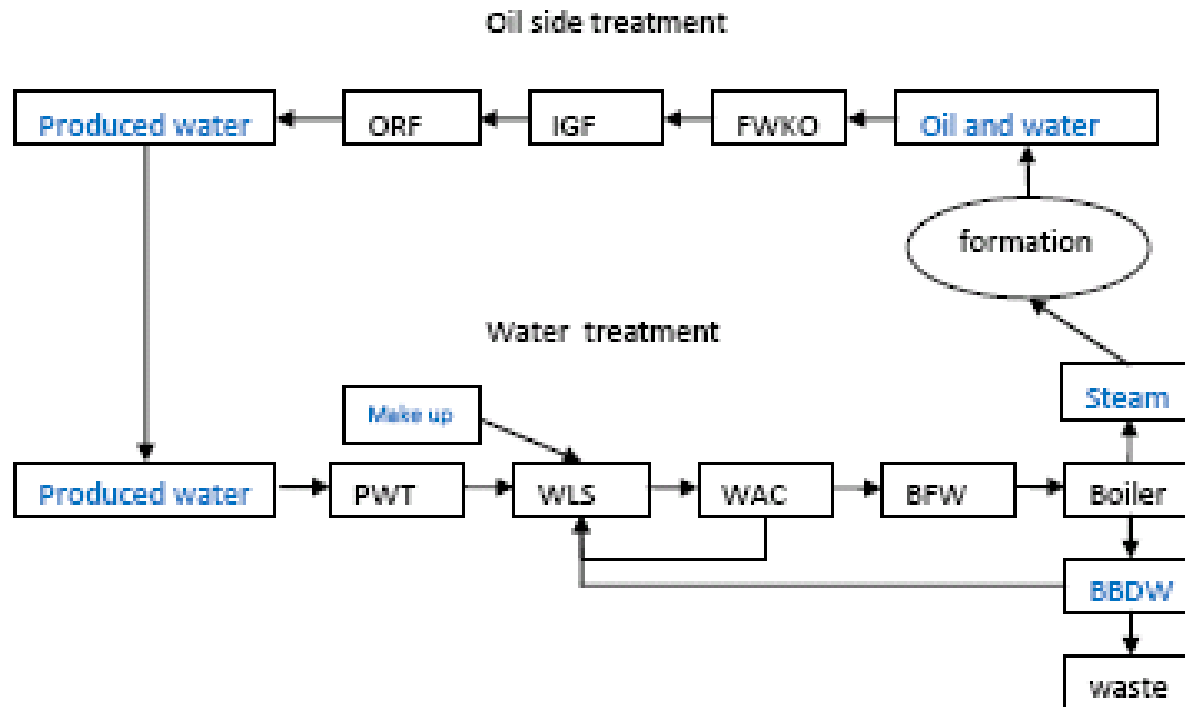
OSPW

- **OSPW is estimated to reach 1 billion m³ in the Athabasca Oil Sands Region by 2025**
- **Remediation strategies based on microbiological degradation are too slow to keep up and are ineffective to completely detoxify OSPW**

Water treatment options



SAGD



Focus

- Recycling and disposal of OSPW
 - characterization
- SAGD
 - Hydrocarbons and organics
 - Scaling deposits
- Characterization of DOM
 - Systematic approach
- FTIR
 - Characterization of unknowns
 - Complements other techniques like GC-MS

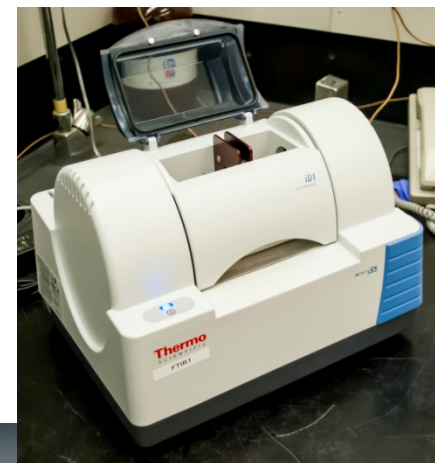
Infrared Spectroscopy

Spectroscopic analysis of organic compounds

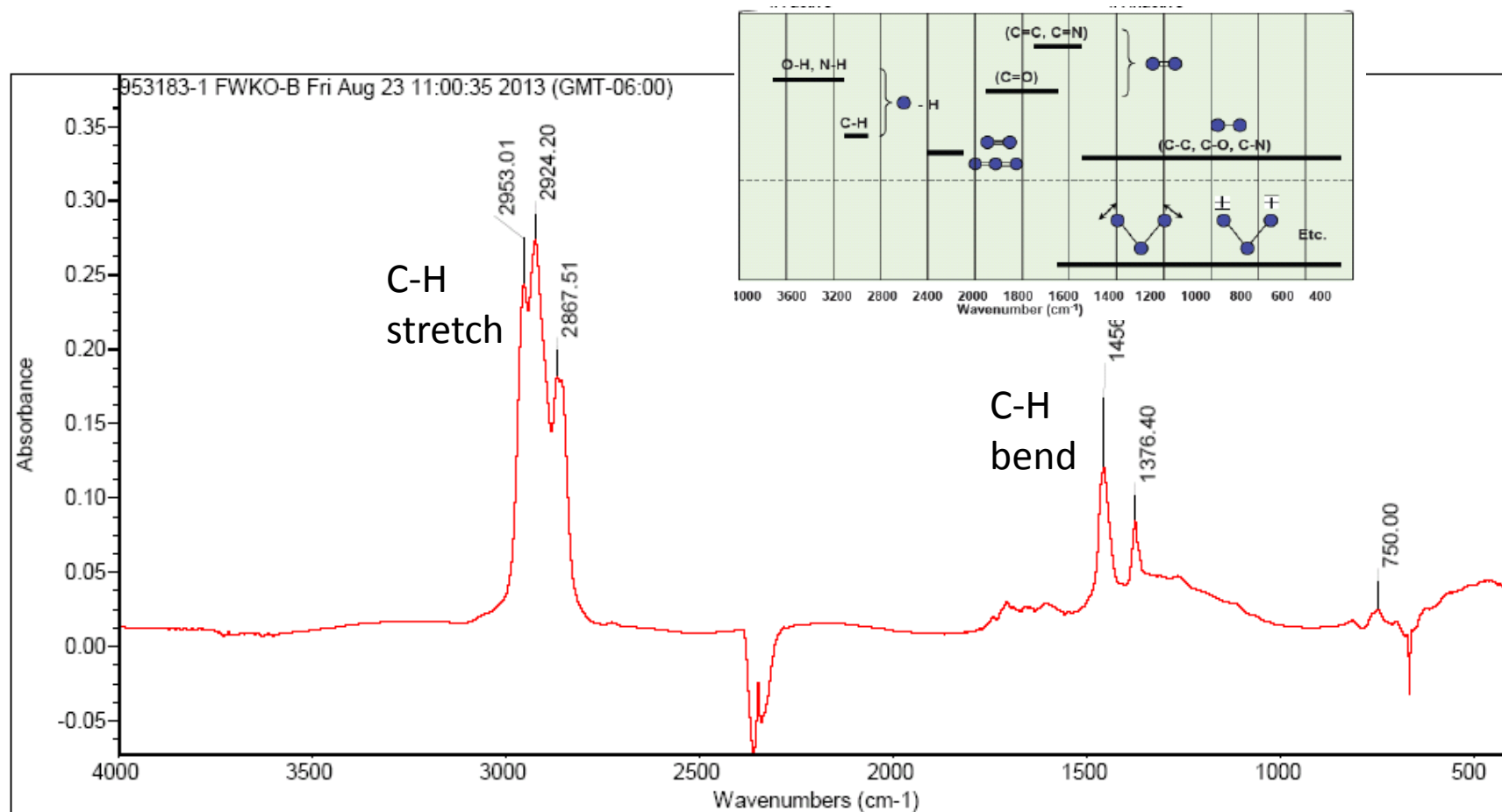
Simple sample handling and quick analysis

Functional groups of the components in a sample

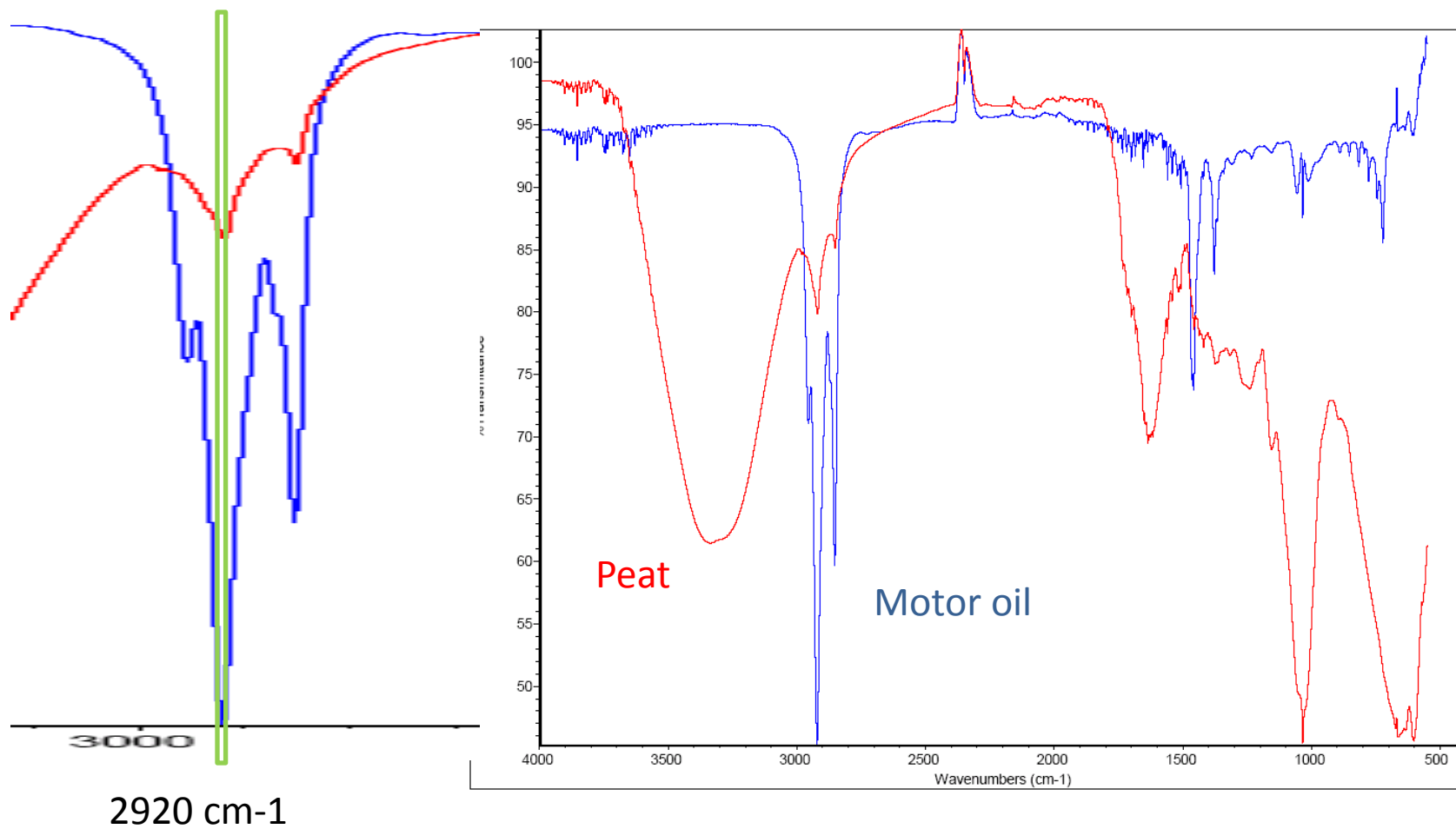
Limitations are being overcome



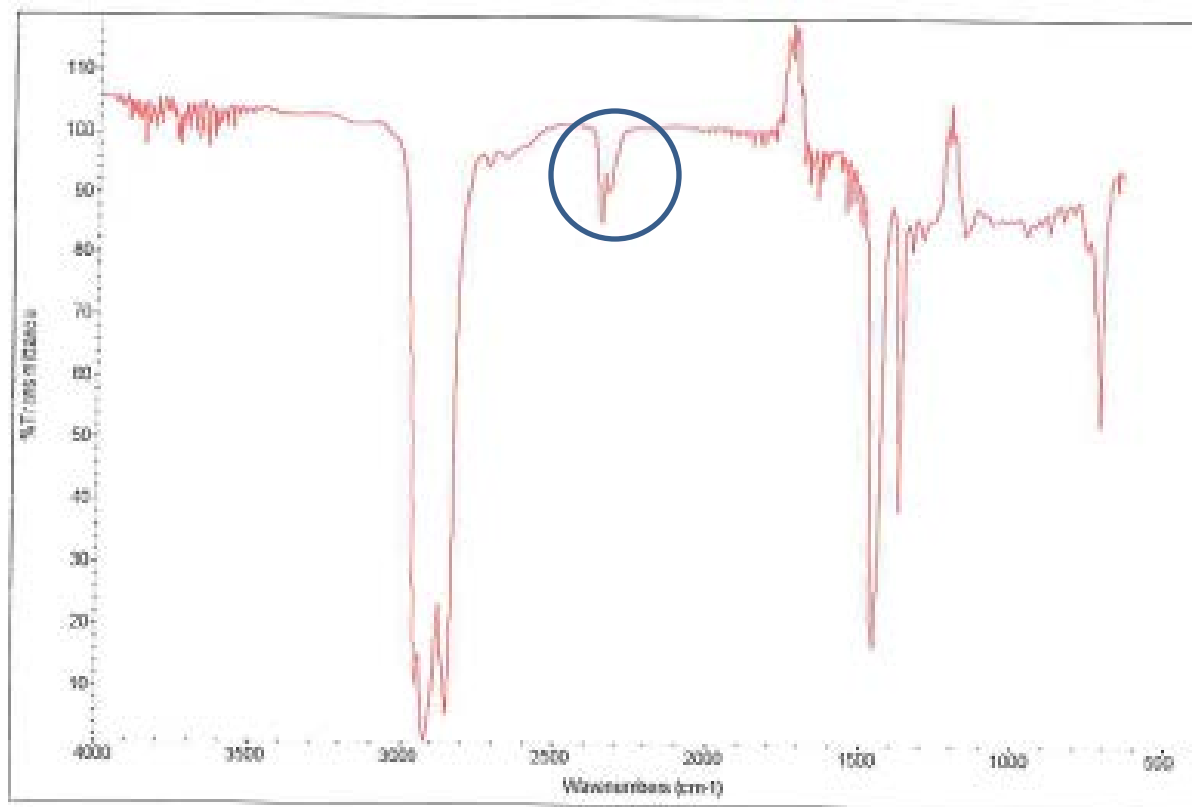
Hydrocarbon example



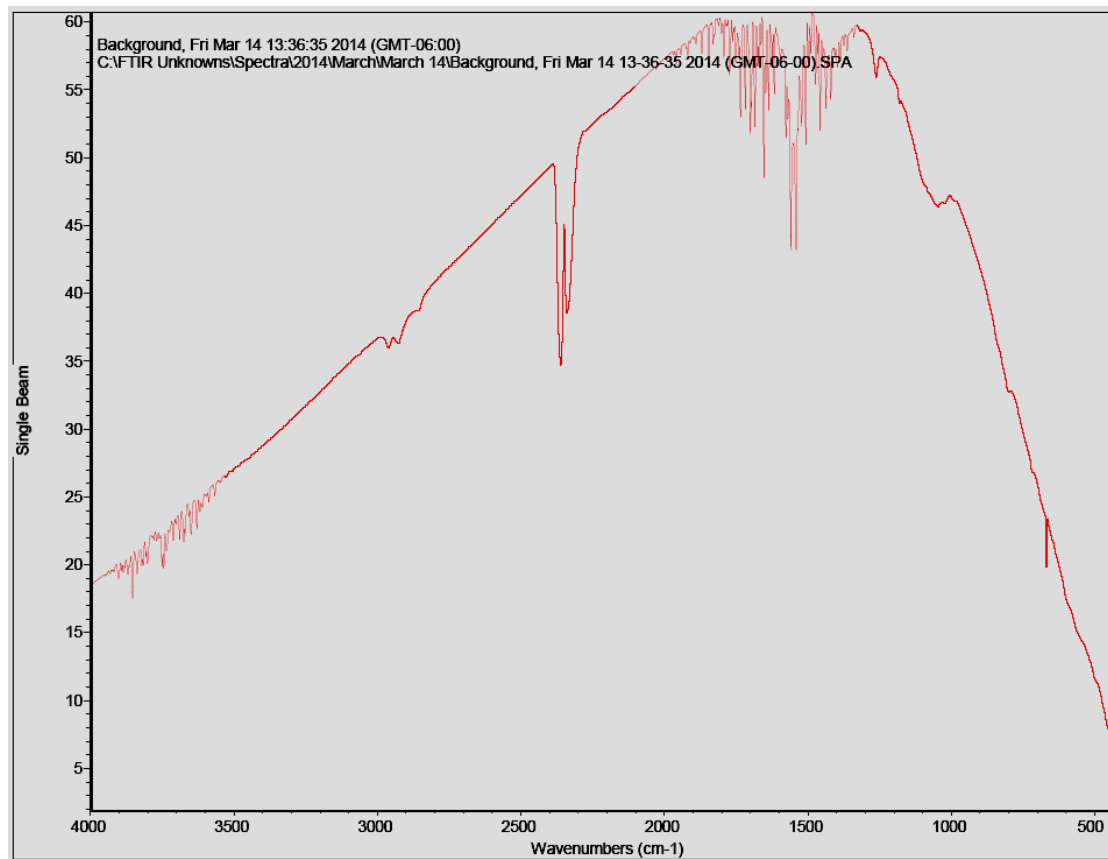
Unique characterization



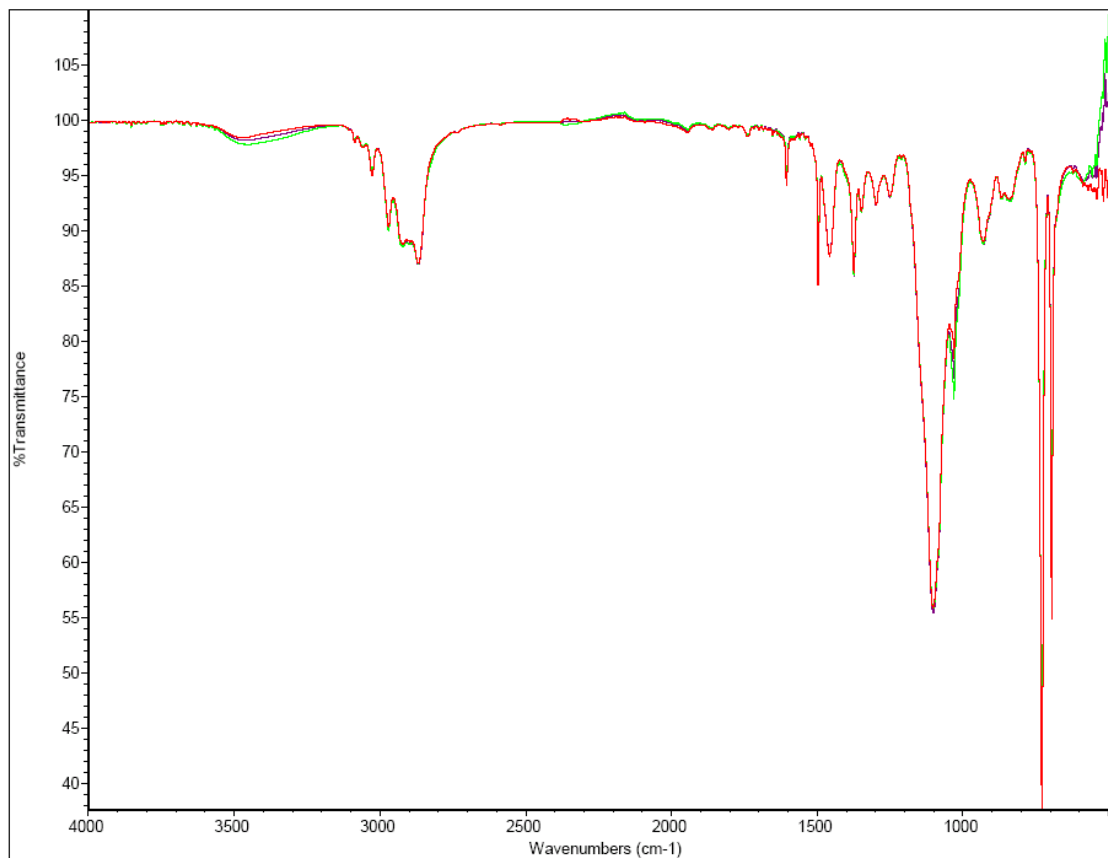
Spectrum interpretation



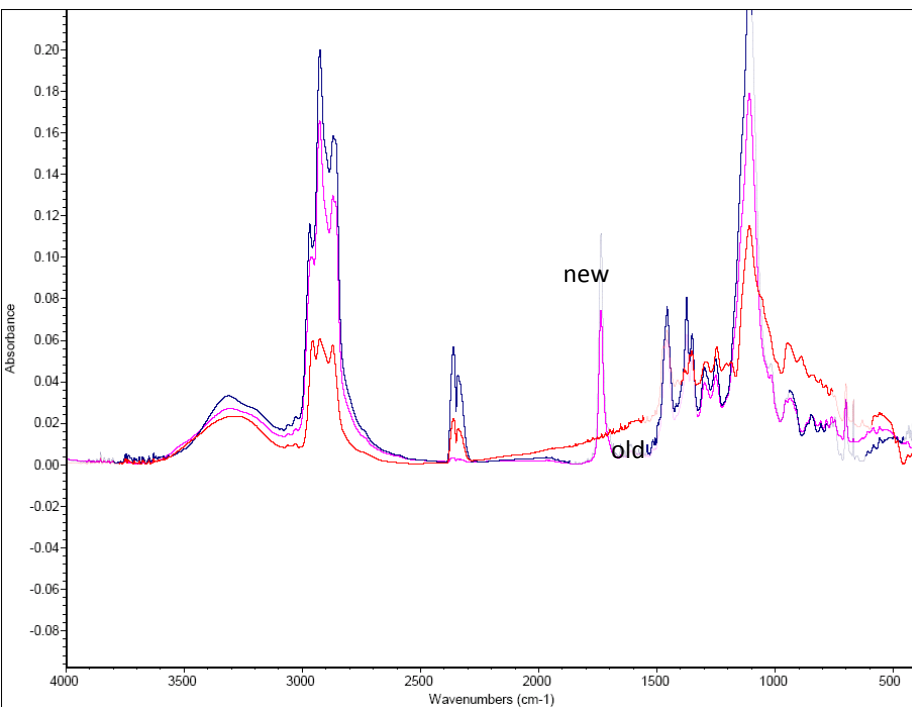
Atmospheric Background



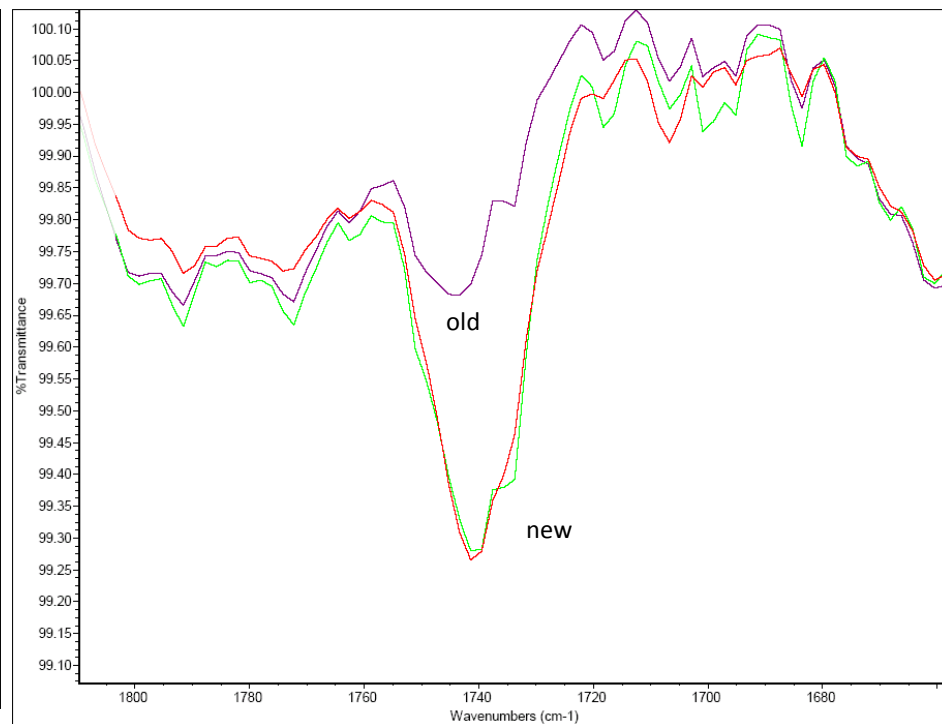
Overlay



Weathering?

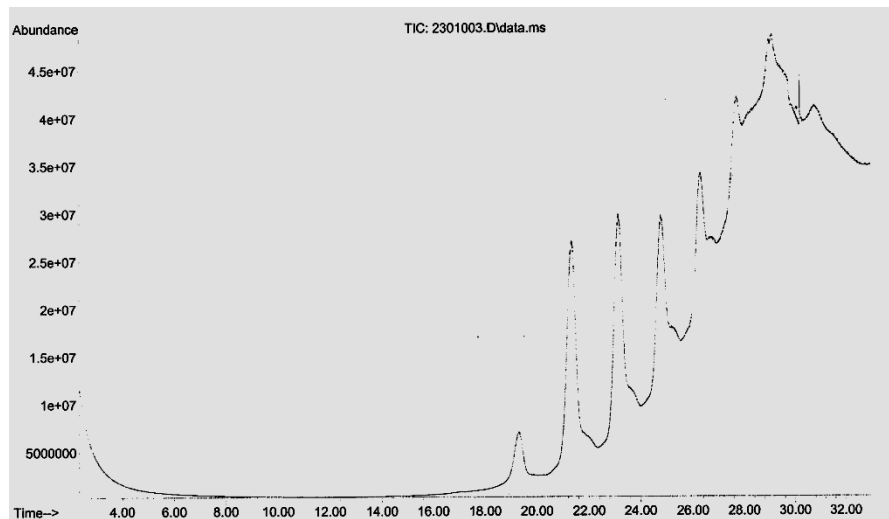


Liquid cell



ATR

Difficult GC chromatogram



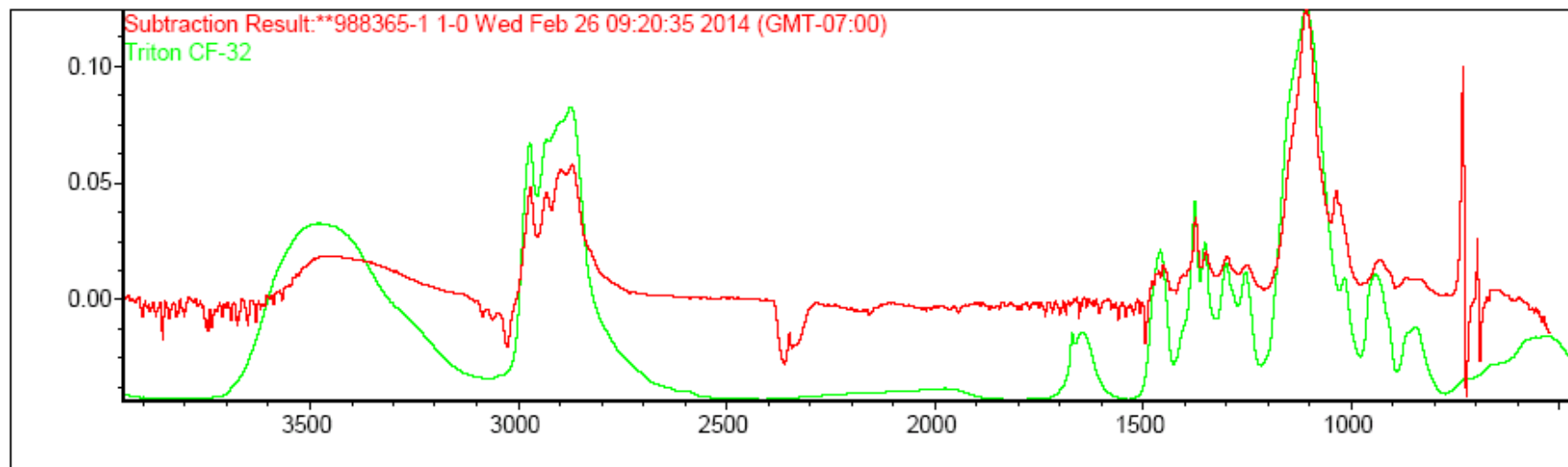
Difference spectrum example

Search results for: Subtraction Result:**988365-1 1-0 Wed Feb 26 09:20:35 2014 (GMT-07:00)

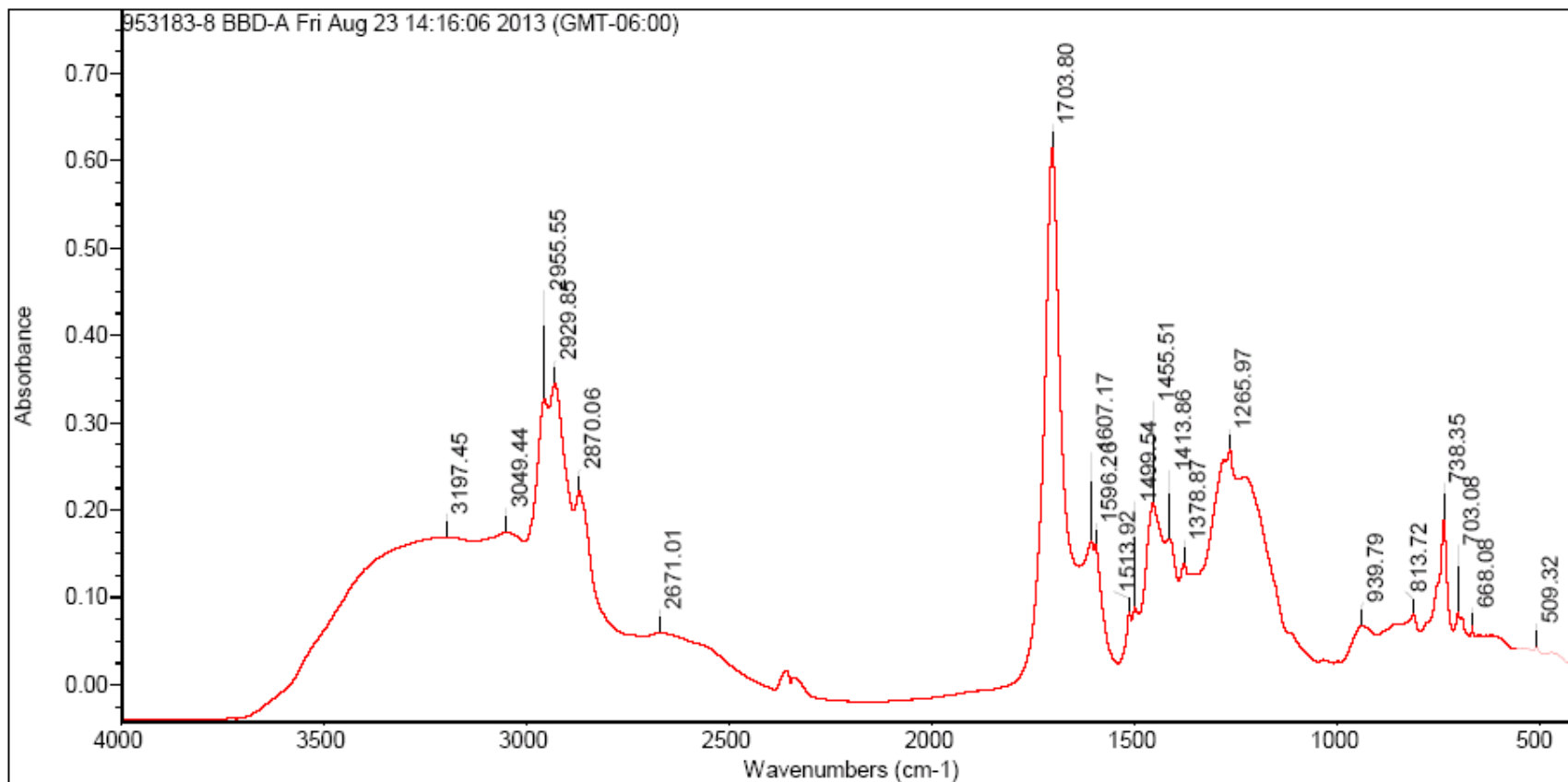
Date: Wed Feb 26 09:55:43 2014 (GMT-07:00)

Search algorithm: Correlation

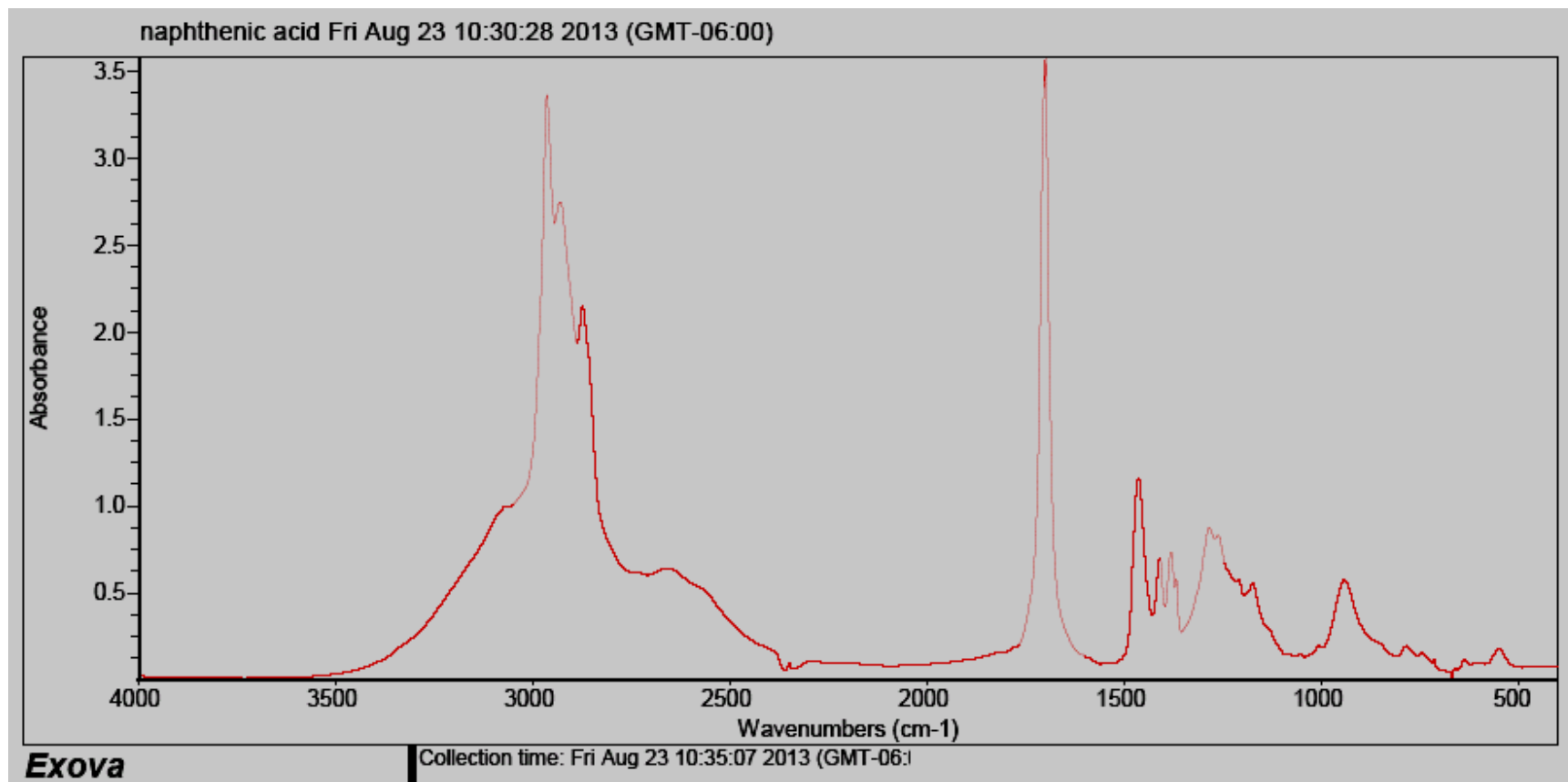
Regions searched: 3495.26-599.75



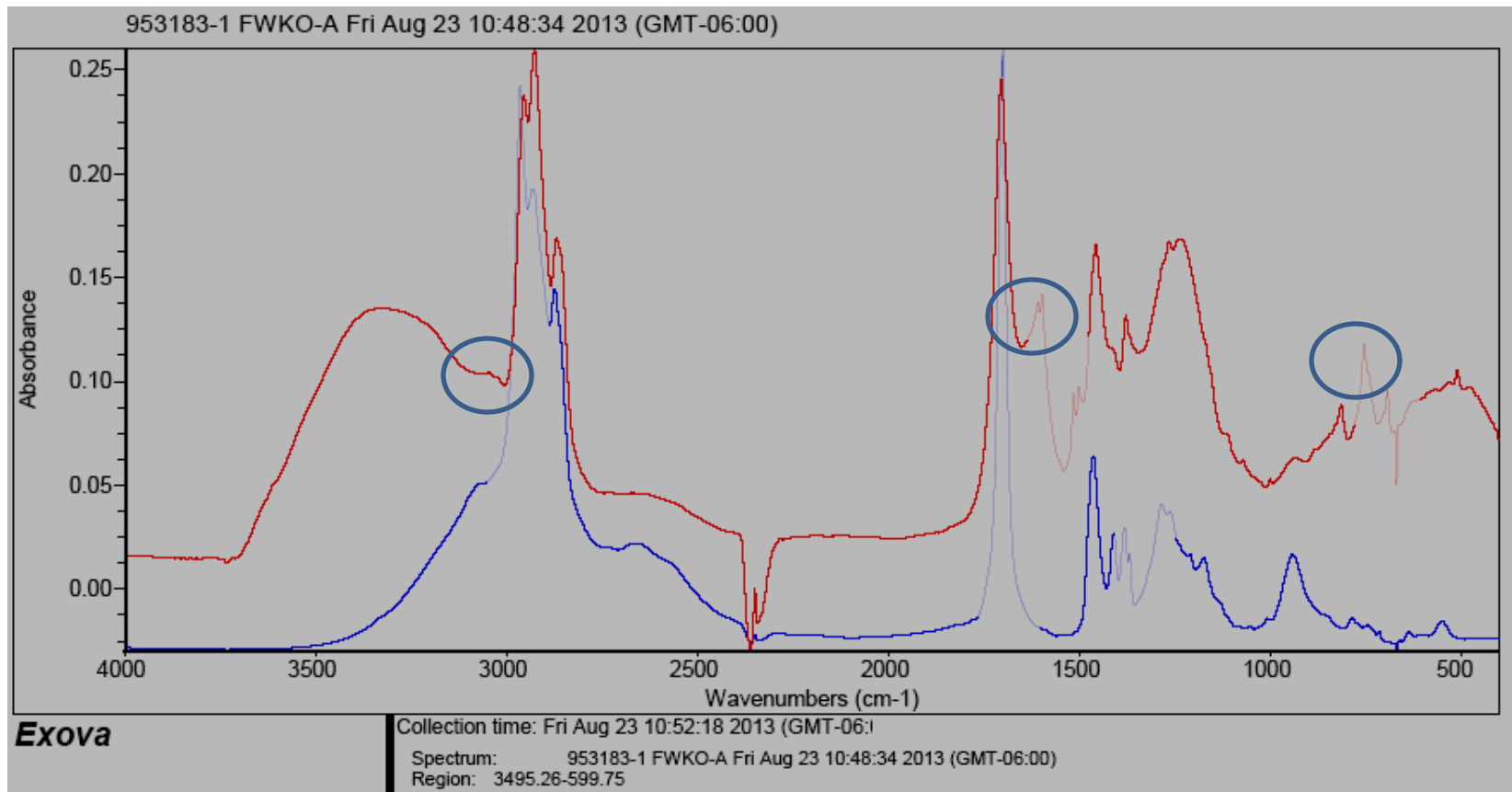
BBD acid extract



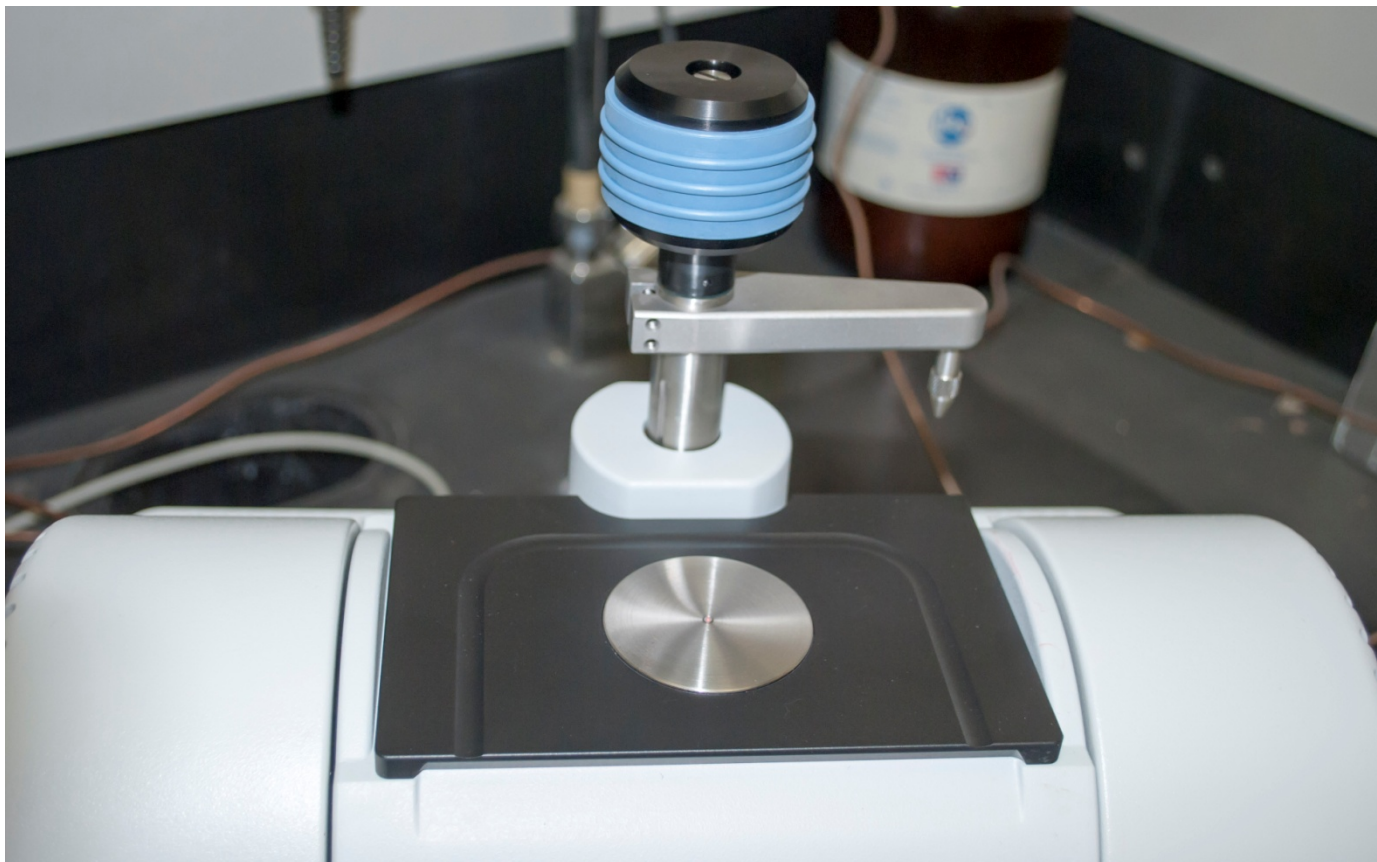
Naphthenic acid



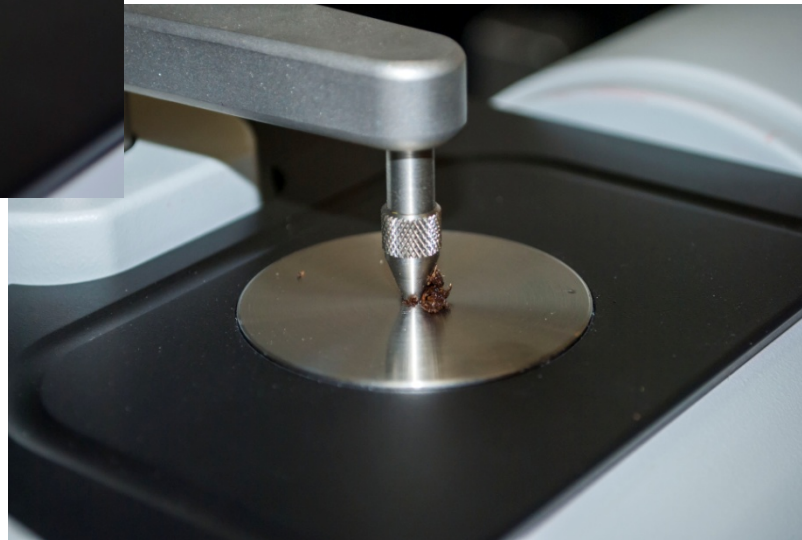
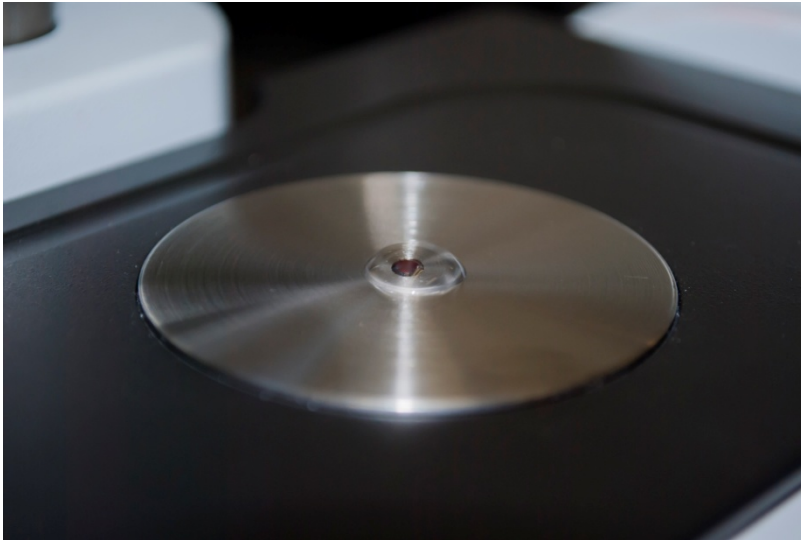
Overlay with NA



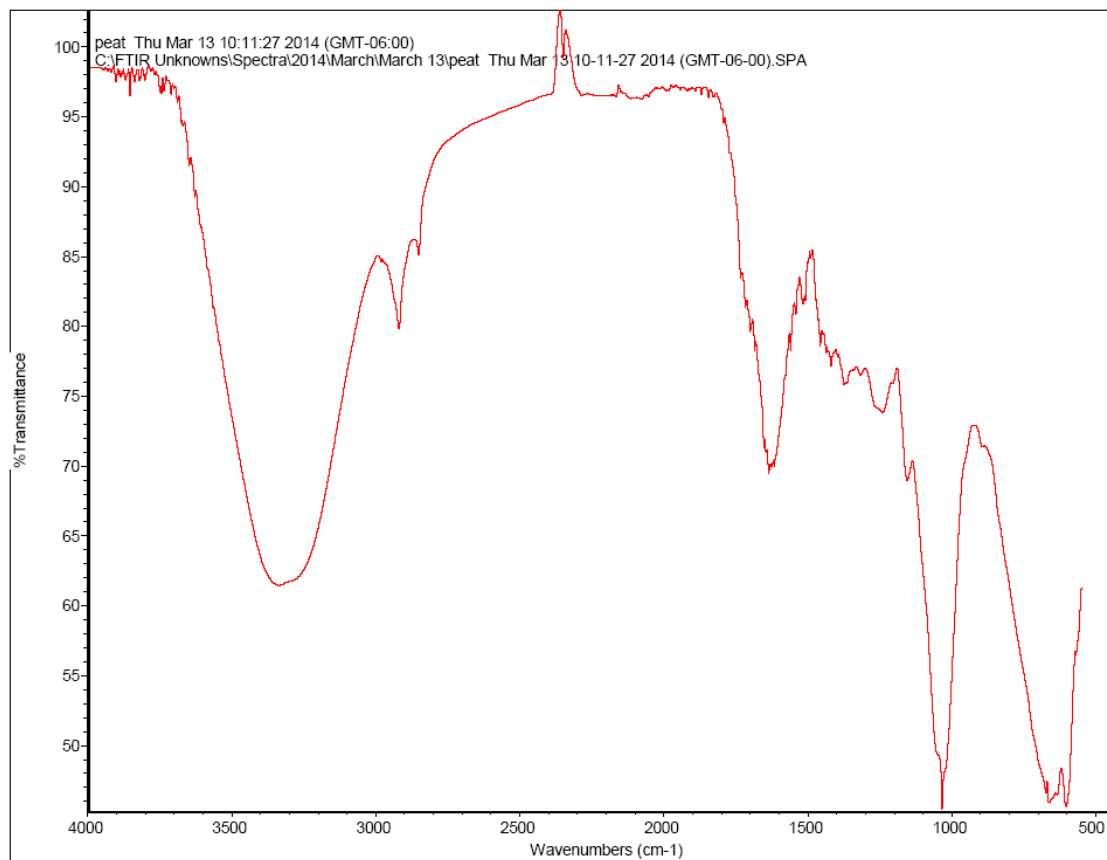
ATR attachment



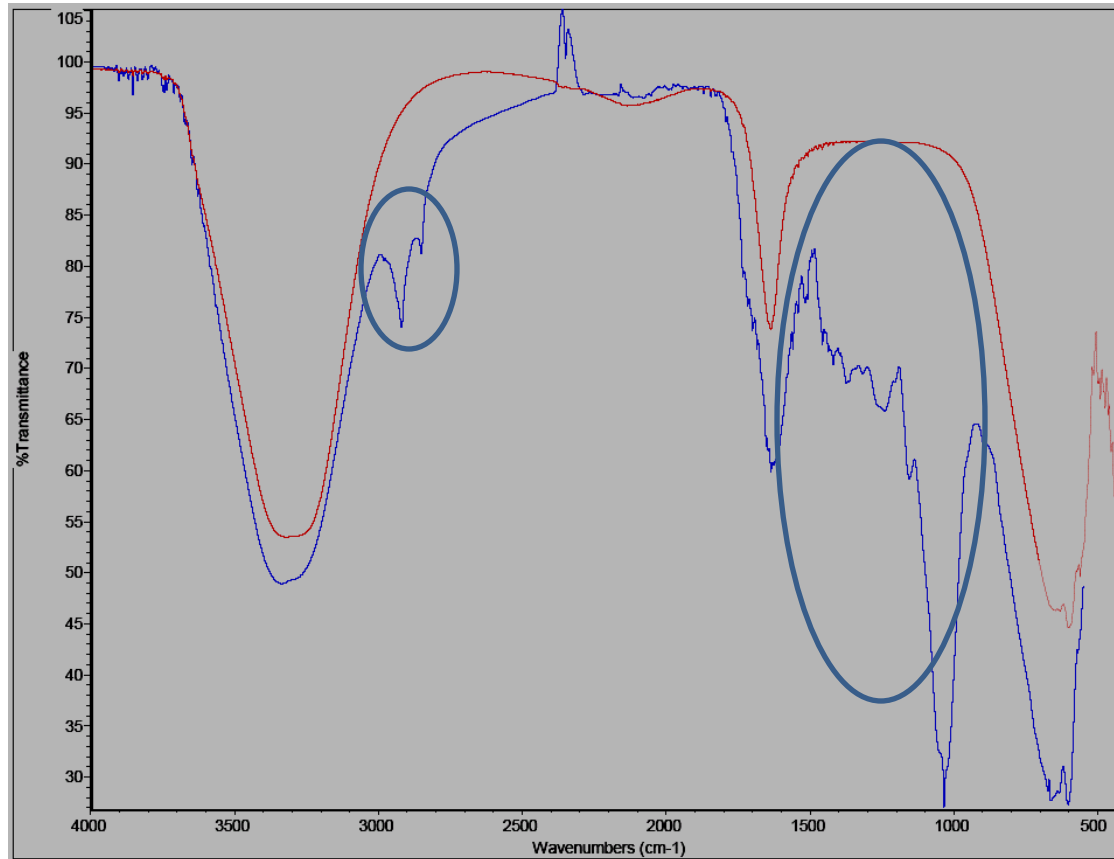
Liquids and solids



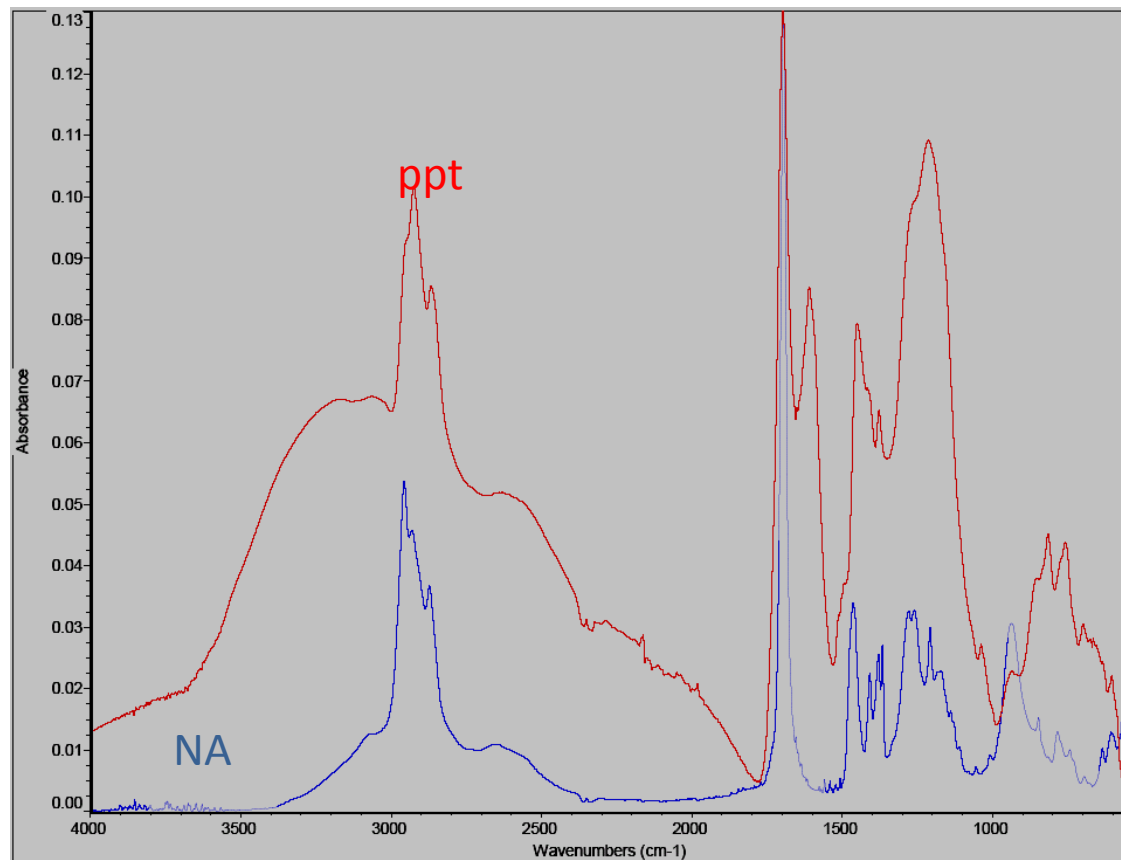
Peat



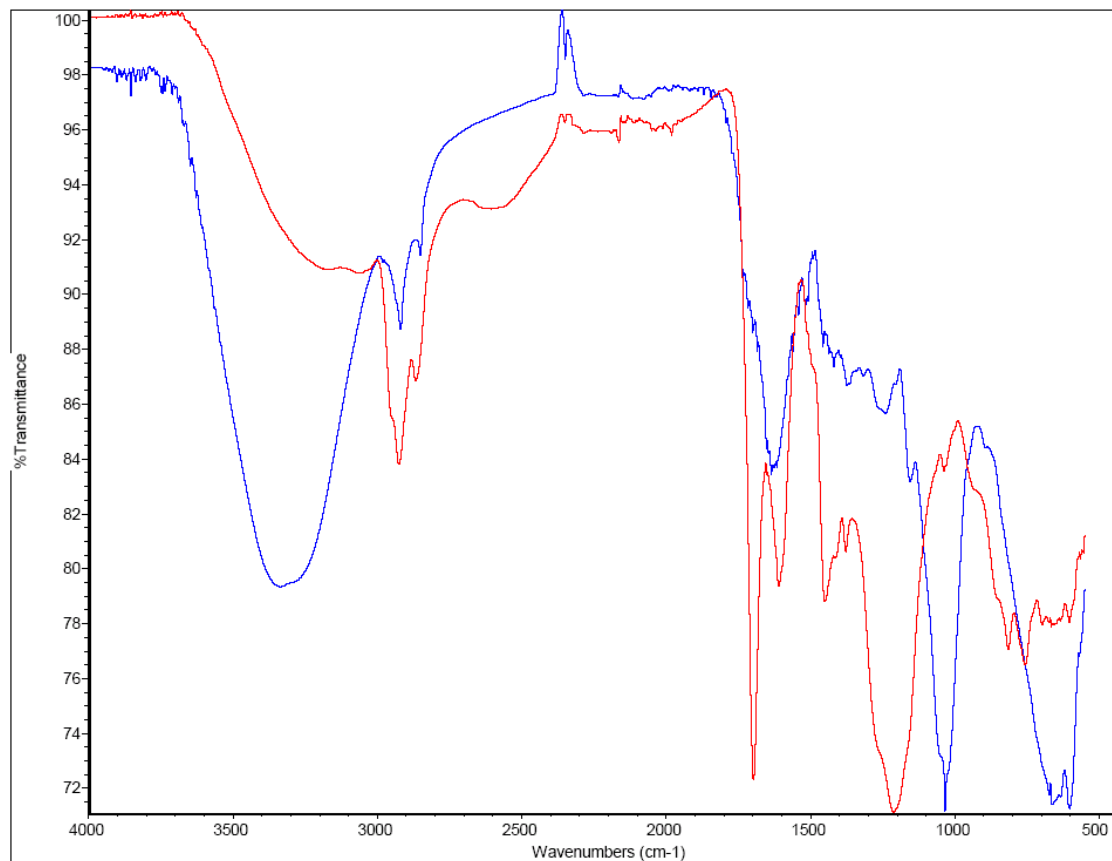
Peat and water overlay



Precipitate



Precipitate and peat overlay



BBD extract

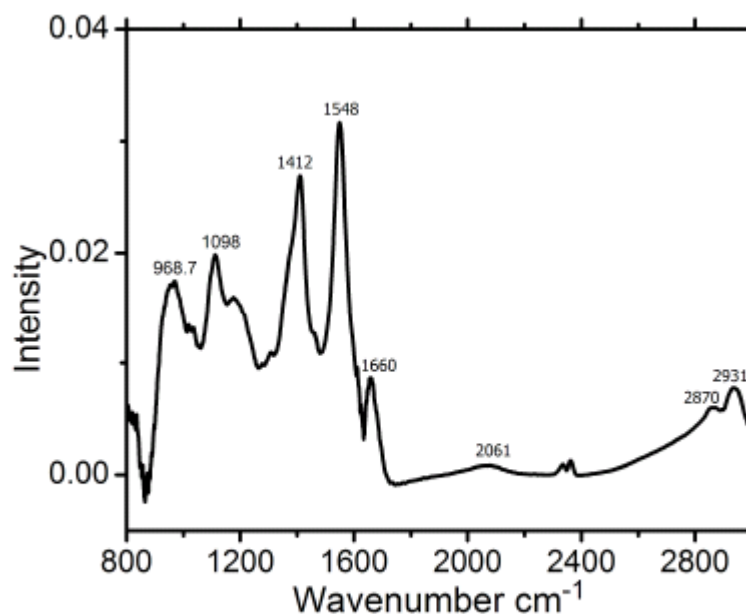
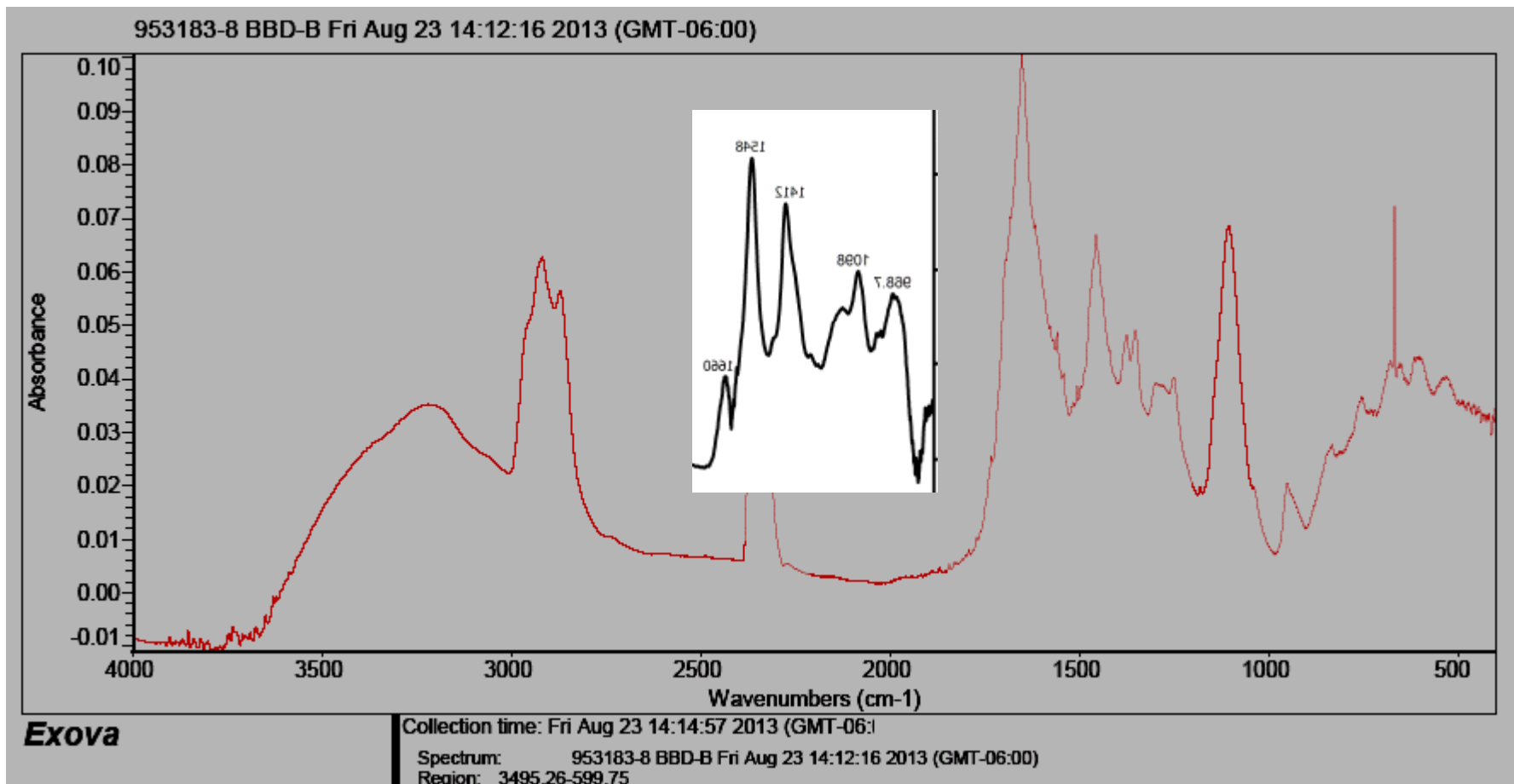


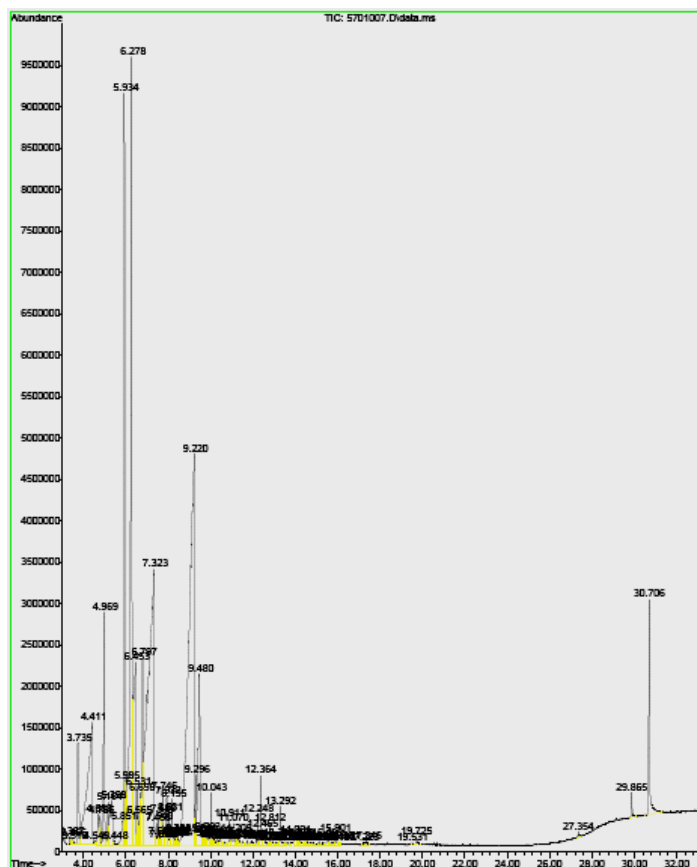
Figure 4.1 – The ATR-FTIR signatures of the DOM present in the SAGD BBD

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Fall 2012
Edmonton, Alberta

BBD B/N extract



Combination approach



Conclusion

- FTIR now common in routine labs