



Asphaltene Stability by Solubility Profile Analysis

Estrella Rogel, Cesar Ovalles and Michael Moir

February 24th , 2010

San Antonio, TX



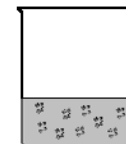
Content

- Introduction
- What is Solubility Profile?
- Examples of measurements: virgin and processed materials
- Correlation of Solubility Profile with P-value
- Conclusions

Flocculation Onset Titration of Asphaltenes

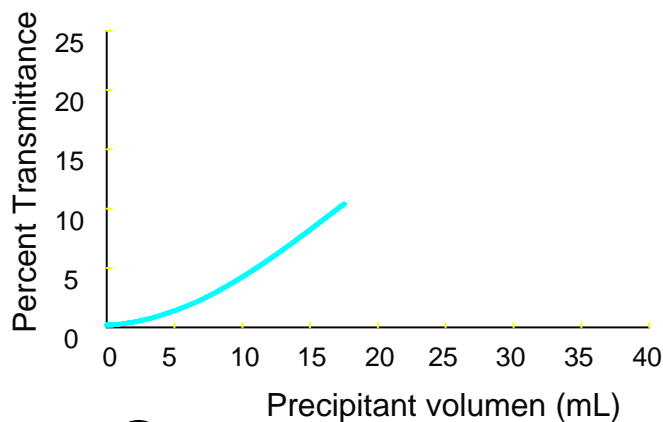
1

Preparation of several solutions of the material



2

Titration of the solutions using a precipitant agent

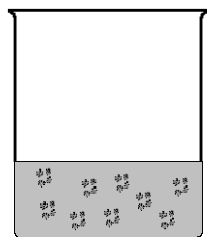
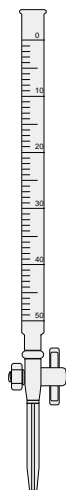
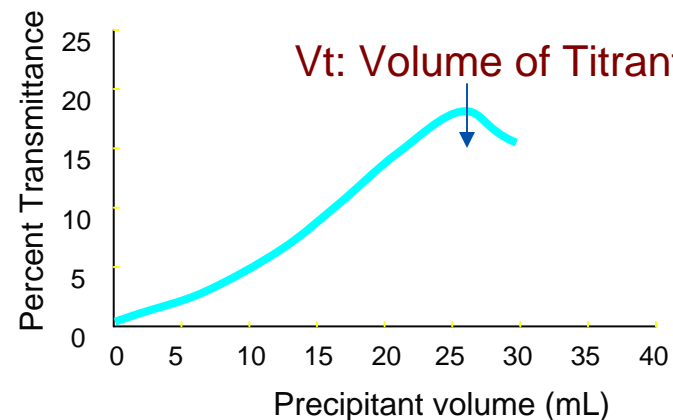


3

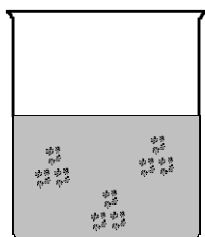
Titration ends

Flocculation Onset

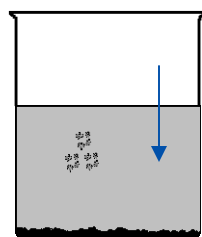
Vt: Volume of Titrant



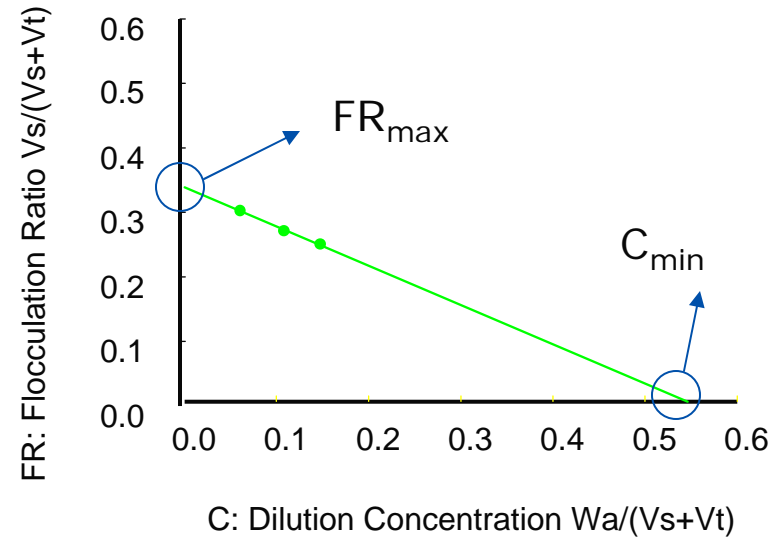
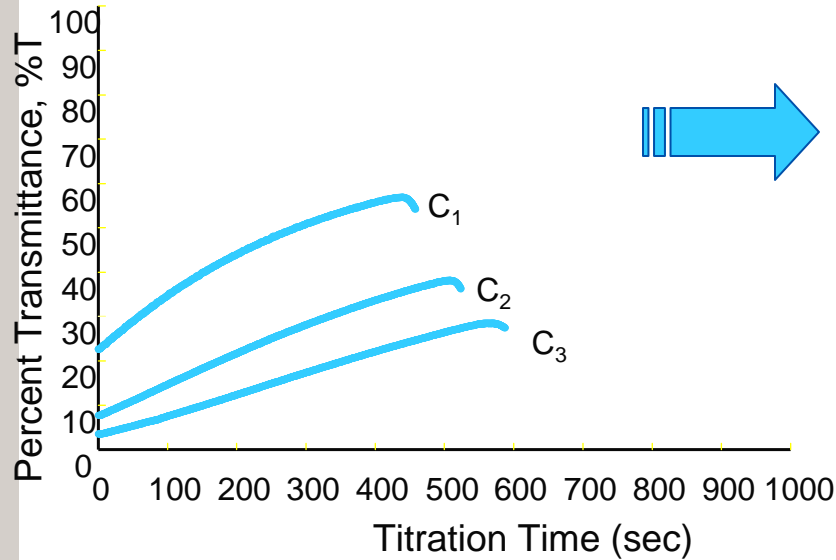
2



3



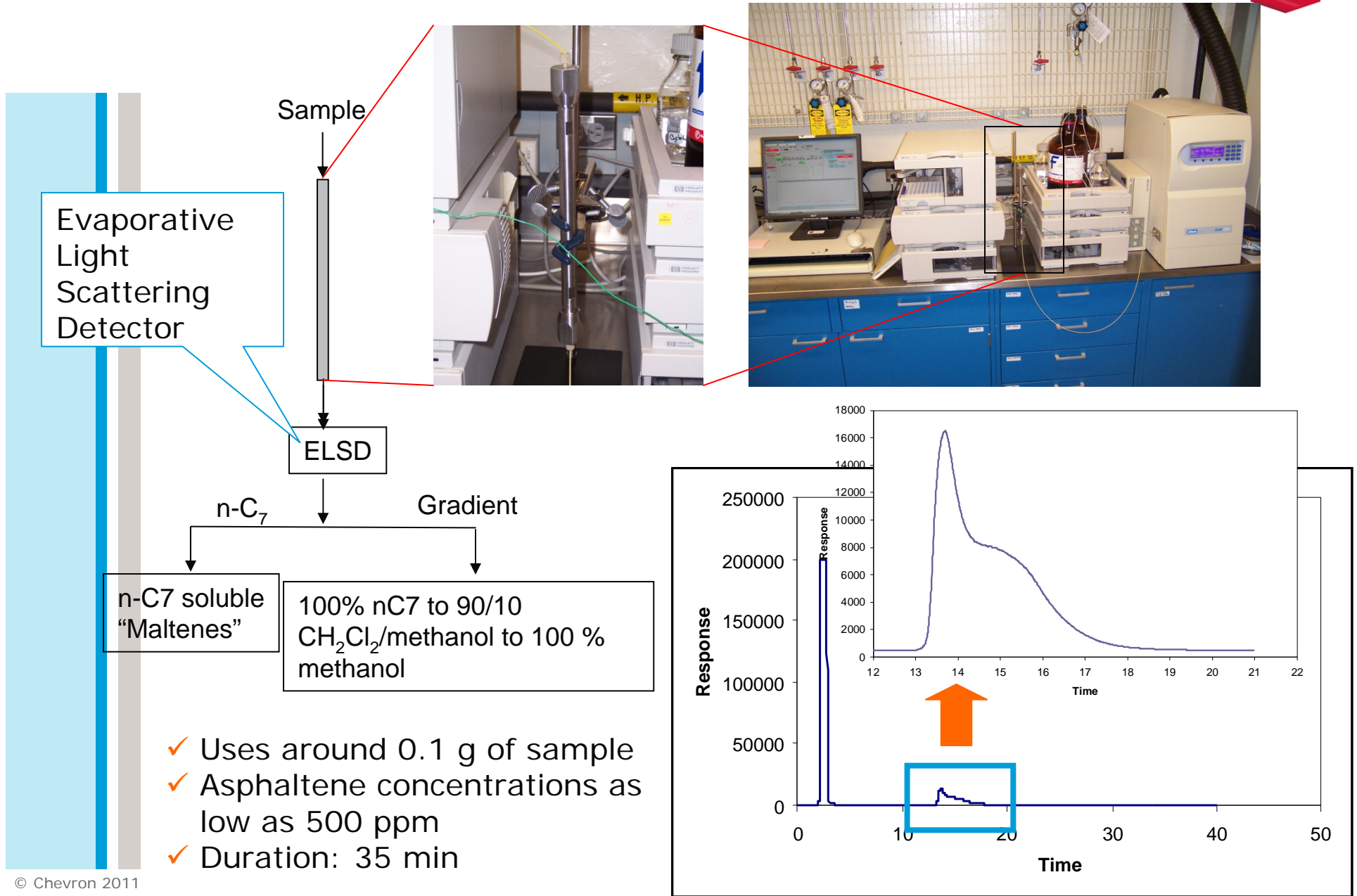
Flocculation Onset Titration of Asphaltenes



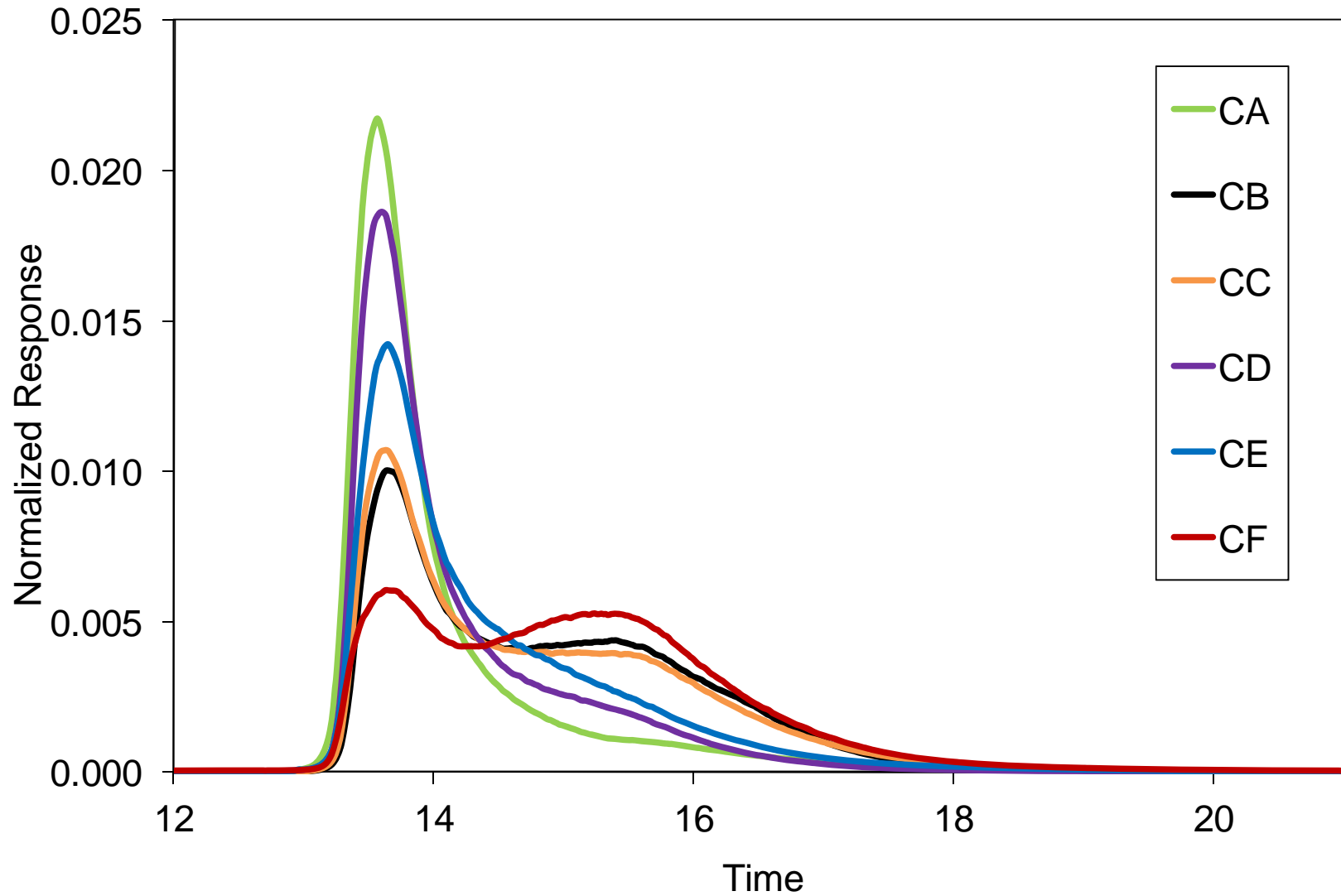
Heithaus compatibility Parameters

- Asphaltene peptizability $p_a = 1 - FR_{max}$
- Peptizing power of the maltenes $p_o = FR_{max} [(1/C_{min}) + 1]$
- Overall compatibility of the system $P = p_o / (1 - p_a)$

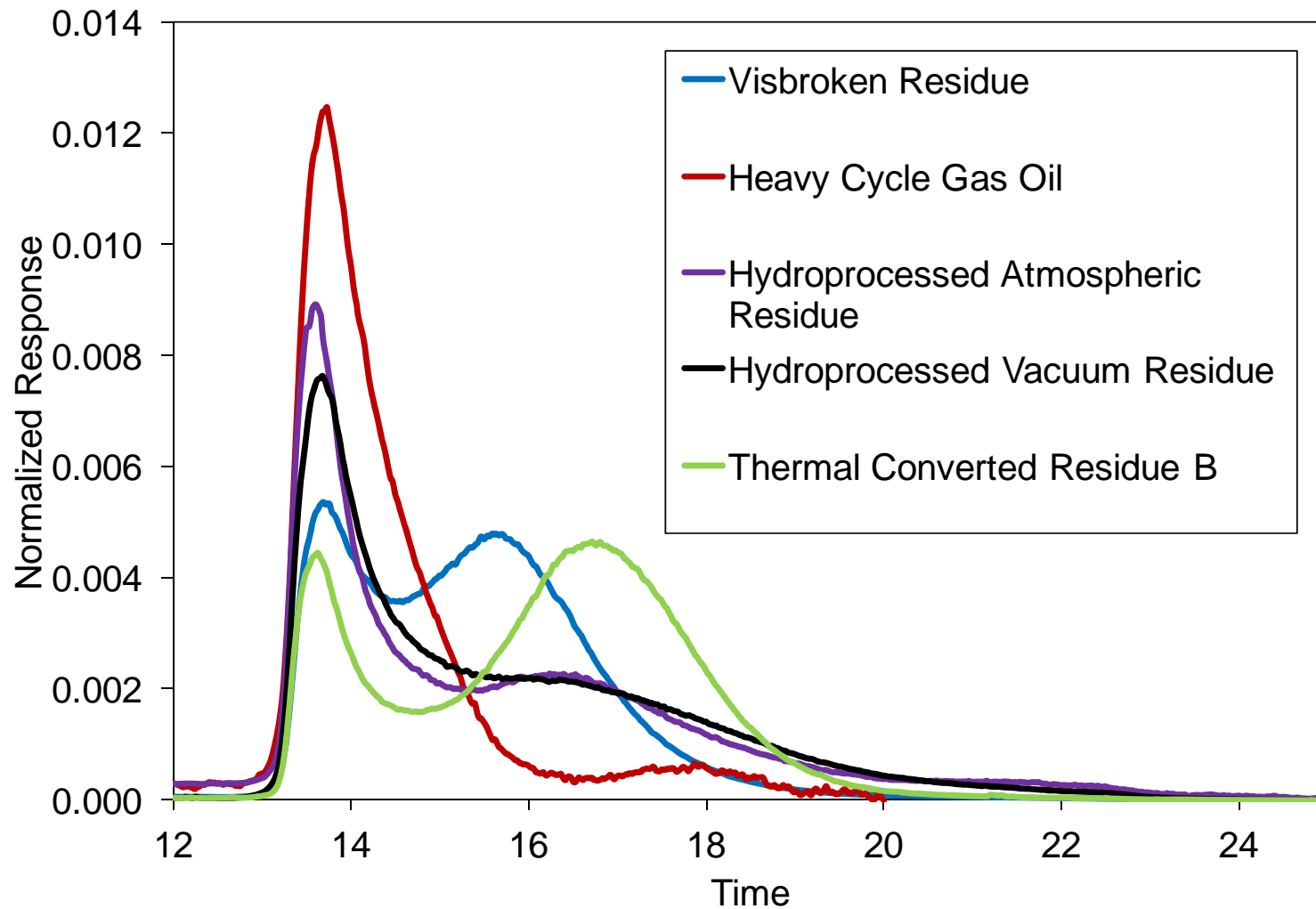
Asphaltenes Solubility Profile



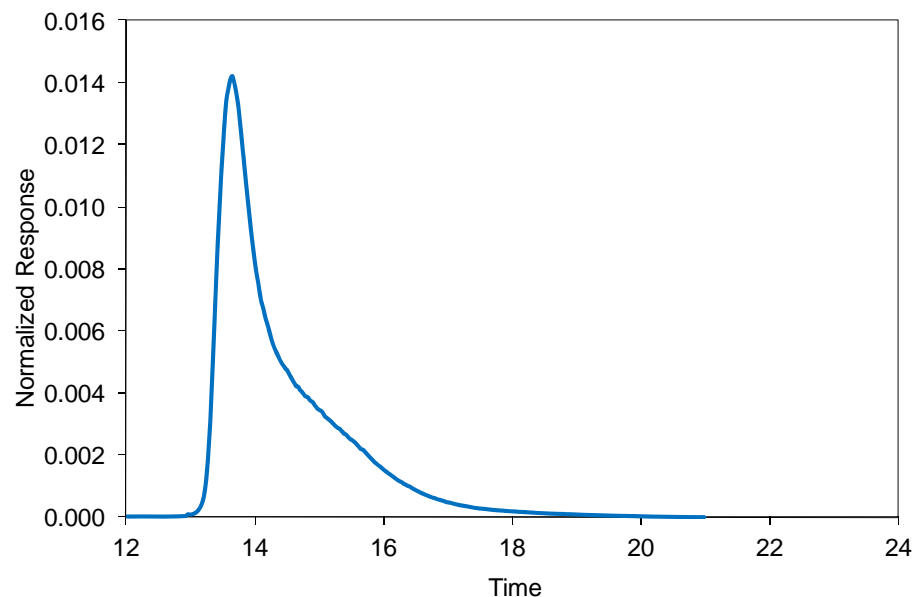
Comparison of Asphaltene Solubility Profile: Virgin Materials



Comparison of Asphaltene Solubility Profile: Processed Materials



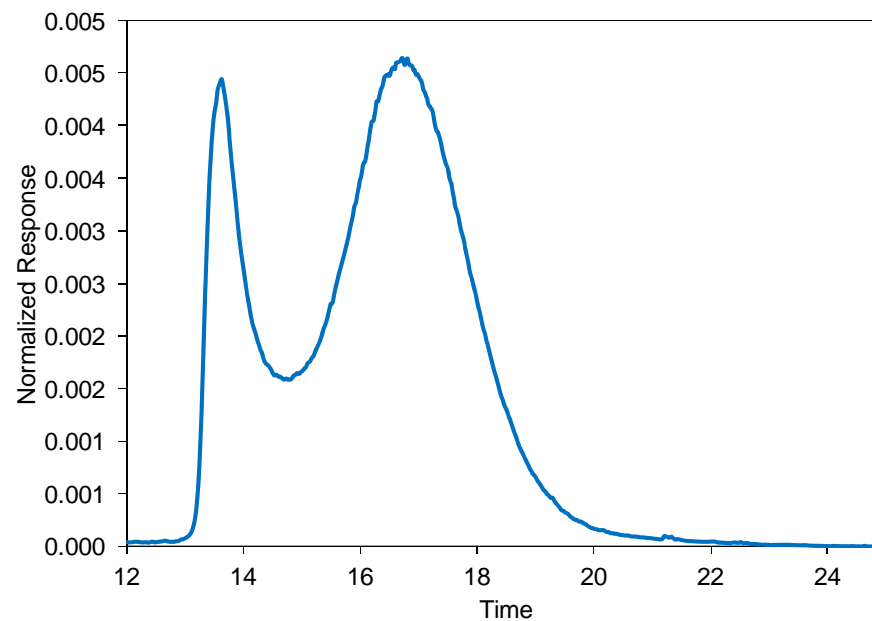
Stable and Unstable Samples



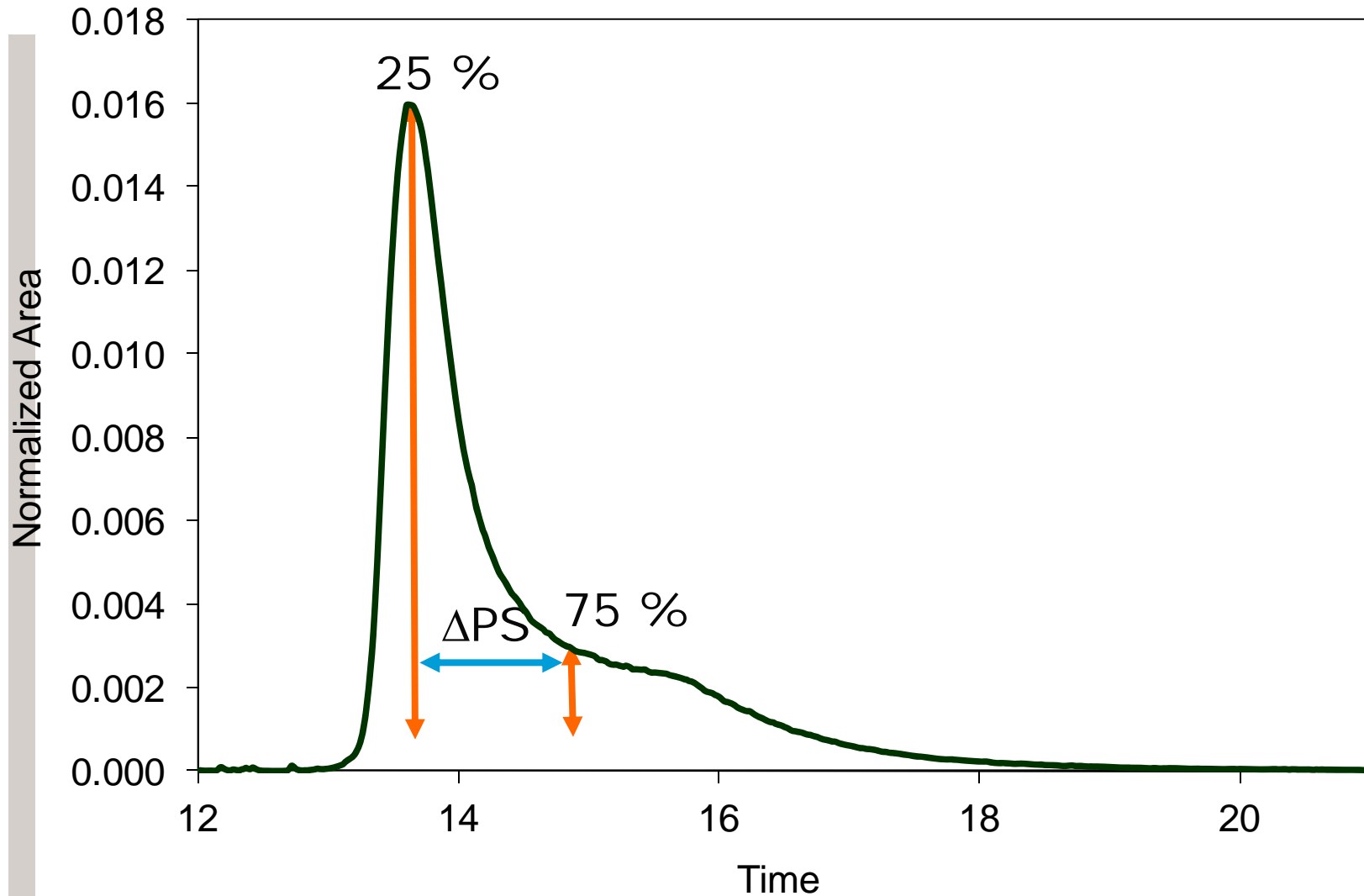
✓ **GOOD:** Stable Samples

X Bad: Unstable Samples

Fouling Problems
High sediment content

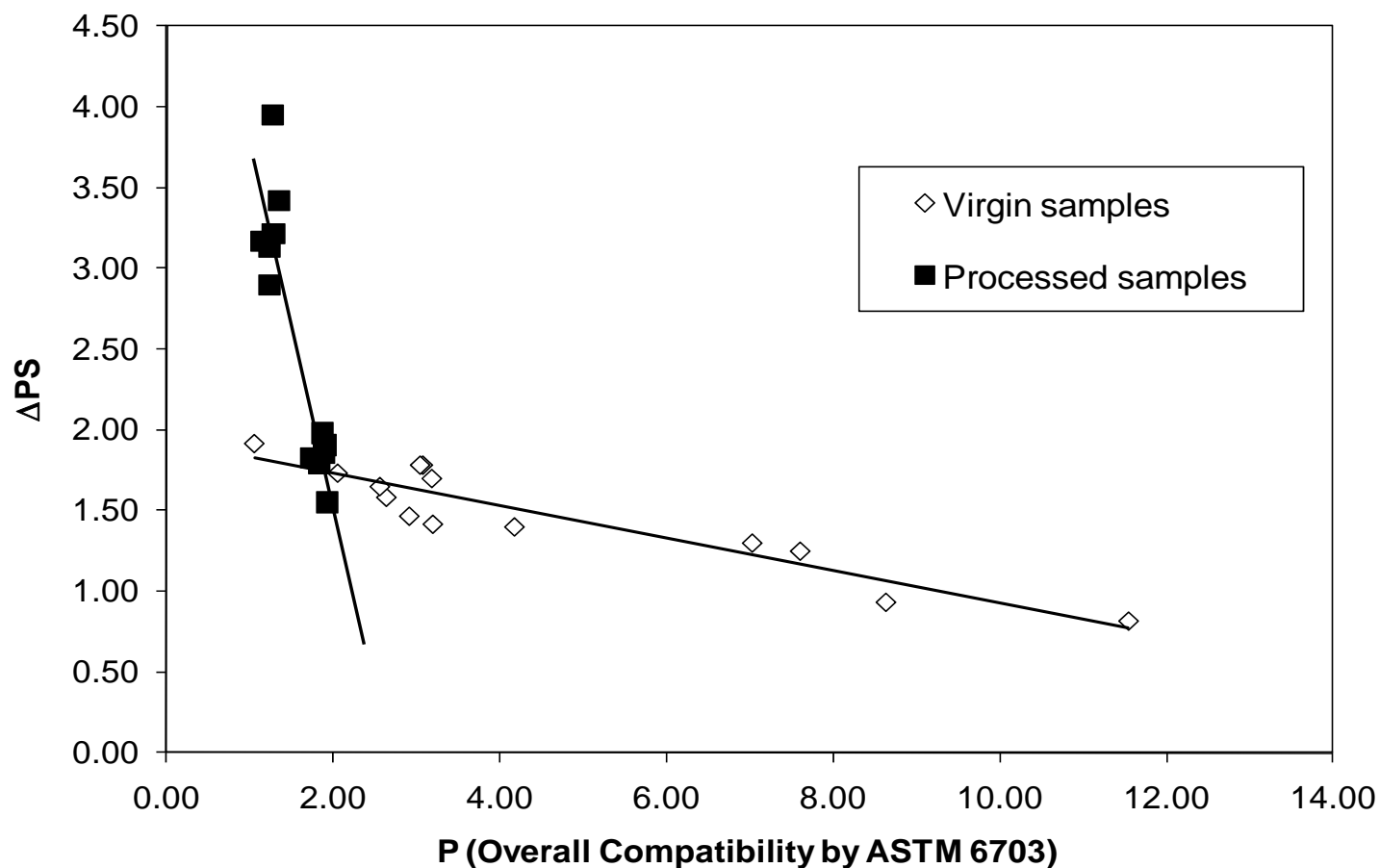


Stability & Solubility Profile of Asphaltenes: Stability Criterion



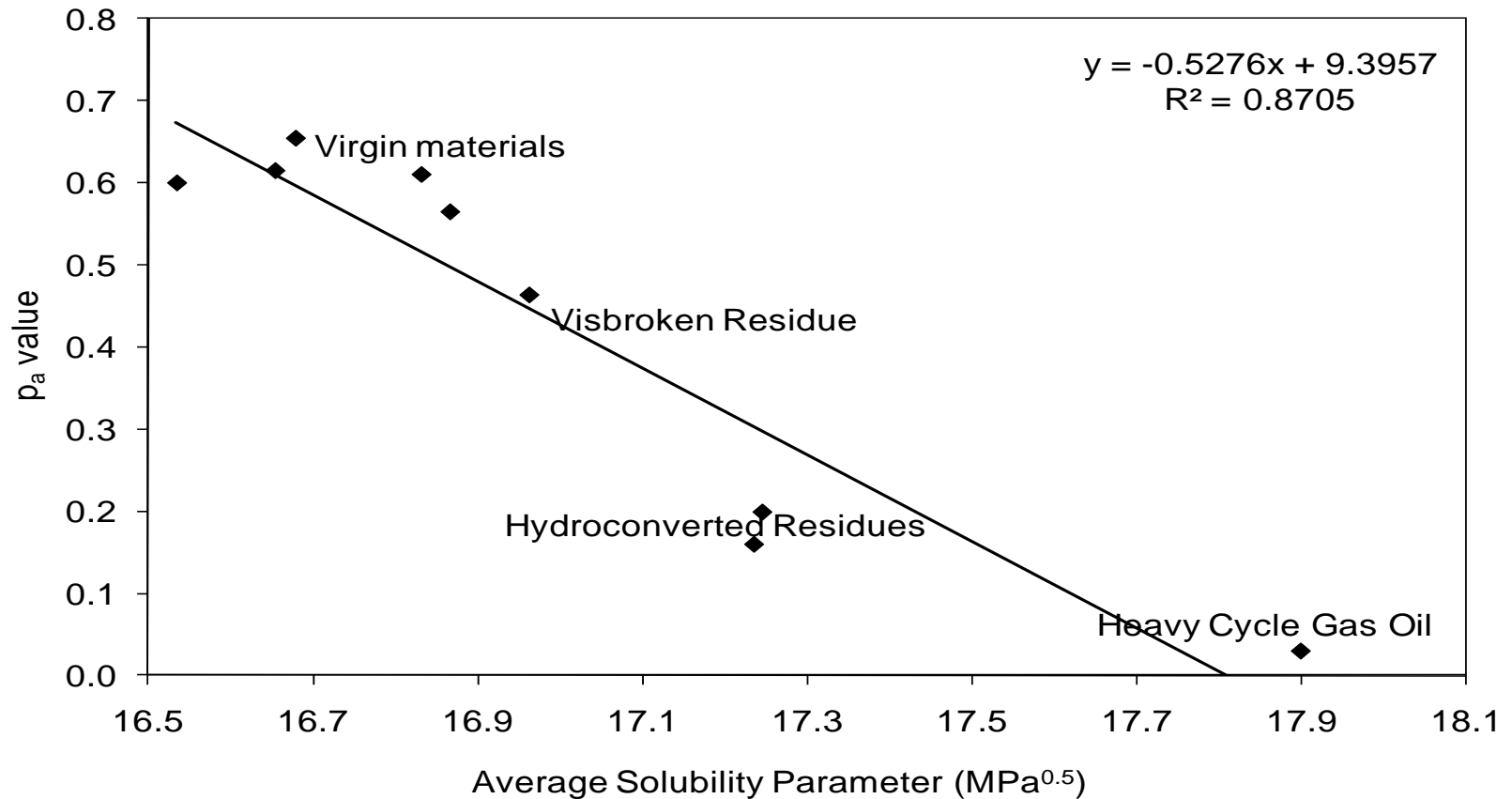


Comparison of Asphaltene Solubility Profile with Heithaus Parameters: P-Value and ΔPS



ΔPS for a) virgin crude oils and b) processed samples measured by the asphaltene Solubility Profile method and the overall compatibility P measured by ASTM D6703.

Comparison of Asphaltene Solubility Profile with Heithaus Parameters: Pa Value and Solubility Parameter



p_a value determined by ASTM D6703 as a function of the average solubility parameter of extracted asphaltenes determined by Solubility Profile method.



Concluding Remarks

- The method uses a small amount of sample, it takes 35 min to perform and it can work for asphaltene concentrations as low as 500 ppm.
- Different patterns for asphaltene solubility profiles were found depending on the origin and processing history of the samples.
- Two characteristic parameters of the solubility profile distribution: SPA (solubility parameter average) and ΔPS (distribution wide) can be obtained and correlated to the asphaltene stability of the samples.
- This method seems promising for the determination of stability of virgin and processed materials and therefore, it can be an alternative to replace conventional titration techniques in the future.
- Currently being evaluated *vis-a-vis* other conventional methods in the Heavy Oil Compatibility Project carried out by CCQTA