Mack T-10 Integrated IR

Report on Oxidation measurement

2/22/01

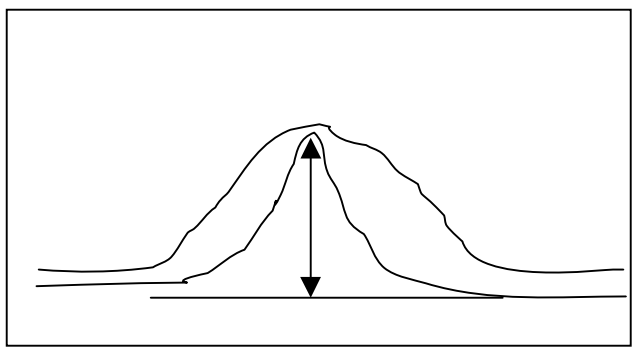
Joe Franklin

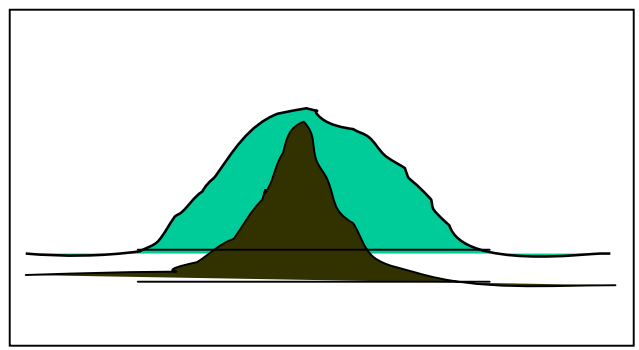
T10 Chemical Subgroup
Issues to address

- Oxidation measurement needed.
- Timing critical.
- Reproducible and valuable data from high soot samples.

Oxidation measurement needed

- Integrated area IR vs. Peak height.
  - Primary value of area - peak broadening.
    - Multiple oxidation components.



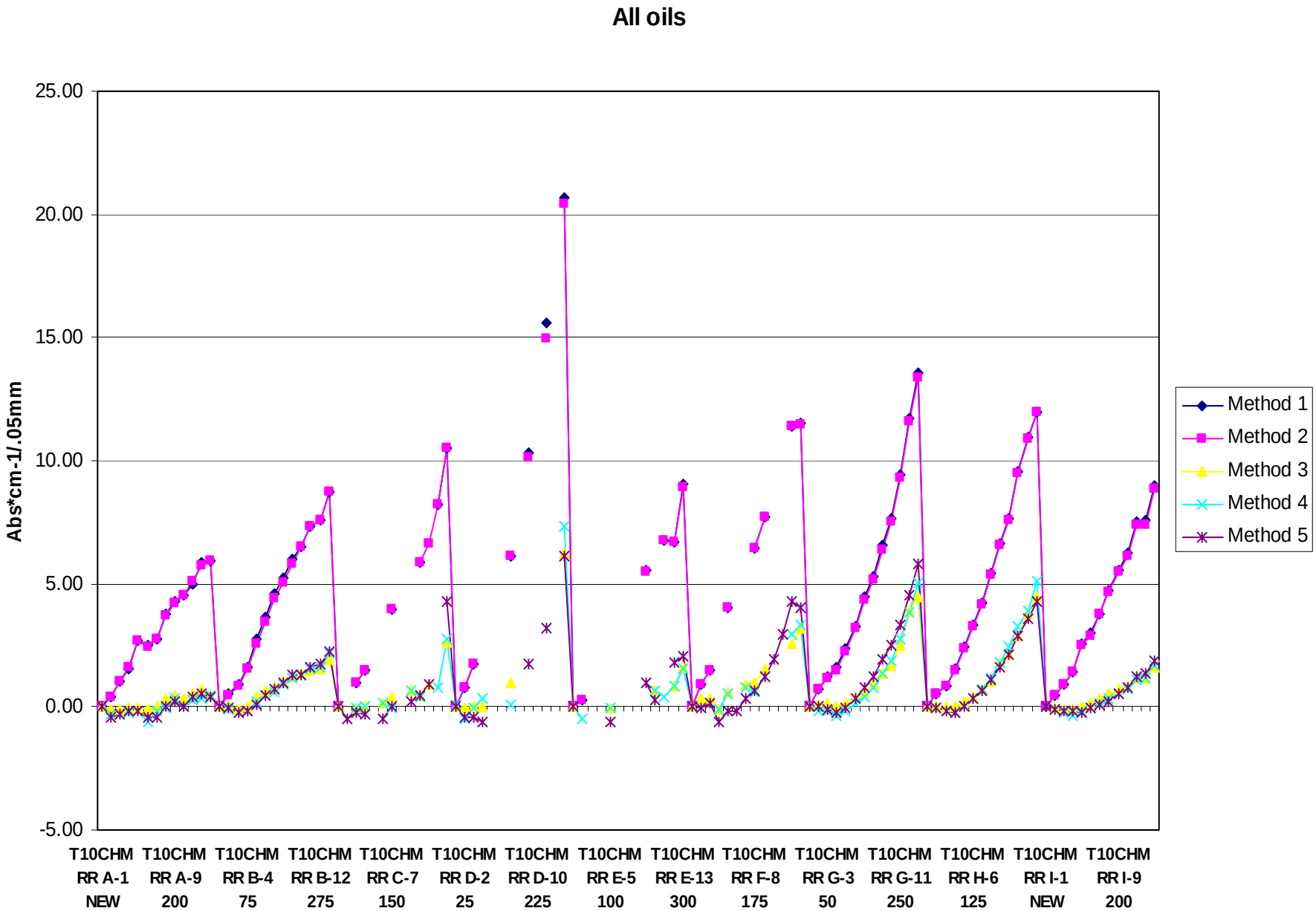


Timing critical

- Use readily available techniques.
  - Transmission cell (0.05mm BaF)
  - Standard detector
  - Dilution with fresh oil as needed to stay within linearity of detector. (measured for instrument)

Reproducible and valuable data from high soot samples

- Round Robin
  - 9 complete T10 tests including intermediates.
  - 4 suppliers
  - 1st set of data not reproducible
    - meeting to review - analysis techniques inconsistent
    - 5 proposed techniques.
  - 4 labs produced data.


All oils
Abs*cm-1/.05mm
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
T10CHM RR A-1 NEW
T10CHM RR A-9 200
T10CHM RR B-4 75
T10CHM RR B-12 275
T10CHM RR C-7 150
T10CHM RR D-2 25
T10CHM RR D-10 225
T10CHM RR E-5 100
T10CHM RR E-13 300
T10CHM RR F-8 175
T10CHM RR G-3 50
T10CHM RR G-11 250
T10CHM RR H-6 125
T10CHM RR I-1 NEW
T10CHM RR I-9 200
Method 1
Method 2
Method 3
Method 4
Method 5

T10 Chemistry Subgroup IR Round Robin

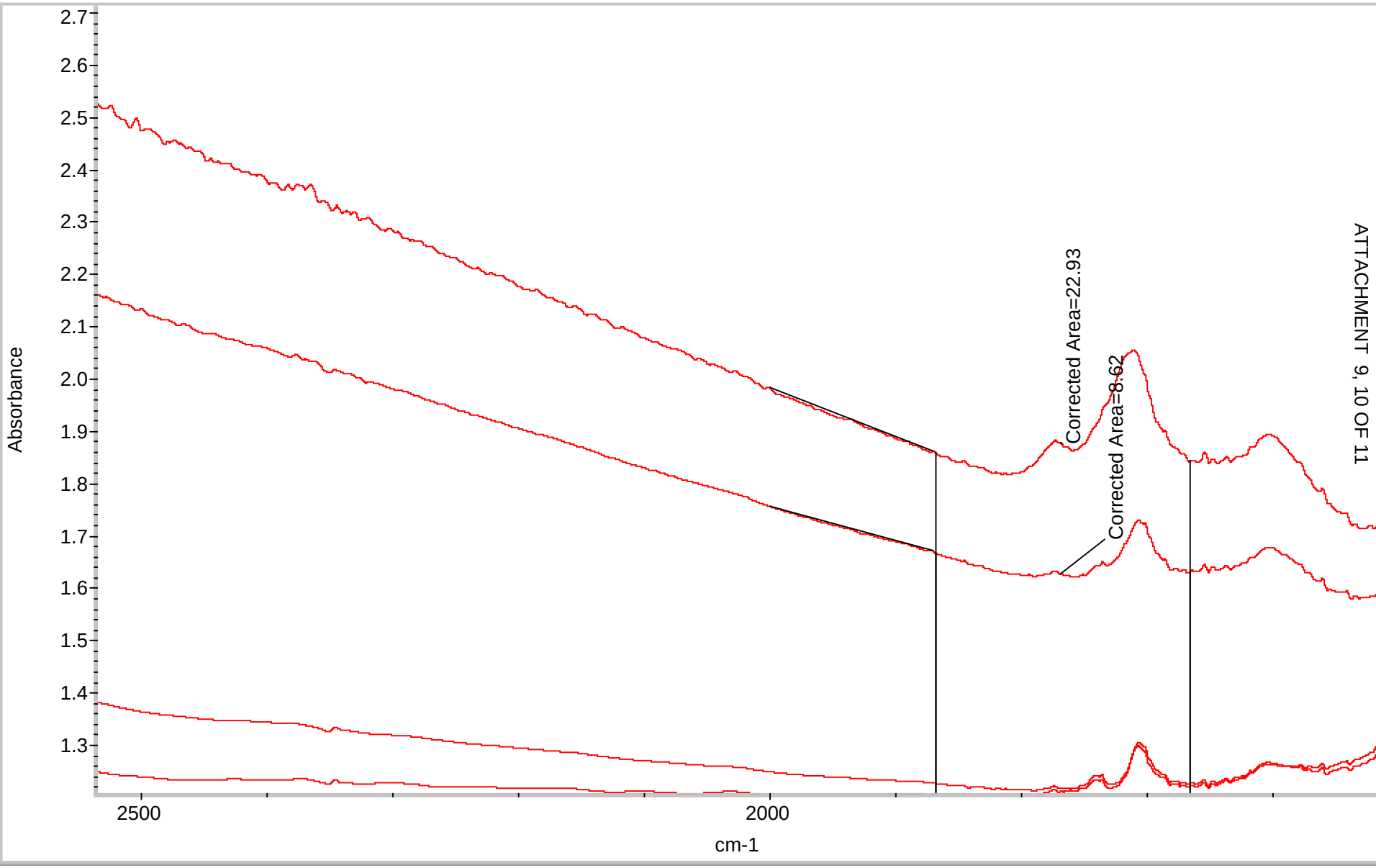
	Recalculation of Original data						
	Lab:	all					
Summary Statistics by method							
method		Method 1	Method 2	Method 3	Method 4	Method 5	
Reproducibility estimate (1 sigma)		**0.3338**	**0.3148**	**0.1866**	**0.2462**	**0.4628**	
sigma/range, %		**1.5%**	**1.4%**	**2.3%**	**2.6%**	**4.9%**	
Data range		21.91	21.91	8.26	9.63	9.46	
min		0.00	0.00	-0.63	-1.18	-1.18	
max		21.91	21.91	7.64	8.45	8.28	

	We decided to re-analyze the data in five ways:
Method 1	? Tangent Baseline correction/Fixed integration region (differential spectra)
	? Baseline calculated as a tangent to the 2000 - 1870 Region
	? Integrate between 1870 and 1665
	? Subtract spectra before calculations
Method 2	? Tangent Baseline correction/Fixed integration region (original spectra)
	? Baseline calculated as a tangent to the 2000 - 1870 Region
	? Integrate between 1870 and 1665
	? Calculations done on original spectra then subtract the integrals
Method 3	? Two Point baseline correction using a minimum (differential spectra)
	? Calculate baseline from point at 1665 and the minimum between 1750 and 1870
	? Integrate between the two baseline points
	? Subtract spectra before calculations
Method 4	? Two Point baseline correction using a minimum (Original spectra)
	? Calculate baseline from point at 1665 and the minimum between 1750 and 1870
	? Integrate between the two baseline points
	? Calculations done on original spectra then subtract the integrals
Method 5	? Two Point baseline correction using fixed points (Differential spectra)
	? Calculate baseline from point at 1665 and 1800
	? Integrate between the two baseline points
	? Subtract spectra before calculations

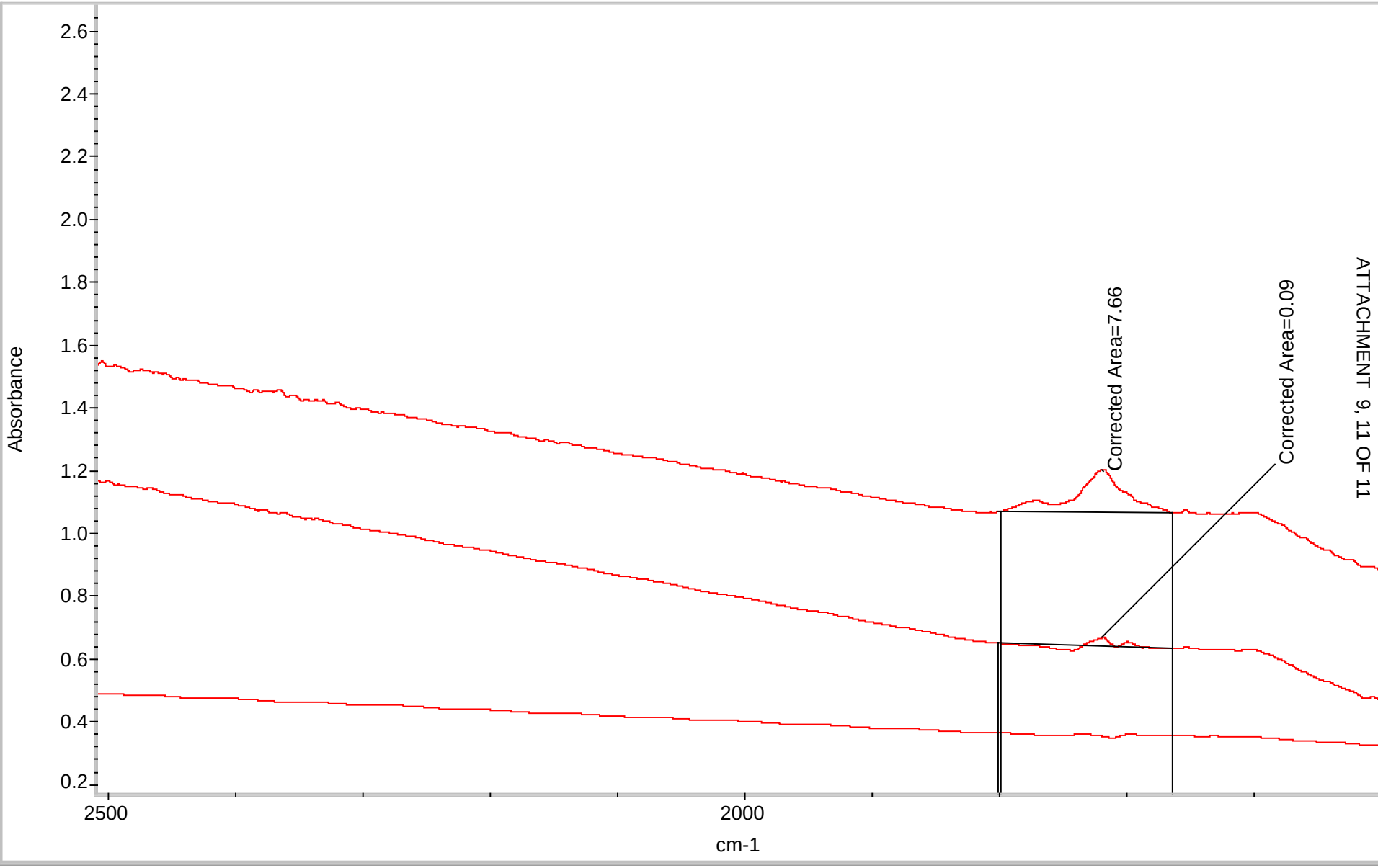
Method selection

- Method 2 and 5 will be run for the matrix.
- Method 2 best reproducibility.
- Method 5 ease of implementation.
- All methods discriminate appropriately based on expected oil performance.

Method 2


Absorbance
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
2500
2000
cm-1
Corrected Area=22.93
Corrected Area=8.62
ATTACHMENT 9, 10 OF 11

Method 5


Absorbance
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
2500
2000
cm-1
Corrected Area=7.66
Corrected Area=0.09
ATTACHMENT 9, 11 OF 11