REVAMPING CONCEPTS FOR UREA PLANTS

EVOLVE
Upgrading an existing plant

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Stamicarbon Urea Workshop
• Owner’s objectives for revamp
• Type of plant and present plant status
• Check availability of raw materials and utilities
• Conventional plant technology with its revamp options
• Stripping plant technology with its revamp options
What are possible motives to revamp an existing urea plant?
OWNERS OBJECTIVE’S FOR REVAMP

- Increased production capacity
- Reduced ammonia consumption
- Reduced steam/cooling water consumption
- Reduced emissions
- Increased reliability
- Lowered maintenance costs
- Increased stability of operations
- Improved product quality
Type of Technology

- **Conventional**
  1. Stamicarbon total recycle plant
  2. Montedison Urea Process
  3. Chemico Urea process
  4. Misui-Toatsu Total Recycle process
  5. ...

- **Stripping Plants**
  1. Stamicarbon CO$_2$ stripping process
  2. Snamprogetti NH$_3$ stripping process
  3. TEC ACES process
PRESENT PLANT STATUS

• Documentation original design + modifications
• Maximum capacity CO$_2$ compressor, HP pumps
• Performance and condition of HP equipment
• Performance different plant section(s):
  • Syntheses
  • Carbamate circulation
  • Ammonia circulation
  • Evaporation/ Crystallization
  • Waste Water treatment
  • Prilling/ Granulation
• Emission and consumption figures
• Current limitations for desired objective(s)
CHECK AVAILABILITY OF RAW MATERIALS AND UTILITIES

**NH₃**
- NH₃ plant revamp necessary or
- NH₃ from other location

**CO₂**
- NH₃ plant revamp necessary or
- CO₂ source available close by (CCP)

**Utilities**
- Steam/Cooling water/ Electricity
Conventional urea processes

- Stamicarbon Total Recycle Process
- Montedison Urea Process
- Mitsui - Toatsu Total Recycle C-Improved Process
- Chemico Urea Process

Typically high consumption figures
Typical figures of a conventional plant

- Steam consumption about 1200 to 1600 kg/ton of Urea
- Cooling water consumption about 100 m³ /ton of Urea
- Ammonia consumption of about 575 to 610 kg/ton of Urea
- Ammonia emission to atmosphere about 0.5 to 2.0 t/h
- Waste water about 0.5 % of urea > 50 ppm of ammonia
- Capacity range from 100 to 1000 MTPD
Revamp scheme’s

• Capacity increase up to 100 % by MIMO (More In More Out technology)

• Capacity increase up to 200 % by conversion to Stamicarbon Pool condenser/Pool reactor technology
Stripping plant design (for all technologies)

- Synthesis at 140 – 200 bar
- MP recirculation section (only Snamprogetti/TEC)
- LP recirculation section
- Evaporation section
- Waste water section
- Finishing section (mostly granulation)
What is most likely to be the main bottle neck in revamping a Stamicarbon CO$_2$ stripping plant?
Revamp technologies Stamicarbon Stripping plant

**Revamp concept**
- More In More Out
- New Stripper/Double stripper
- MP add-on concept
- Pool condenser concept

**Capacity increase**
- up to 30 %
- up to 45 %
- up to 50 %
- up to 100 %
**Revamp technologies Stamicarbon Stripping plant**

**Revamp concept**
- More In More Out
- New Stripper/Double stripper
- MP add-on concept
- Pool condenser concept

**Capacity increase**
- up to 30%
- up to 45%
- up to 50%
- up to 100%
MIMO Concept

- Installation of efficient reactor trays
- Maximum utilization of existing design margins
- Adding heating and condensation capacity in LP and evaporation sections only.
- Using up design margins in finishing sections
STAMICARBON STRIPPING PLANTS
MIMO: CHANGES IN RECIRCULATION SECTION

To HP scrubber
From HP stripper
Lean carbamate from E720
To E702
Desorbed water from E753
To E705
From HP Scrubber
To evaporation
To HP scrubber
To V703
Gases / air
Liquids
Lean solution/melt/slurry
Steam/water
New

Recirculation section (new)

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STAMICARBON STRIPPING PLANTS
MIMO: CHANGES IN EVAPORATION SECTION

Evaporation section (new)

From urea solution tank

UF 85

To atm. Absorber C751

From flash separator

Solids / air
Liquids
Urea solution/melt/slurry
Steam/water
Now

To desorber/hydrolyzer

Solid urea

From C304

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MIMO: CHANGES IN WASTE WATER TREATMENT

Waste water treatment section (new)

To low pressure carbamate condenser

Gases / air
Liquids
Urea solution/melt/slurry
Steam/water
New

Ammonia water tank

Process water to Battery Limits

Steam

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MIMO concept: References

- PIC, Kuwait (conventional plant)
  - Original capacity: 550 MTPD
  - After revamp: 1065 MTPD

- Razi, Iran
  - Original capacity: 1500 MTPD
  - After revamp: 1800 MTPD

- Shiraz, Iran
  - Original capacity: 1500 MTPD
  - After revamp: 1800 MTPD

- Grodno, Belarus
  - Original capacity: 1200 MTPD
  - After revamp: 1400 MTPD

- PAFL, Pakistan
  - Original capacity: 1080 MTPD
  - After revamp: 1420 MTPD
Double stripper concept

- Installation of parallel HP stripper or a new bigger one
- Installation of efficient reactor trays
- Installation of a booster for CO₂ compressor
- Installation of a parallel LP recirculation section
- Installation of a parallel evaporation section
- Improvements in waste water treatment
- Modifications in finishing section or additional granulation section.
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Double stripper concept: References

- Sasferco, Canada
  - Original capacity: 2000 MTPD
  - After revamp: 2800 MTPD

- Yuntianhua, China
  - Original capacity: 1620 MTPD
  - After revamp: 2000 MTPD

- Abu Qir (3), Egypt
  - Original capacity: 1925 MTPD
  - After revamp: 2500 MTPD

- Geomaxima, China
  - Original capacity: 1760 MTPD
  - After revamp: 2320 MTPD
MP Add on concept

- Installation of efficient reactor trays
- NO modifications in High Pressure equipment.
- Installation of a parallel MP Carbamate recirculation section
- Installation of a MP CO$_2$ compressor
- Improvements in waste water treatment
- Modifications in finishing section or additional granulation section.
MP Add on concept: References

- **SKW, Germany**
  - Original capacity: 1050 MTPD
  - After revamp: 1500 MTPD

- **Daqing, China**
  - Original capacity: 1640 MTPD
  - After revamp: 2300 MTPD

- **Urumqi, China**
  - Original capacity: 1740 MTPD
  - After revamp: 2610 MTPD

- **Sasferco, Canada (original design 2000 MTPD)**
  - Original capacity: 2800 MTPD
  - After revamp: 3400 MTPD

- **DSM, Geleen**
  - Original capacity: 1140 MTPD
  - After revamp: 1540 MTPD
Pool condenser concept

- Replacing HPCC by Pool condenser
- New or additional CO$_2$ compressor.
- Installation of a parallel HP stripper
- Installation of a parallel LP recirculation system
- Installation of a parallel evaporation system
- Modifications in waste water treatment
- Parallel finishing section
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POOL CONDENSER REVAMP CONCEPT

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STAMICARBON STRIPPING PLANTS
POOL CONDENSER / REACTOR OPTION

Gases / Air
Liquids
Urea solution/melt/slurry
Steam/water
New
Pool condenser revamp: References

- PIC, Kuwait (conventional to stripping)
  - Original capacity: 1065 MTPD
  - After revamp: 1650 MTPD

- QAFCO, Qatar
  - Original capacity: 1000 MTPD
  - After revamp: 1900 MTPD

- Erdos, China (TOYO)
  - Original capacity: 2000 MTPD
  - After revamp: 3520 MTPD

- Ningxia, China (SNAM)
  - Original capacity: 1740 MTPD
  - After revamp: 2610 MTPD
DO YOU ALSO HAVE AN OLDER PLANT?
LETS DISCUSS YOUR OPPORTUNITIES