Marathon Petroleum Company LP

Non-Traditional Refinery Preheat Fouling

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CCQTA/COQA Joint Meeting

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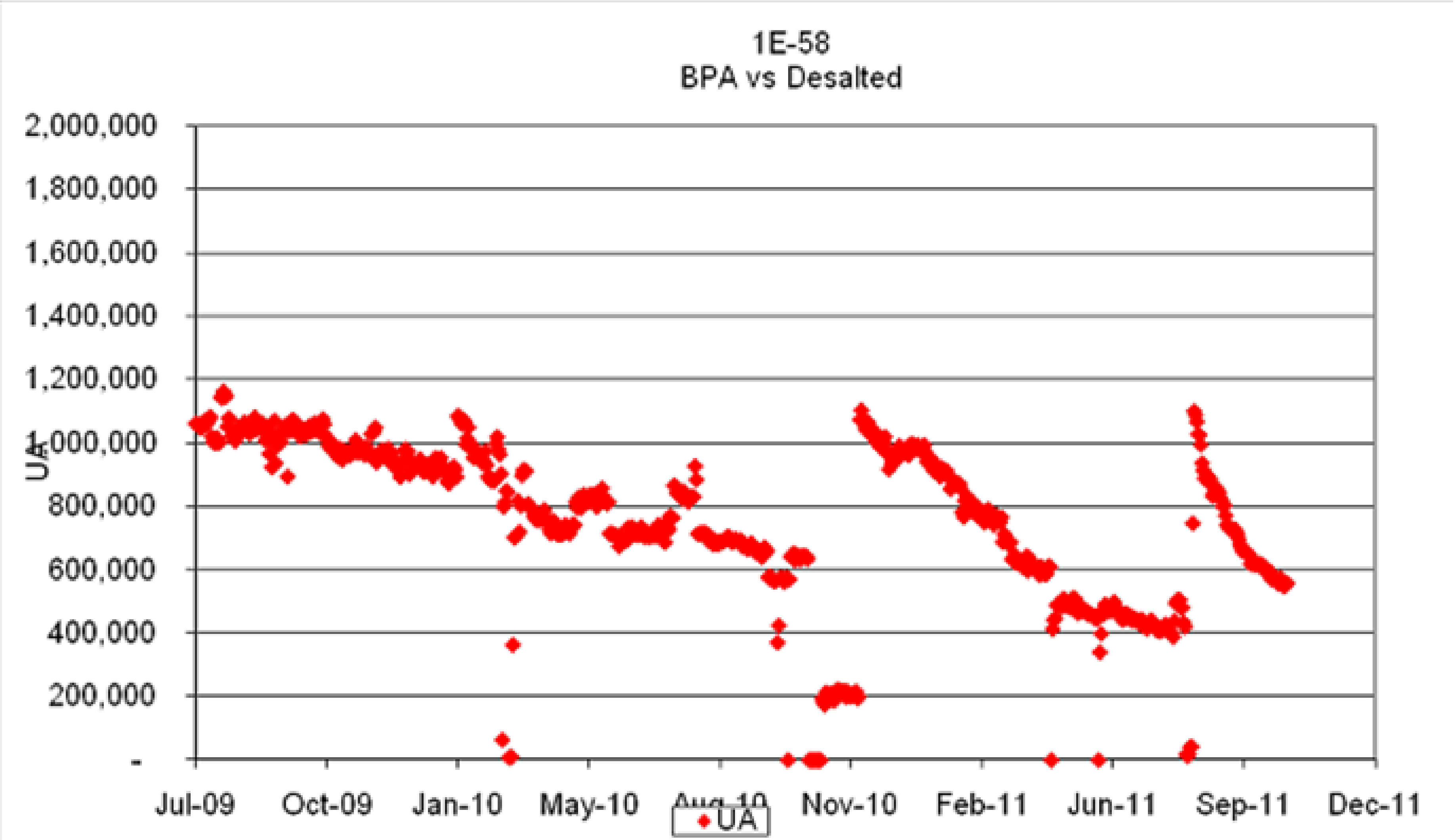
Timeline

- Light sweet crude refinery, historically no heavy sour injection
- 12/2010 - Started <10% Canadian crude (WCS/CLK) injection.
- Quickly recognized decrease in heat transfer in critical heat exchanger, final desalted crude.
- Cleaning cycle decreased 10X, from 24 months to 2.5
- Troubleshooting begins…

Initial Indication of Increased Fouling



Timeline - cont.

- Material was believed to be asphaltenes, had coked in tubes.
- Observed increased rag draw on desalters, not alarming.
- Pursued treatment options
  - Anti-foulant / asphaltene stabilizer injection downstream of desalter.
  - Injected stabilizer into heavy Canadian receipt at pipeline pumping station prior to blending with WTI for viscosity reduction.

CCQTA Heavy Oil Compatibility (HOC)

- WTI and CLK included in sample set to evaluate stability test methods.
- Many methods showed same results, HOC discontinued pursuing a common method.
- HOC attempted to determine a correlation between compatibility and fouling.
- Traditional belief that fouling rate is related to asphaltene content, or stabilization of the asphaltene.

CCQTA Heavy Oil Compatibility (cont.)

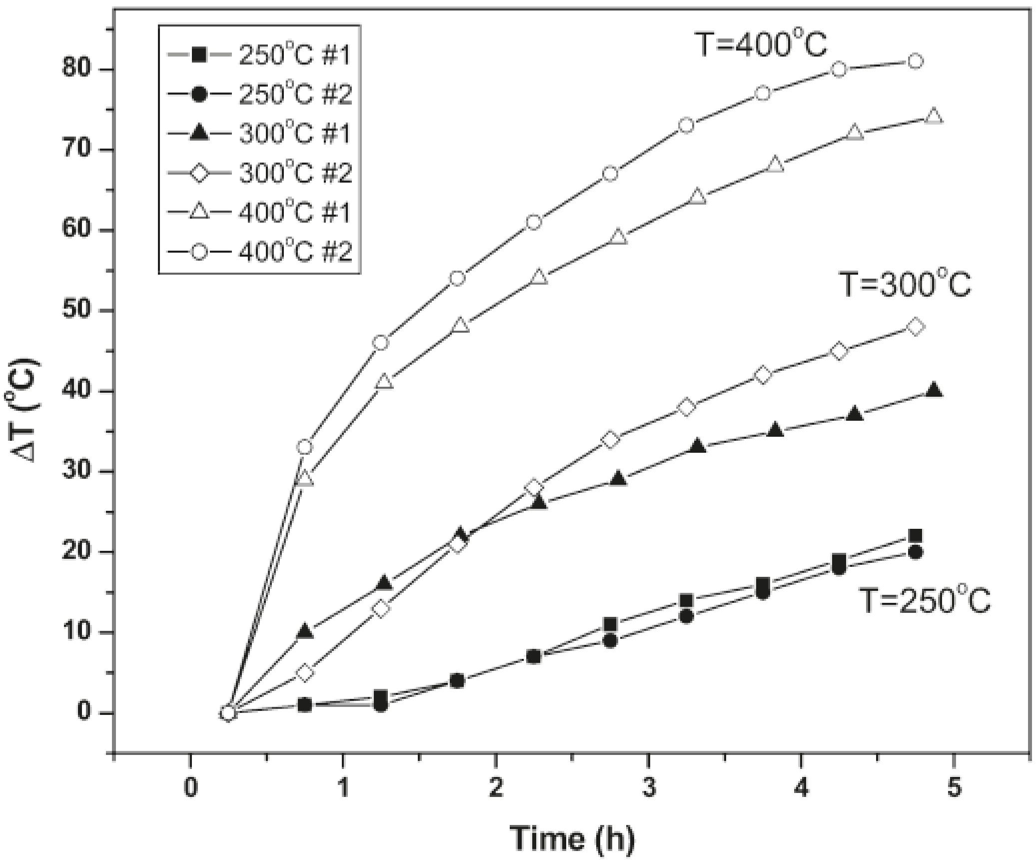
- WTI and CLK tested individually on Alcor HLPS for baseline fouling rate.
- Found WTI fouled worse than CLK, blend tests halted.
- HOC concluded that compatibility methods could not be used to predict fouling.

Confusion/Contradiction

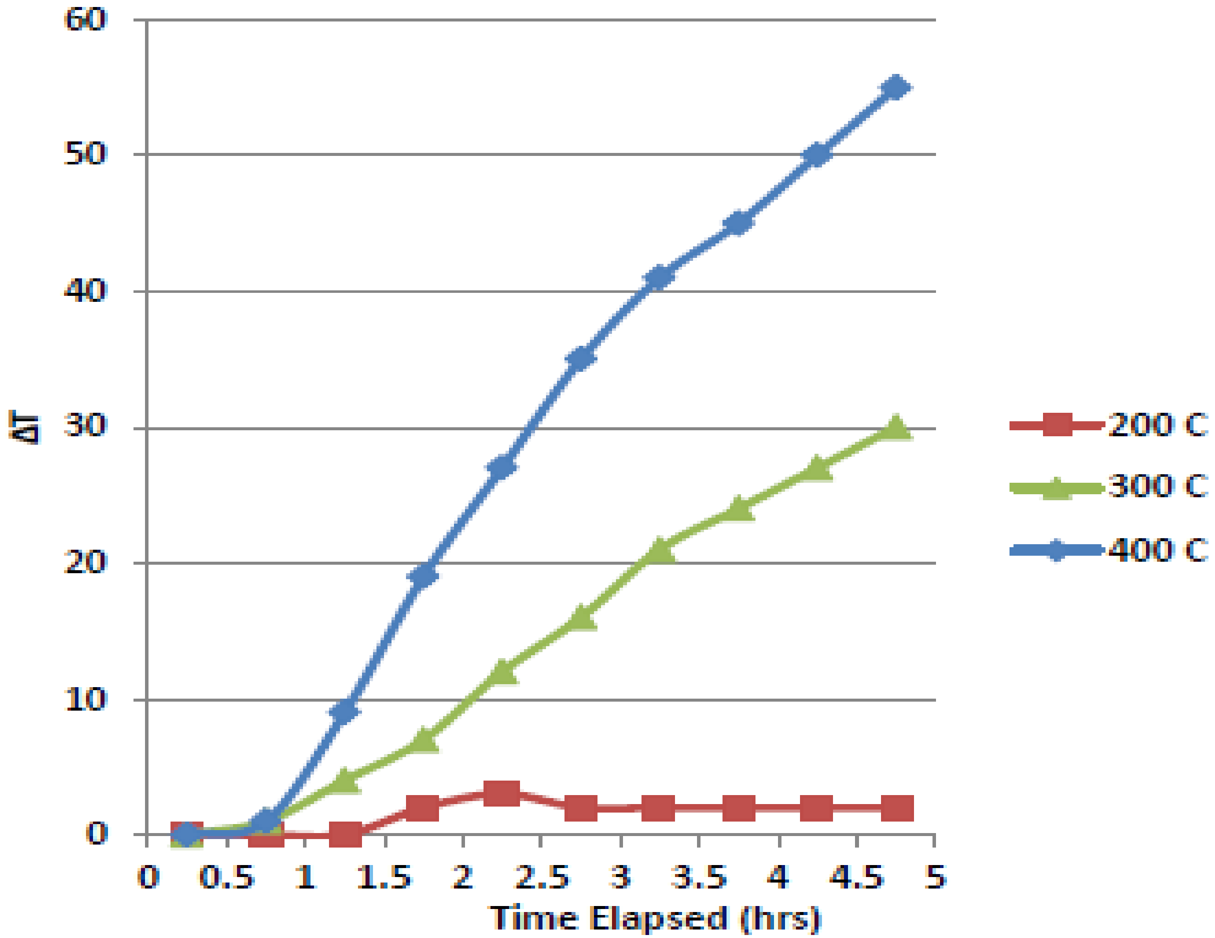
- Conventional fouling should continue to worsen through the preheat circuit as temperature is increased.
  - No fouling observed in preflash crude exchange or heater.
  - All other crude heaters foul to some degree.
- Fouling rate is related to % asphaltene.
  - Alcor fouling of other refinery slates inversely proportional to asphaltene content: 0.6> 1.1>3.4%
  - Confident all asphaltenes are destabilized in 1.1% slate.

Fouling of Light Sweet Crude - 2010

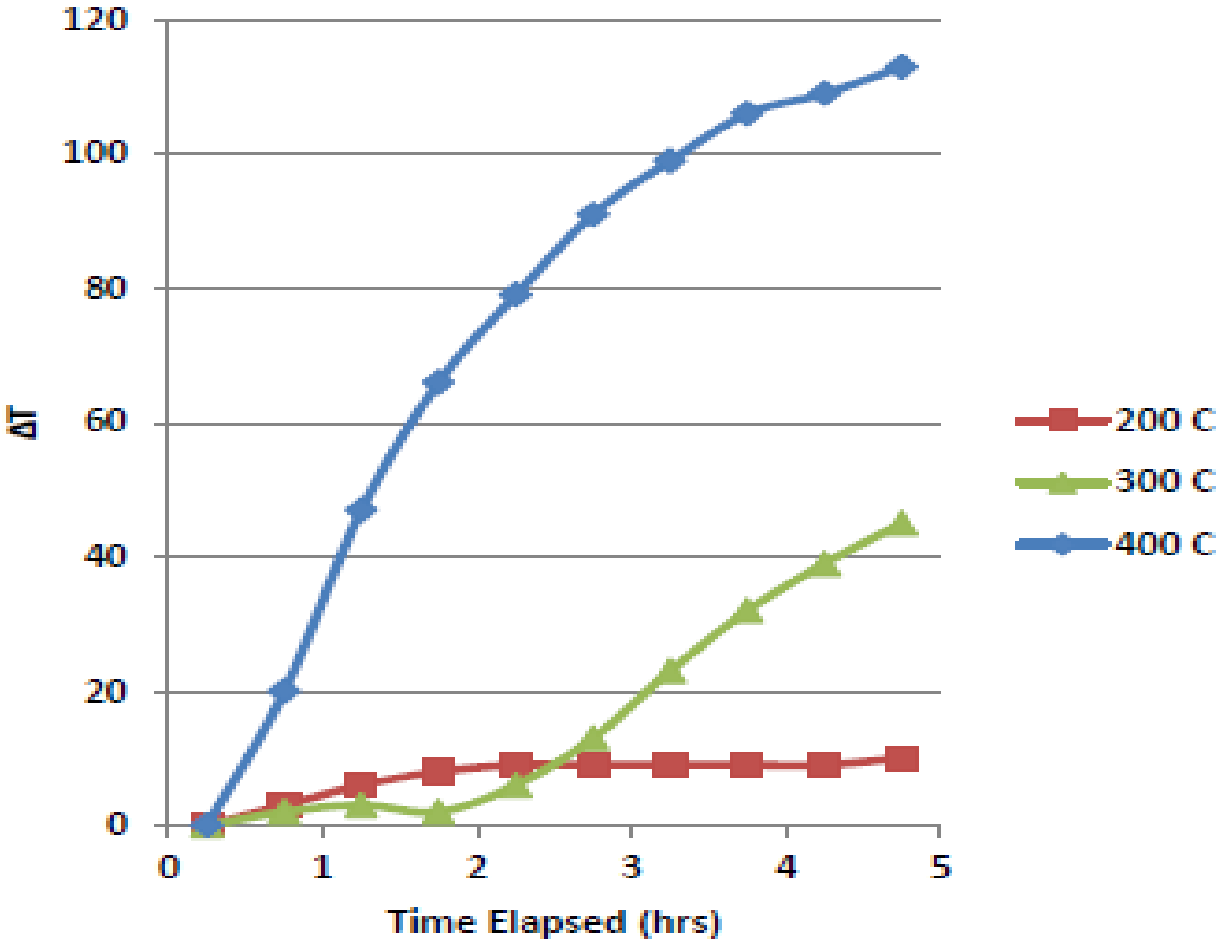
Energy Fuels **2010,** *24*, 6110–6118 · DOI:10.1021/ef101097c



Preflashed Crude – Light Sweet Crude w/ Heavy Injection



Preflashed Crude - Light Sweet Crude



Summary

- Fouling of unit with 10% asphaltenes (destabilized) stops at desalted crude exchange.
- Light sweet refinery fouls worse, through the heater.
- Fouling rate from Alcor inversely proportional to %C7 isol.
- Another fouling mechanism occurring in today’s light sweet crudes?