Synthesis of Ammonia

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INTRODUCTION

Ammonia Synthesis is a common chemical process carried out in plants all around the world. It consists of taking hydrogen (usually from methane or syn gas) and combining it with Nitrogen (generally separated out from the air) to form ammonia (N2 + 3H2 --->2 NH3). Ammonia is typically used for fertilizers, household cleaning products, and a main ingredient in some explosives.

Figure 1. Aspen model of Ammonia Synthesis process.

Figure 2. Model used to test Reactor Conversions

RESULTS

The Stochiometric Reactor is the ideal reactor but is unrealistic, so the CSTR was chosen based on its conversion at a reference temperature of 450°C (83%).

Optimal Temperature 425-475°C .

Optimal Pressure 80-90 Atm.

Leads to a final NH3 concentration of 90-94% after distillation.

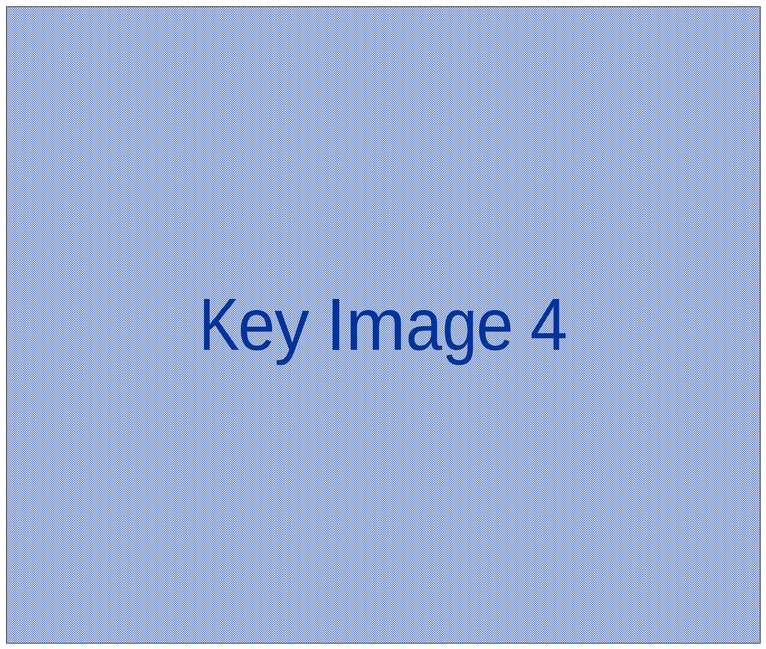

Figure 3. Temperature Sensitivity Around CSTR

CONCLUSIONS

Based on the results from the sensitivity analysis it can be concluded that 83% of your nitrogen can be consumed to form ammonia at a temperature of 450°C and a pressure of 135 atm, the operating conditions of the ideal reactor, using the CSTR. This will produce ammonia with a purity of 97% after distillation.

Figure 4. Pressure Sensitivity around CSTR

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