

Thermal Cracking, Experiences & Advancements

Syllabus

Day One

- 1. Introduction to Petrochemical Industry (1 Hour)**
 - A. Overview of the Petrochemical Industry**
 - 1. Ethylene Position in the Hydrocarbon Processing Industry**
 - 2. Overview of Up Stream and Down Stream of Ethylene**
 - B Safety in the Petrochemical Industry**
 - 1 Review of 2002 Algiers Incident**
 - 2. Review of BP Incident**
 - 3. Ethylene Boiler Incident**
 - 4. Ethylene Flare Incident**
 - C. Discussions and Review**
- 2. Ethylene Overview (1 Hour)**
 - A. Comparison of Flow Schemes**
 - 1. Gas Crackers and Liquid Crackers current designs and comparisons**
 - 2. DeMethanizer First**
 - 3. DeEthainzer First**
 - 4. DePropanizer First**
 - B. Discussions and Review**

3. Ethylene Furnace Technology (1.5 Hour)

A. Historical Development

B. Design Constraints

- 1. Residence time**
- 2. Partial Pressure**
- 3. Low Pressure**

C. Comparison of Current Designs

- 1. One pass coil**
- 2. Two pass U coil**
- 3. W coil**
- 4. Hybrid coil**

D. Furnace Run lengths

- 1. Design and normal run lengths of current designs**
- 2. Factors affecting run lengths**

E. Anti Coking

- 1. Comparison of technologies**

F. Future Opportunities

- 1. Catalytic**
- 2. Latest patents**

G. Ethylene Furnace Trouble Shooting

- 1. Convection Bowing**
- 2. Insulation**
- 3. External transition designs**

H. Discussions and Review

- 4. Quench System Review (2.5 Hours)**
 - A. Overview of Quench System**
 - 1. Quench Oil Tower**
 - 2. Quench Water Tower**
 - 3. Dilution Steam Generation**
 - A. Case study of a Saturator revamp**
 - B. Case study of DSG reboiler fouling**
 - B. Design of Quench System Towers**
 - 1. Fundamentals of Distillation for Olefin Plants**
 - A. Fundamentals overview**
 - B. Review of distillation equipment selection**
 - 2. Designing Towers for Fouling Service**
 - 3. Case Studies**
 - A. Quench Water Tower Revamp**
 - B. Quench Oil Tower Fouling**
 - C. Discussion and Review**

Syllabus

Day Two

5. Compressor Review (1 Hour)

A. Compressor Overview

1. Four versus Five Stages
2. Efficiency gains
3. Eliminating recycles
4. Inter-stage cooler issues and fouling
5. Caustic tower issues and design

B. Compressor Run Lengths

1. Review of Run Length
2. Wash oil and inhibitor
3. Water Wash

C. Discussion and Review

6. Acetylene Reactor Review (1 Hour)

A. Front End vs. Back End Overview

B. Review of current catalyst

1. Catalyst run lengths
2. Catalyst conversion
3. Operating windows

C. Operational Issues

D. Discussion and Review

- 7. Molecular Sieve Review (0.5 Hour) – Optional based on time constraints**
 - A. Molecular Sieve Application in Olefin Plants**
 - B. Molecular Sieve principles**
 - C. Discussion and Review**

- 8. Ethylene Unit Economics (1 Hour)**
 - A. Investment Guide Lines**
 - B. Follow The Money**
 - 1. Where is the money made?**
 - 2. Where is the money spent?**
 - 3. Where is the money lost?**
 - C. You verses the industry**
 - D. Discussion and Review**

- 9. C3 and C4 Reactors (0.5 Hour) - optional**
 - A. Overview of C3 Reactors**
 - 1. Catalyst Review**
 - 2. MAPD Safety Issues**
 - B. Overview of C4 Reactors**
 - 1. Catalyst Review**
 - 2. Safety Issues**
 - A. Challenges with temperature excursions**
 - C. Discussion and Review**

10. Ethylene Distillation (2-3 Hours)

A. Olefin Fractionation System Overview

1. Cold Fractionation Tower Review

- 1. Low Pressure vs. High Pressure DeMethanizer**
- 2. Open loop vs. closed loop C2 Towers**
- 3. Heat integration issues**

2. Hot Fractionation Tower Review

- 1. Fouling**

B. Optimize Distillation Column Design for Improved Reliability in Operation and Maintenance

- 1. Correct distillation equipment for process conditions**
- 2. Correct equipment selection for expected run length**
- 3. Thermal stability, chemical stability and safety**
- 4. Maintenance reliability, accessibility and simplicity of repair**
- 5. Evaluation of the most cost effective solution for minimum life cycle cost**

C. Chemical Treatments for Distillation Columns

- 1. Applications and Optimization of chemical treatment programs**

D. Process Control for Olefin Plants

A. Tower Balances

- 1. Material Balance**
- 2. Energy Balance**
- 3. Composition Balance**

- B. APC and Optimization**
 - 1. Follow the money**
 - 2. Thermodynamics and Equilibrium**
 - 2. Percent on Line**

E. Trouble Shooting Distillation Columns

- 1. Principles of troubleshooting**
- 2. Do the simple checks first**
- 2. Calculations of trouble shooting**

F. Revamping Distillation Columns

- 1. Test run to determine current unit constraints**
- 2. Simulation and hydraulic analysis of current operations**
 - A. Simulation Guide lines**
 - B. Hydraulic Guide lines**
- 3. Design of new required equipment**
- 4. Inspection of new equipment**
 - A. Case studies of fabrication and installation issues**
- 5. Pre Commissioning and Commissioning**

G. Discussion and Review

11. Summary

- A. Furnaces**
- B. Compression**
- C. Fractionation**