Taking Some of the Challenge out of Challenge Crudes

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Topics

• What is a Challenge Crude?
• Assessment Methods
  – Desalting
  – Fouling
  – Corrosion
• Summary
What is a Challenge Crude?

• Challenge or Opportunity crudes are any crude that is traded at a discount
  – New crudes to market
  – Crudes that are known to have processing problems
  – Distressed cargoes
  – Any crude that a refiner has not processed before
Assessment Methods

• Early assessment can reduce the risk in processing these crudes

• Several key aspects that are not on the assay
  – How will it affect desalter operation?
  – Will it cause fouling in exchangers and furnaces?
  – Will it cause corrosion?
Will it Affect Desalter Operation?

- Several factors can impact desalting operation
  - Viscosity
  - Gravity
  - Solids Content
  - Asphaltene content / stability
  - Conductivity
  - Operational limitations (i.e., Temp, wash water, etc.)

- The key characteristic is the crude’s emulsification tendency
Emulsification Characteristics

- Portable Electric Desalter (PED) can be used to bench test crudes
  - Relative comparison between crudes and crude slates
PED Results

Water Separation - Whole Crude No Demulsifier

Whole Crude - With Demulsifier
Crude Conductivity

- Conductivity increases with temperature and can reduce desalting electric field strength
- Blending is not predictable

![Graph showing the relationship between temperature and conductivity for different blends of DOBA and ARAB HVY.](image-url)
Will it Cause Fouling in Exchangers and Furnaces?

- **Primary fouling mechanism is asphaltene destabilization and precipitation**
  - Crude Compatibility
  - Thermal Destabilization

- **Some crudes exhibit other mechanisms**
  - Traditional organic polymerization
Crude Compatibility

- Mixing of crudes can result in asphaltene precipitation
- Nalco Fouling Potential Analyzer (FPA)
  - Measures stability of crude oils and blends
  - Differs from the blending indices
  - Indicates desalter impacts

Crude B has higher stability than Crude A
Asphaltene Dispersancy Test

- Determines the relative effectiveness of dispersing asphaltenes in non-solvent medium
  - Field test
  - Aids in dispersant selection
  - Discerns dispersant performance
Thermal Destabilization

- Asphaltene destabilization can be triggered by temperature
  - Temperature decreases the resin-asphaltene interaction
Hot Liquid Process Simulator Results

- Used to determine fouling potential of crudes and resids
- Used to select antifoulants and determine their effectiveness

![Graph showing temperature changes with and without antifoulant](image)

- $\Delta T = -25^\circ C$ (130 min) for Outlet Temp. (no Antifoulant)
- $\Delta T = -2^\circ C$ (112 min) for Outlet Temp. (with Antifoulant)

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Will it Cause Corrosion?

- Majority of the challenge crudes on the market are high acid crudes
  - Total acidity
  - Naphthenic acid content
  - Distribution of acids

- Other species are organic chlorides / undesaltable chlorides / phantom chlorides
High Temperature Naphthenic Acid Corrosion

- Not all TAN is a problem
- Measure of naphthenic acid content better gauge of corrosivity
Distribution of Acid

• Distribution can be used to determine likely areas of concern
  – Some newer assays have this TAN data
  – Nalco has a library of high acid crude nap acid distributions
• Relative comparison with respect to field experience
Corrosivity testing

- Laboratory rig used to simulate temperature and shear stress
- Test metallurgy of the unit
- Test inhibitor effectiveness

![Graph showing corrosion rate comparison between untreated and treated samples.](image-url)
Experience

• Crudes that this process has been used successfully
  – DOBA
  – Grane
  – CPC
Summary

• Processing opportunity crudes can significantly improve refinery profitability
• Testing can be done before the crude arrives to identify potential risks in desalting, fouling and corrosion
• Communication between buyers, refiners and crude process aid suppliers is key to successful introduction
• Planning ahead can allow the refiner to reduce unknown risks associated with running Challenge/Oppportunity Crudes