



# Ammonia Production without Molecular Hydrogen for use in Fertilizer Production

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## Small Scale Liquid Anhydrous Ammonia Production avoids Haber Process

Ammonia production usually requires the formation of molecular hydrogen followed by contacting the hydrogen with molecular nitrogen over a catalyst in the Haber Bosch process for ammonia synthesis, more commonly known as simply the Haber process. This concept for a small-scale liquid anhydrous ammonia reactor has the potential to allow for the production of ammonia on a distributed and as-needed basis from water vapor and air (nitrogen source). The ammonia reactor and process may also be able to produce ammonia at relatively low temperatures as well as atmospheric pressure. Once formed, ammonia can be used in fertilizer production.

**NOTE:** This technology has been demonstrated on very small lab scale only. This technology will require substantial additional process development and scale-up. It will also require analysis to show economic viability. The licensee company must be prepared and capable of transforming this technology into a commercially viable product.

## Ammonia Synthesis for Fertilizer Production Reduces the Demand for Foreign Imports like Natural Gas

The Haber process usually depends on the consumption of natural gas for the required molecular hydrogen inputs. In the United States in particular, the cost of ammonia has continued to rise due to a reliance on domestic imports of natural gasses that are rising in cost. This reactor would help eliminate the dependence on foreign natural gas imports required by traditional anhydrous ammonia production methods.

### FEATURES AND BENEFITS OF ANHYDROUS AMMONIA PRODUCTION REACTOR:

- Small scale reactor can be engineered for local production of ammonia
- Reactor operates at atmospheric pressure
- Reactor operates at lower temperatures than traditional Haber process
- Water vapor and air (nitrogen source) are the only inputs

### Researchers

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