More Propylene in Existing FCC Units & Revamps

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Purpose (Objective)

• To present and briefly discuss producing more propylene (C3=) in conventional FCC’s, potential revamps and concerns
Contents - Covering 4 Points

• Why Propylene from FCCU’s ?

• Current operating modes & feedstocks (G&A)
  • Different Mode – More Distillate + C3=

• Utilizing other feedstocks

• Revamps to Existing Units
Why Propylene from FCCU’s?

- Europe, North America (US) refineries are facing profitability challenges
  - Gasoline demand declining both areas
  - Middle Distillates (Diesel) markets increasing both areas
  - European surplus gasoline export markets are declining
  - US lighter shale crudes, “tight oil” use is increasing that produce more naphtha and less diesel

- C3= shortages are expected; C3= Prices >> Gasoline (Chemical & Polymer Grades)

- Existing FCC’s & Steam Crackers can’t meet the demand
More Propylene in Existing Units

• Operating Variables
• Catalysts
• Feedstock Changes
• Hardware Changes
  • New HOFCC Designs - Revamps
More Propylene in Existing Units

• Operating Variables
  • Increase Severity (Increase conversion)
    • Reactor Temps
    • Residence Times
    • High Cat/Oil Ratios
  • Lower Partial Pressure *

✓ Recycle Cracked Naphtha
Catalysts

- ZSM-5
- Lower RE, UCS
- Higher Activity (?)

Feedstocks Changes

- More H2 content

Hardware Changes

- New HOFCC* Designs Components for Revamps

* HOFCC - High Olefin FCC
Distillate Mode – More Propylene

• Catalyst
  • ZSM-5
  • Lower RE, UCS
  • Higher Activity

• Recycle cracked naphtha (LCN, FRCN)

Note:

Distillate Mode typically operates to produce enough C4= to meet Alky capacity
Need for Revamps?

• Different Feedstocks
  • More severe HDT
  • Less Resid
  • Lighter Feeds –
    • Tight Oil
    • Condensates
    • Naphtha (paraffinic)

• Distillate Mode + Propylene
Concerns

• Gas Con Changes （ More Light Gases ）
• Treating & Contaminant Removal
  • Treating Off Gas for C2=&C2
  • Polymer Grade C3=

• Aromatic Gasoline
  • Gasoline Blending
  • Aromatic Extraction
Fluid Catalytic Cracking PFD
Hardware Changes for More Propylene (Revamps)

Increase Reaction Time

• Additional Reactor Zone
  • 2nd riser terminates in existing Rx. Vessel
  • 2nd riser / downflow rx. terminates in new Rx. Vessel

• Recycle LCN/FRCN to feed or 2nd reaction zone

• More Bed Cracking

• Premix catalysts - spent/regen (RxCat Vessel)
Summary - Licensor Types of HOFCC

- UOP- PetroFCC
- S&W Deep Catalytic Cracker (DCC) *
- KBR- Maxofin Process- *
- Axens / S&W - High Severity FCC (HS-FCC)*
- ABB Lumus /Indian Oil Company - Indmax *
- Sinopec*
- Others

* Proprietary Catalysts
KBR MAXOFIN Process

- Primary Feed Riser
- Second Riser For Naphtha Recycle
- Fresh Feed
- Recycle Injection
UOP PetroFCC Process
Technip Stone & Webster DCC Process

- Fresh Feed
- Riser Steam
- Flue Gas
- To Gas Recovery
- Slurry Recycle
- Stripping Steam
- Reactor
- Regenerator
- Blower
- Riser Steam
- Fresh Feed
Shell Milos Distillate + Olefins

Source Shell Global Solutions
Retrofit To Axens/Shaw’s R2R FCC Unit

Existing RFCC

Retrofit

Stripper Vessel

Reactor - Stripper Vessel

Downer Reactor

Reactor Riser

Regenerator
Conclusions
More Propylene in Existing FCC Units & Revamps

• Producing More Propylene in existing FCC’s is viable for increasing refinery profitability
• Producing More Propylene in Distillate Mode is viable
• Revamps to existing FCC’s utilizing HOFCC’s Technology and catalysts are being implemented!
THANK YOU

The End

Questions ???

Additional Follow-up discussions during the Revamp Workshop