

# 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?**

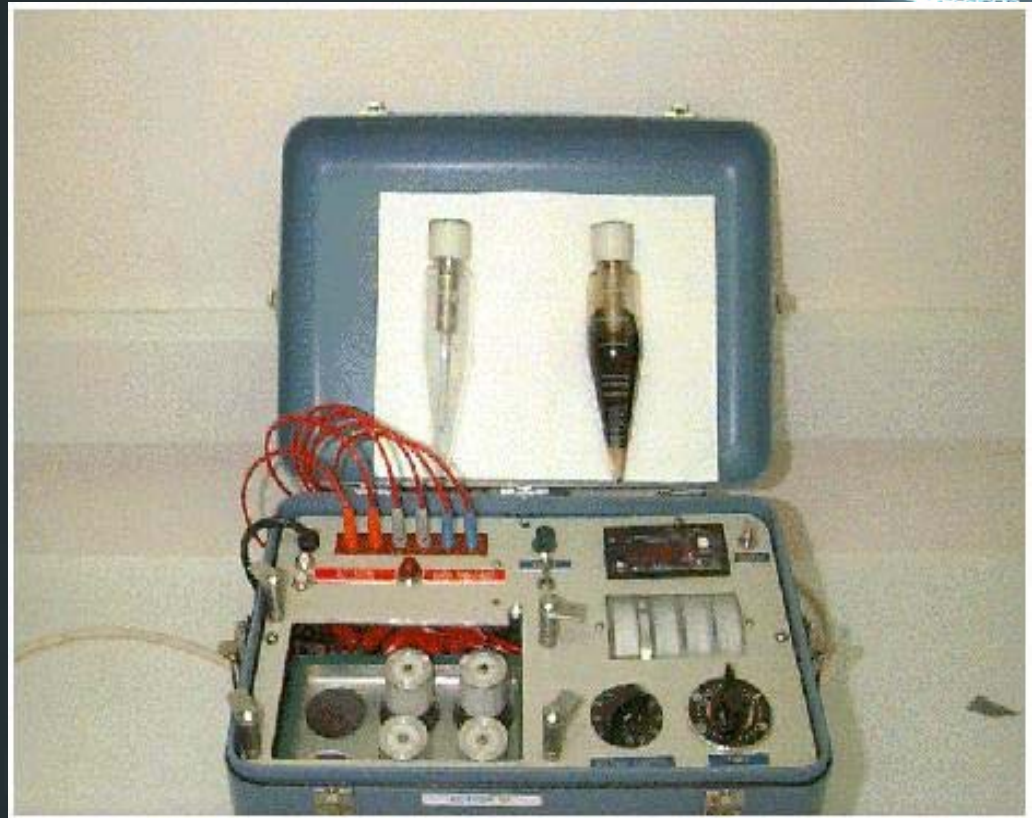
# Will it Affect Desalter Operation?



- **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

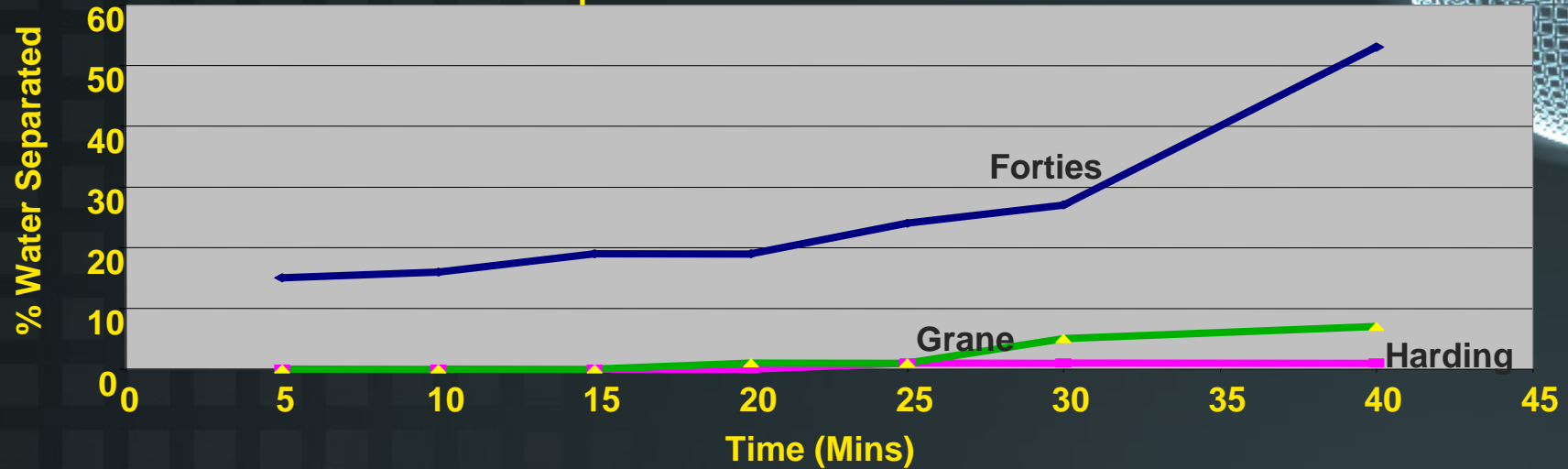
- **Portable Electric Desalter (PED) can be used to bench test crudes**
  - Relative comparison between crudes and crude slates



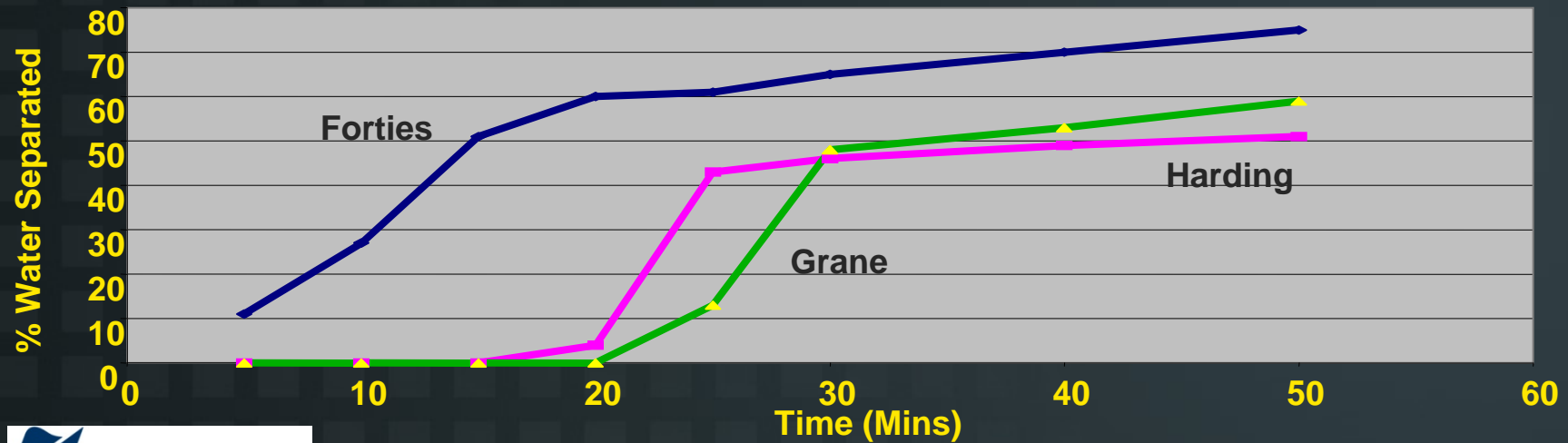
# PED Results



### Water Separation - Whole Crude No Demulsifier



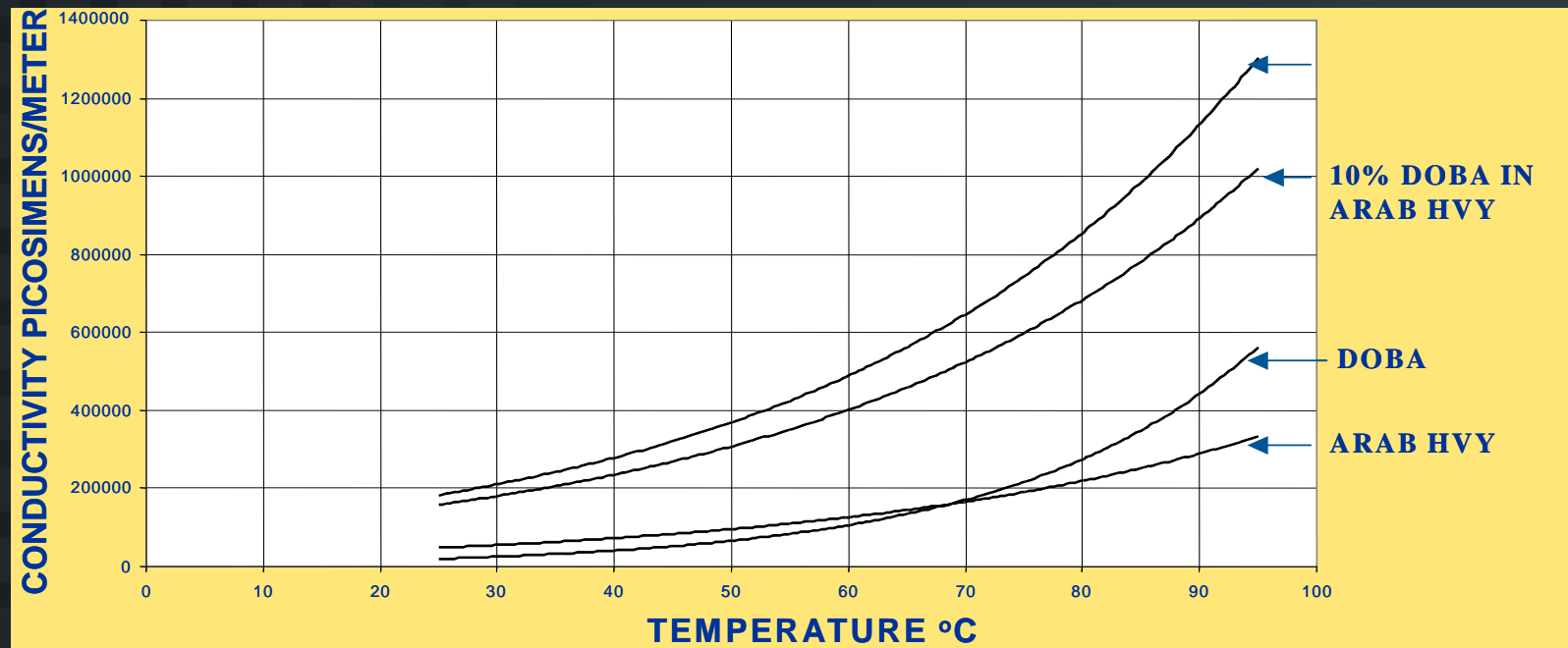
### Whole Crude - With Demulsifier



# Crude Conductivity



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





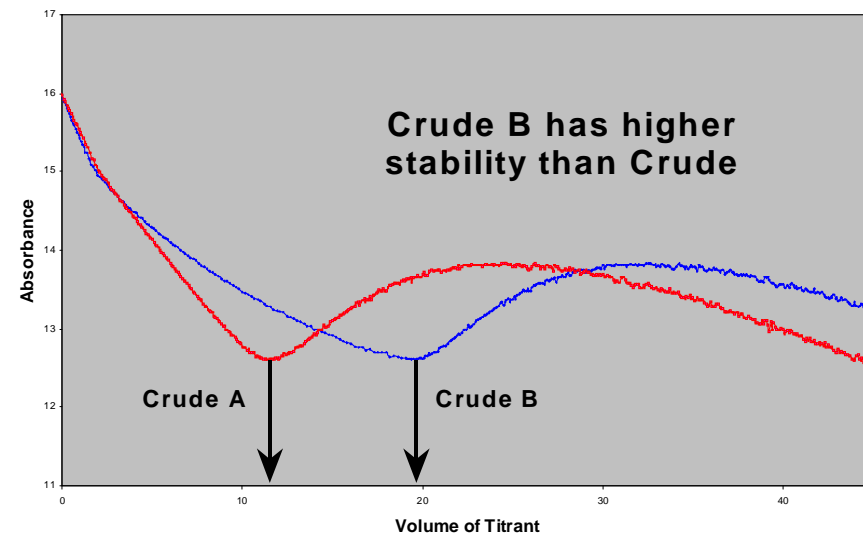
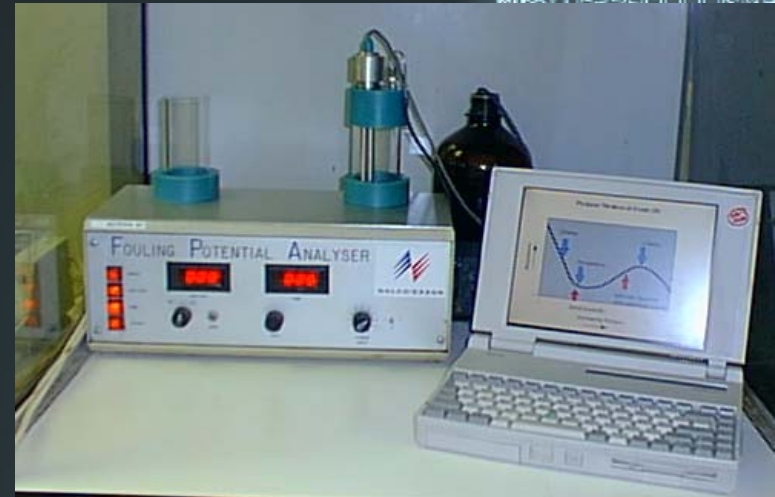
# Will it Cause Fouling in Exchangers and Furnaces?



- **Primary fouling mechanism is asphaltene destabilization and precipitation**
  - Crude Compatibility
  - Thermal Destabilization
- **Some crudes exhibit other mechanisms**
  - Traditional organic polymerization

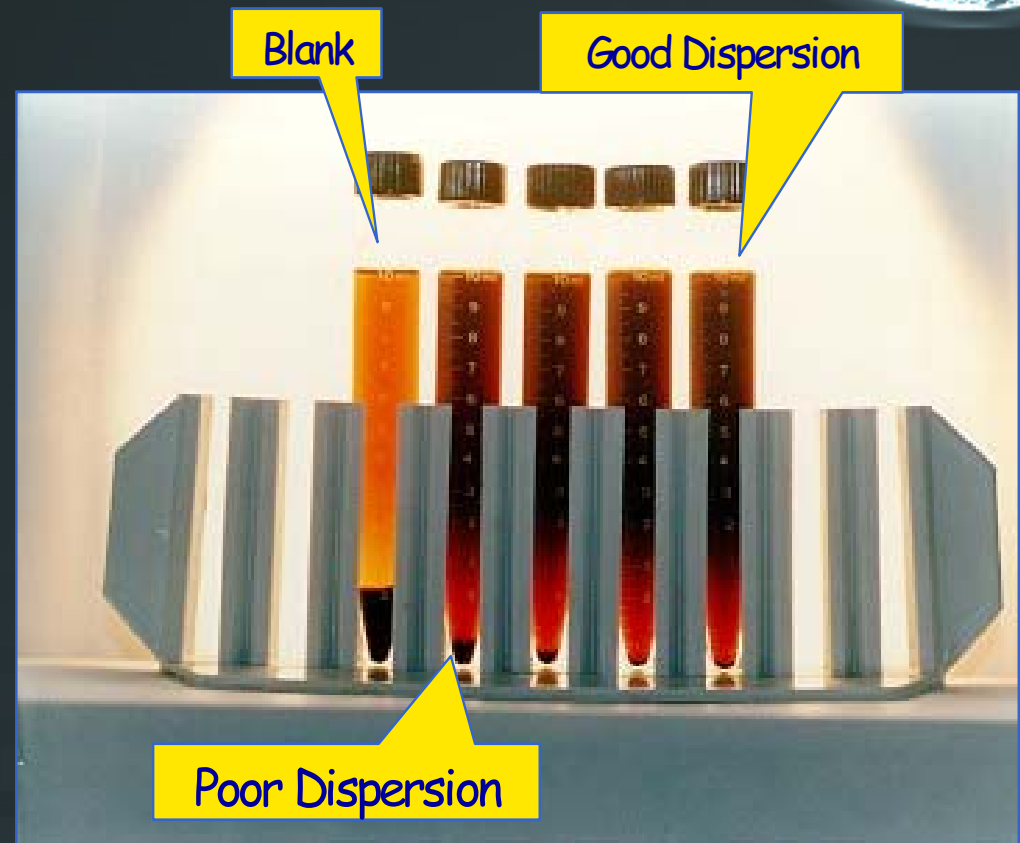
# Crude Compatibility

- **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



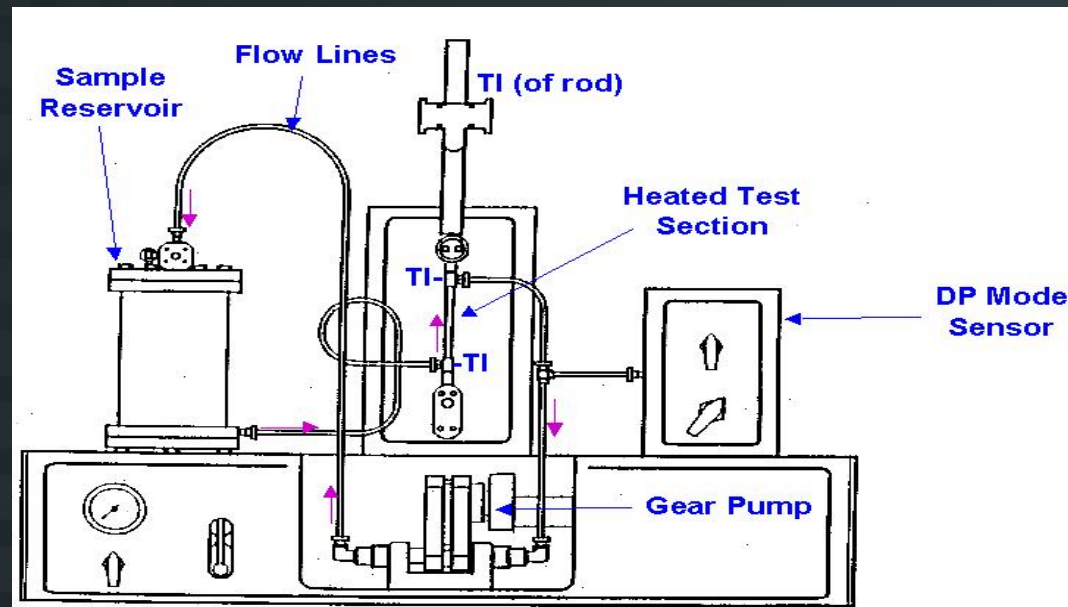
# Asphaltene Dispersancy Test

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



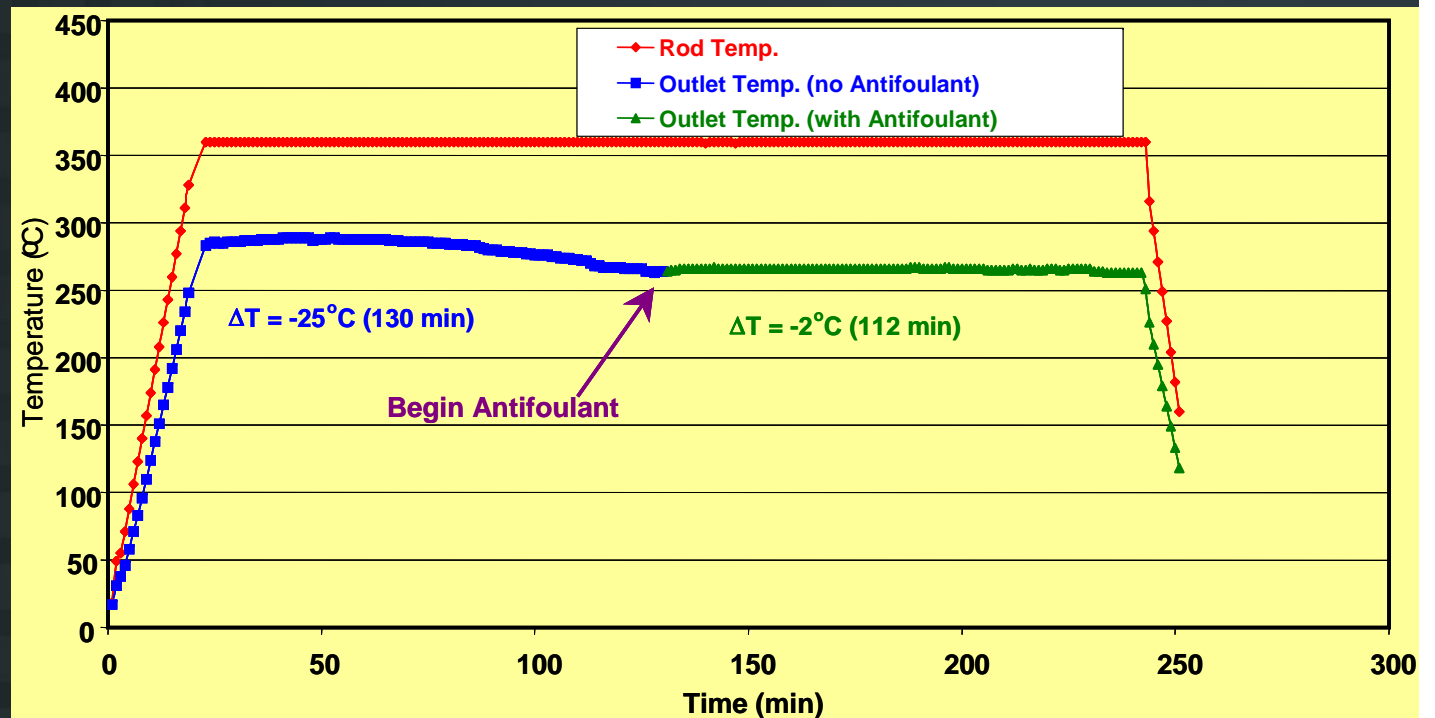
# Thermal Destabilization

- Asphaltene destabilization can be triggered by temperature
  - Temperature decreases the resin-asphaltene interaction

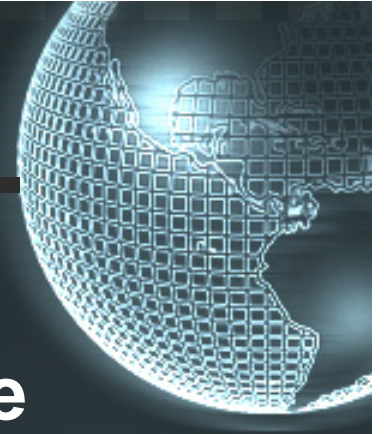


# Hot Liquid Process Simulator Results

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



# Will it Cause Corrosion?

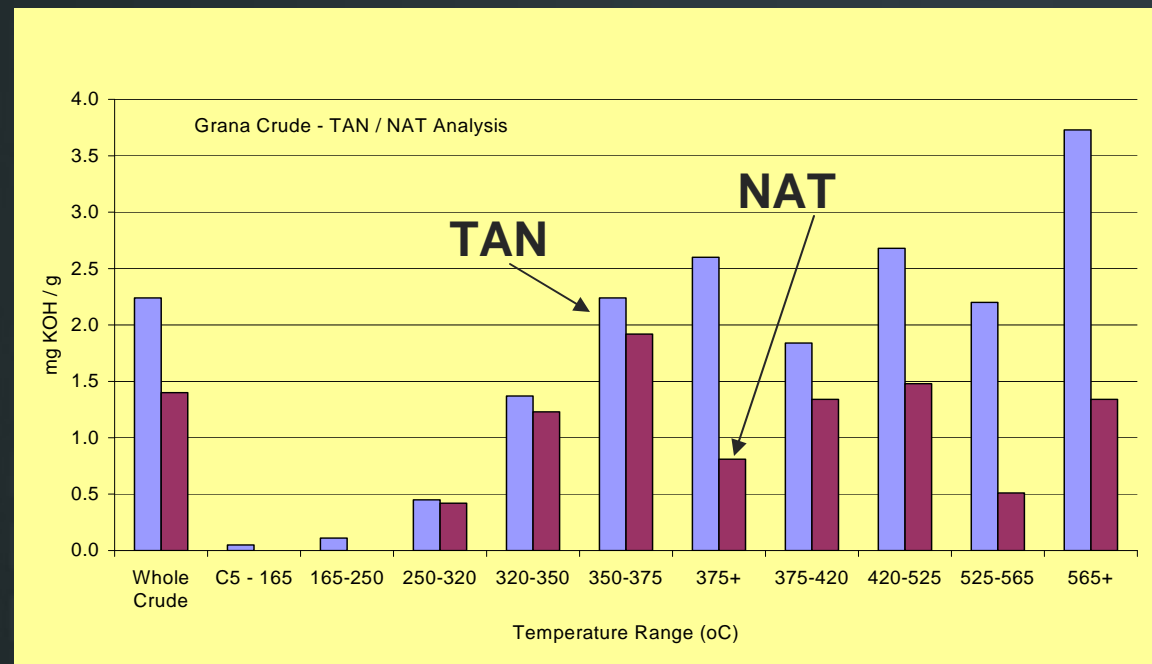


- **Majority of the challenge crudes on the market are high acid crudes**
  - Total acidity
  - Naphthenic acid content
  - Distribution of acids
- **Other species are organic chlorides / undesaltable chlorides / phantom chlorides**

# High Temperature Naphthenic Acid Corrosion

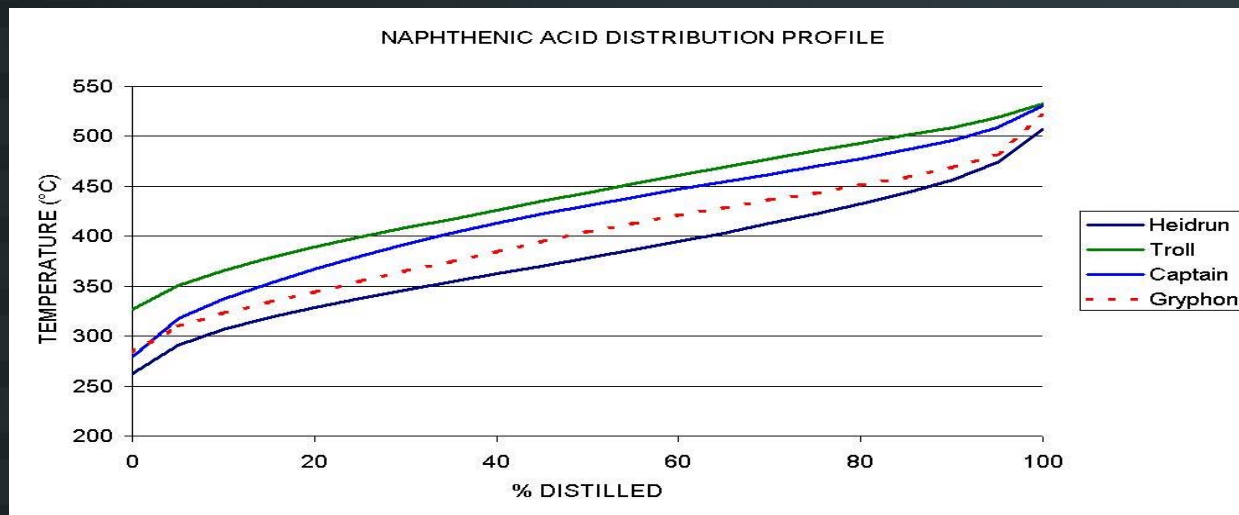


- Not all TAN is a problem
- Measure of naphthenic acid content better gauge of corrosivity



# Distribution of Acid

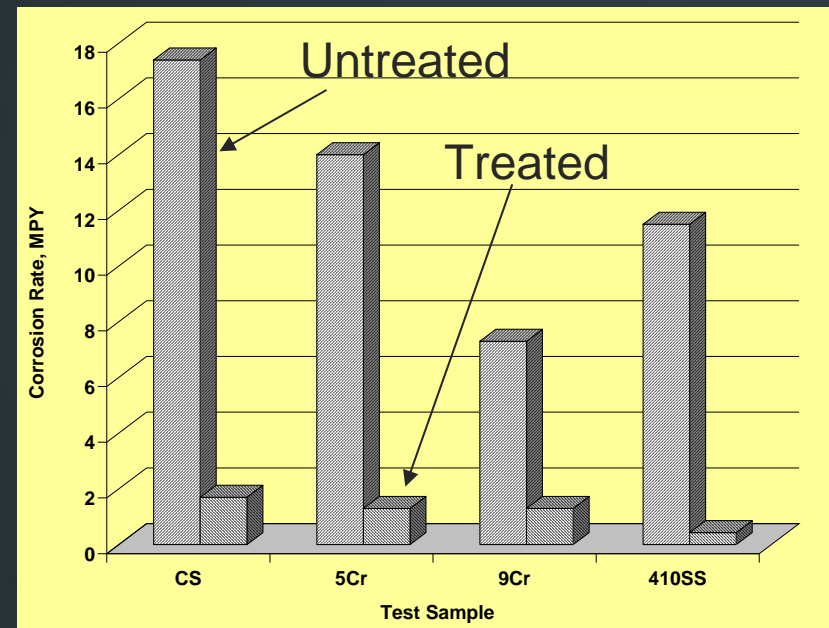
- Distribution can be used to determine likely areas of concern
  - Some newer assays have this TAN data
  - Nalco has a library of high acid crude nap acid distributions
    - Relative comparison with respect to field experience





# Corrosivity testing

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



# 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/Opportunity Crudes**