Capacity Increase of Urea Plants

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Outline

- Targets and requirements of a revamp
- Revamp concept for a capacity increase of 17% (1925-2250 MTPD)
- Contractor's input
- CO₂ generation
Targets and requirements of a revamp

- Capacity increase
  - By using existing margins to get maximum possible additional product with the lowest effort necessary
  - Elimination of bottlenecks

- Reduction of energy consumption (e.g. heat integration)

- Environmental improvements
  - Reduction of emissions (to comply with new laws and international standards)

- Increase of reliability and availability

- Utilization of a well proven and reliable technical concept

- Short as possible implementation downtime for modifications and new equipment
Revamp targets

**Melt Plant**
- Plant I
  - STAC 1925 mtpd
  - Change: +17%
    - Original: 2250 MTPD
    - Revised: 2250 MTPD

**Granulation**
- Plant I
  - UFT 2000 mtpd
  - Change: +12.5%
    - Original: 2250 MTPD
    - Revised: 2250 MTPD

- Plant II
  - STAC 1925 mtpd
  - Change: +17%
    - Original: 2250 MTPD
    - Revised: 2250 MTPD

  - STAC 2000 mtpd
  - Change: +12.5%
    - Original: 2250 MTPD
    - Revised: 2250 MTPD
The basis before the revamp for both plants
Conventional Stamicarbon CO₂ Stripping Process
Block Diagram Plant I & II (MP Section)

1925 MTPD +17% → 2250 MTPD

NH₃ → Synthesis → MP Section
CO₂ → Synthesis

LP Recirculation
Carbamate 20wt% water
urea solution
Carbamate 30wt% water

Desorption
Parallel Desorption

Evaporation
Waste heat

Granulation

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Revamp concept 1925 → 2250 MTPD

- **Reactor**
- **HP Scrubber**
- **HPCC**
- **After reactor**
- **Stripper**
- **MP Section**

**New equipment**

- Carbamate 20wt% water
- To LP absorber
- To recirculation

**Flow Diagram**

- NH₃, CO₂, Air inputs
- CO₂ outputs
MP Section (operating at ~20bar)

- MP Rectifying Column
- MP Pre-Evaporator
- MP Stripper
- Level Tank f. MPCC
- HP Carbamate Pump
- To synthesis
- To recirculation
- CO₂
- MP CO₂ Compressor
- From synthesis
- To 2bar Absorber
- new equipment
Overview of the revamp measures for plant I & II
Overview of the revamp measures for plant I & II
Uhde‘s input to optimise the concept

Case 1: before revamp
  - One pump in operation
  - One pump stand-by
Uhde’s input to optimise the concept

Case 2a: after revamp
- Two pumps in operation
- Fall back to capacity before revamp in case of malfunction or maintenance

Case 2b: after revamp
- Two pumps in operation
- One pump stand-by
- Production remains at revamp capacity

2250 MTPD

HP NH₃ / Carbamate Pumps

A

B

C

in operation

in operation

stand-by
Uhde’s modifications of closed cooling water loops

Lower water temperature in order to reduce fouling on CW side.
CO₂ and NH₃ for Urea Production

- Production of ammonia plant is typically with lower ratio CO₂ / NH₃ (1.14 t/t for ideal process with no loss and pure CH₄ as feedstock)

- Demand of urea plant per ton of urea: 0.566 t NH₃ + 0.733 t CO₂
  ⇒ Ratio CO₂ / NH₃ needed: 1.29 t/t
Ways of CO₂ Production

- Increased CO₂ production by recovery of CO₂ input and CO₂ removal and return of excess synthesis gas to reformer fuel

Diagram:
- NG feed → Reforming → CO shift → CO₂ removal → Purification → Synthesis → NH₃
- CO₂ flue gas → CO₂ recovery → CO₂ to urea
- Syngas return as reformer fuel

Increased CO₂ production by recovery of CO₂ input and CO₂ removal and return of excess synthesis gas to reformer fuel.
Conclusion

- Changes in one place always lead to changes in another place
  - Overall knowledge

- Many constraints in an existing plant and set by the existing periphery
  - Collaboration between all involved parties

- Input to optimize the revamp concept for a tailor-made solution
  - Experienced contractor

Thank you for your attention!

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