# Production of Acrylonitrile from Ammonia

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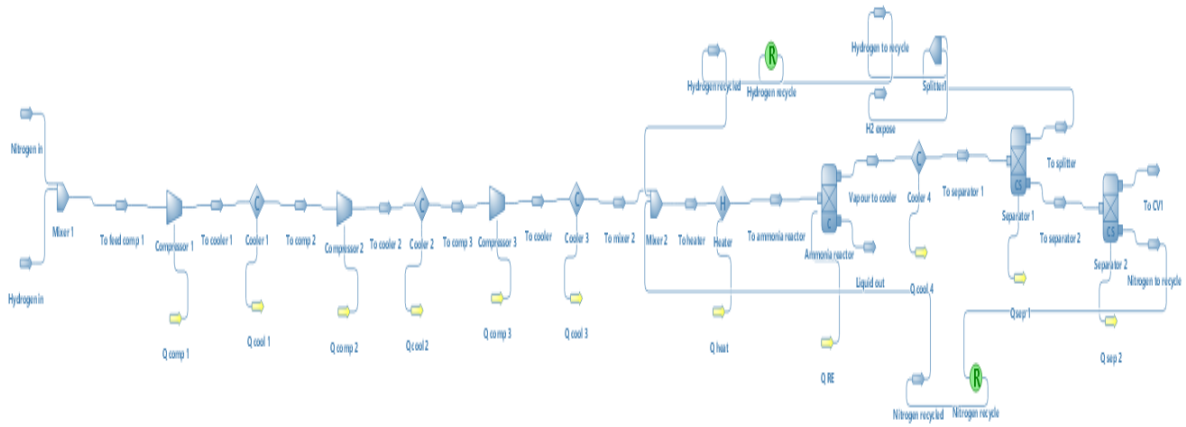
**Background & Description:**

Acrylonitrile is a highly reactive monomer and unsaturated hydrocarbon. It is used as a raw material in the production of fibres, dyes; anti-oxidants. Industrial production of acrylonitrile is done by Sohio process. Worldwide production of acrylonitrile is through Sohio process that is vapour phase ammoxidation of propene. The advantage of the process is the high conversion of reactants with minimum residence time. Air, Nitrogen, Hydrogen and propene are fed into the reactor operating at 7-8 bar pressure and 350 K-510 K with Mass flow of 3000 kg/hr for nitrogen & 9000 kg/hr for hydrogen & property package is taken as Peng Robinson, UNIFAC & NRTL , Ammonia and air should be supplied to the reactor in excess of stoichiometric proportions as excess air is needed for the regeneration of the catalyst and excess ammonia drives the reaction closer to the completion. Reaction is highly exothermic. The gaseous phase product stream is quashed in liquid phase through counter current water absorber to remove inert gases and recover reaction products. Mixtures of acrylonitrile, acetonitrile, carbon oxides and hydrogen cyanide are formed. Product surge is sent to the fractionator to remove hydrogen cyanide. Acrylonitrile is separated from acetonitrile by extractive distillation. Acrylonitrile obtained after extractive distillation is subjected for drying. Acetonitrile and hydrogen cyanide which are the primary by-products of the process are subjected to incineration. Incineration leads to the formation -nitrogen oxides, carbon oxides which are the primary pollutants.




**Production of Acrylonitrile from Ammonia**

**Results:**

Feed Stream Nitrogen in Results:

| | |
|---|---|
| Temperature | **25 C** |
| Pressure | **8 Bar** |
| Mass Flow | **3000 Kg/hr** |
| Molar Flow | **107.092 Kmol/hr** |
| Volumetric Flow | **331.19 $m^3$/hr** |
| Mixture Molar Enthalpy | **-60.8065 KJ/Kmol** |
| Mixture Molar Entropy | **-17.3537 KJ/(Kmol.K)** |
| Vapour Phase Molar Fraction | **1** |
| Phases | **Vapour** |
| Energy Flow | **-1.80885 KW** |

Feed Stream Hydrogen in Results:

| | |
|---|---|
| Temperature | **25 C** |
| Pressure | **8 Bar** |
| Mass Flow | **9000 Kg/hr** |
| Molar Flow | **4464.55 Kmol/hr** |
| Volumetric Flow | **13864.9 $m^3$/hr** |
| Mixture Molar Enthalpy | **-2.6161 KJ/Kmol** |
| Mixture Molar Entropy | **-17.2064 KJ/(Kmol.K)** |
| Vapour Phase Molar Fraction | **1** |
| Phases | **Vapour** |
| Energy Flow | **-3.24437 KW** |

Nitrogen to Recycle Stream Results:

| | |
|---|---|
| Temperature | **110 C** |
| Pressure | **100 Bar** |
| Mass Flow | **92.781 Kg/hr** |
| Molar Flow | **3.3102 Kmol/hr** |
| Volumetric Flow | **1.09347 $m^3$/hr** |
| Mixture Molar Enthalpy | **2136.12 KJ/Kmol** |
| Mixture Molar Entropy | **-31.884 KJ/(Kmol.K)** |
| Vapour Phase Molar Fraction | **1** |
| Phases | **Vapour** |
| Energy Flow | **1.96524 KW** |

Product Formed Acrylonitrile Results:

| | |
|---|---|
| Temperature | **110 C** |
| Pressure | **100 Bar** |
| Mass Flow | **3647.55 Kg/hr** |
| Molar Flow | **214.177 Kmol/hr** |
| Volumetric Flow | **8.42106 $m^3$/hr** |
| Mixture Molar Enthalpy | **-12372.4 KJ/Kmol** |
| Mixture Molar Entropy | **-64.6181 KJ/(Kmol.K)** |
| Vapour Phase Molar Fraction | **0** |
| Phases | **Liquid** |
| Energy Flow | **-736.081 KW** |