Linde’s Rectisol® Wash Process
Acid Gas Removal is an Important Process Step in the Production of Synthesis Gas

Main Components in the Feedgas
- H2
- CO

⇒ Shall Remain in the Feedgas

Acid Components in the Feedgas
- CO2
- H2S
- COS

⇒ To be Removed

Impurities in the Feedgas
- HCN
- NH3
- Metal Carbonyls
- H2O

⇒ Removed upstream the Process
Linde’s Rectisol® Wash Process

Rectisol® is Physical Wash Process using Methanol as Solvent.

Rectisol® Wash Process

- Physical Wash Process, whereas the Acid Gas components are solved in the solvent
- Methanol is used as solvent
- Selective Removal of H2S and CO2
- Excellent Handling of Trace Components

Characteristics of Methanol

- High Solubility of the Acid Gas
- Low Solubility of the Main Gas Components
- High Loading Capacity

- Cheap and readily available solvent
- Low corrosiveness
- Low vapour pressure
- Low methanol losses
Linde’s Rectisol® Wash Process
Higher Feedgas Pressure Reduces the Utility Consumption Costs Significantly.

Influence of Feedgas Pressure

\[ \text{WM} \approx \frac{V}{p \cdot \lambda_i} \]

Effect of Higher Feed Gas Pressure

- Low Solvent Circulation Rate
- Low Utility Consumption
- Smaller Column Diameter
- Higher Wall Thickness
- Negligible Influence on Equipment Cost

⇒ High Operation Pressure is Favorable for the Rectisol® Process
Solubility Coefficient $\lambda_i$ of various gases in Methanol at ambient pressure

⇒ Low Operation Temperature is Favourable for the Rectisol® Process
### Linde’s Rectisol® Wash Process

Rectisol® allows a wide Range of Application.

| Feedgas Source          | Unshifted and/or Shifted Feedgas
<table>
<thead>
<tr>
<th></th>
<th>Coal or Oil Gasification, Heavy Residue Oil</th>
</tr>
</thead>
</table>
| Feedgas Flow Rate       | 11,000 – 450,000 Nm³/h
|                         | in one train                              |
| Feedgas Pressure        | 20 – 120 bar
|                         | high pressure preferable (30 – 80 bar)    |
| CO2 Content in Feedgas  | > 3 mol% preferable > 10 mol%            |
| Advantages              | selective H2S/COS and CO2 removal possible
|                         | wide spread product range                |
Linde’s Rectisol® Wash Process

Rectisol® is a very Flexible Process to achieve a wide Range of Product and By-Product Quality.

Simplified Process Flow Diagram
Linde’s Rectisol® Wash Process

Rectisol® is an Excellent Process to Produce Hydrogen and IGCC Fuelgas.

Block Diagram to Generate IGCC Fuelgas and Hydrogen

- Oil/Coal
- Air

PO

CO Shift

Rectisol I

Regen. System

Rectisol II

Gas Turb. (IGCC)

el. Power

Tailgas

CO2/N2 Ventgas

Pure Hydrogen

H2S Fraction

Exhaust
Linde’s Rectisol® Wash Process
Rectisol® is an Excellent Process to Produce IGCC Fuelgas.

Block Diagram to Generate IGCC Fuelgas without CO2

- **Oil/Coal** to **PO**
- **Air** to **ASU**
- **Oxygen** to **CO Shift**
- **Fuel Gas** from **Rectisol**
- **Gas Turb. (IGCC)**
- **el. Power**
- **Exhaust**
- **Claus**
- **H2S Fraction**
- **CO2 Compr.**
- **CO2 Storage**
### Linde’s Rectisol® Wash Process

Rectisol® Guarantees Highest Product Quality.

<table>
<thead>
<tr>
<th></th>
<th><strong>Fuel Gas for IGCC</strong></th>
<th><strong>CO2 Product</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CO2</strong></td>
<td>general</td>
<td>typical</td>
</tr>
<tr>
<td></td>
<td>&lt; 5 vppm, up to 5 mol%</td>
<td>1-2 mol% 1)</td>
</tr>
<tr>
<td><strong>H2S + COS</strong></td>
<td>&lt; 0.1 vppm</td>
<td>2-10 vppm</td>
</tr>
<tr>
<td><strong>H2O</strong></td>
<td>&lt; 0.1 vppm</td>
<td>&lt; 0.1 vppm</td>
</tr>
<tr>
<td><strong>Methanol</strong></td>
<td>50 – 150 vppm</td>
<td>50 – 150 vppm</td>
</tr>
<tr>
<td></td>
<td>Δp ~ 2 bar</td>
<td>Δp ~ 2 bar</td>
</tr>
</tbody>
</table>

1) CO2 recovery rate 90 – 97%

2) no vent gas, N2 < 4 mol%

3) with Additional Water Wash Column

4) adjusted to compressor design
Linde’s Rectisol® Wash Process
Air Separation Technology Applied to CTL / Linde Core Business

Gasification Island

Coal → POX → Rectisol

- ASU: O₂, H₂S, CO₂, trace components

Consumers
- CTL:
  - Synthetic Diesel
  - Synthetic Naphta
  - Lubricants
  - Alpha-Olefins
- CTC:
  - Methanol
  - MTO
  - Acetic Acid
  - Oxo Chemicals
- H₂:
  - Refinery
  - Hydrogenation
  - Ammonia
  - Energy
- SNG
- IGCC: low/zero CO₂ emission power plants

Linde Engineering core business

Linde AG Linde Engineering Division
Dr. A. Prelipceanu, Dr. H.-P. Kaballo, U. Kerestecioglu
The 2nd International Conference on IGCC & XTL Technologies
Freiberg, 8th – 12th May, 2007
Advantages in General

- Flexible process concerning feedstocks and products
- High absorption capacity of Methanol
  - low solvent circulation rate
  - low energy consumption
- Proven in many plants world-wide
  - extended experience in handling of trace components
- Cheap and readily available solvent
- High One-Train capacity
- Favourable combination with a cryogenic process

Rectisol® is an Excellent Technology to Treat Syngas from Gasifications.
Linde Kindly Thanks You for Your Attention.

Linde Engineering