# PRODUCTION OF AMMONIA THROUGH HABER'S PROCESS.

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## BACKGROUND

Ammonia is one of the most important chemicals used in industries for the commercial production of fertilizers and many other uses. It contributes significantly to the nutritional needs of terrestrial organisms by serving as precursor to food and fertilizers. The global production for ammonia was 176 million tonnes in 2014. Ammonia can be obtained by dry distillation of nitrogenous vegetable and animal waste products it can also be produced by the distillation of coal, but the most important process is Haber's process being used worldwide for the production of ammonia.

## DESCRIPTION OF FLOW SHEET

The  process starts with  mixing two streams of hydrogen at 1 bar and nitrogen at 8 bars which are introduced at 27 degrees and then   fed to the compressor where the pressure  is increased by 10 bar ,then they  are introduced into to the equilibrium  reactor  where ,in the presence of iron catalyst at a temperature of around 850 degrees  and at a pressure of  around 100  bar , occurs  an exothermic reversible reaction.

$$N_2+3H_2 \leftrightarrow 2NH_3 \qquad \Delta Hr = -91796.00 \text{ KJ/kg}$$

Ammonia is formed  along with some unconverted hydrogen and nitrogen . The formed ammonia is then passed through a  cooler, where it is cooled  by extracting heat from it .Then the stream containing mixture of ammonia ,hydrogen and nitrogen is send to the component separator  where  the upper stream consisting of hydrogen is   recycled back to the main stream of hydrogen  via cooler where the temperature is considerably decreased from 857 K to 300 K and the other stream from the component separator consisting of a mixture of nitrogen and ammonia is given to the another  component separator where pure stream of ammonia comes out as the main product and the nitrogen is again recycled back to the main stream via cooler .

**RESULTS:**

The stream wise results for the production is given as :

| | Reactor top | Reactor bottom | Hydrogen | Nitrogen | Main product | Recycle stream (hydrogen) | Recycle stream (nitrogen) |
|---|---|---|---|---|---|---|---|
| Temperature(K) | 863.415353 | 863.4153 | 300.00 | 300.00 | 857.7453 | 300 | 299.995 |
| Pressure(Pa) | 10,450,662.5 | 10,450,662.5 | 101325 | 800,000 | 9,450,662.50 | 101,325 | 800000 |
| Mass flow(kg/s) | 57.468410 | 0.00 | 26.50995 | 30.958376 | 8.38 | 25.021421 | 24.063207 |
| Molar flow(mol/s) | 13763.394778 | 0.00 | 13,150.5569 | 1,105.103 | 492026 | 12.412.15 | 858.970774 |
| Volumetric flow(m3/s) | 9.453911 | 0.00 | 323.822432 | 3.445437 | 0.371454 | 305.53 | 2.678056 |
| Mix density(kg/m3) | 6.078797 | 0.00 | 0.081866 | 8.985326 | 22.570170 | 0.081894 | 8.985326 |
| Mixture molar weight(kg/kmol) | 4.175453 | 0.00 | 2.015880 | 28.014000 | 17.031000 | 2.01546 | 28.014000 |

**REFERENCE:**
https://en.m.wikipedia.org/wiki/Ammonia.
www.chemguide.co.uk/physical/equilibria/haber.html