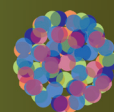


F5 FERTILISERS

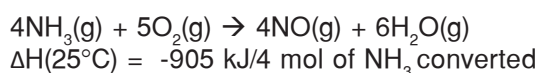
BUILDING FERTILISERS FROM MOLECULES 2



CHEMICAL
INDUSTRIES
RESOURCE PACK

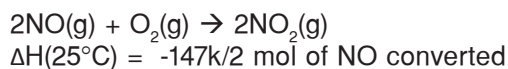
The Ostwald process

Once ammonia has been produced by the Haber process, it can be converted into nitric acid through a multi-step procedure known as the Ostwald process. In the first step in this reaction, ammonia and oxygen gas react, in the presence of a catalyst, to form nitrogen monoxide according to the following reaction:

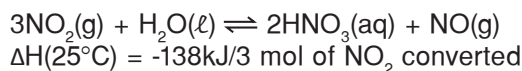


The reaction is quite exothermic. In the commercial reaction, the catalyst used is a platinum-rhodium metal gauze that is heated to about 900°C . However, even a hot copper wire can catalyse the reaction in the laboratory. Once the reaction has started, the energy it produces is enough to keep the catalyst hot enough to sustain the reaction.

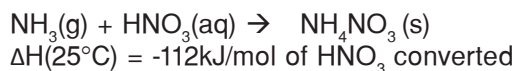
In the next step, the nitrogen monoxide (NO) reacts with oxygen to produce nitrogen dioxide (NO_2). No catalyst is required for this reaction.



Instead of storing the NO_2 , we can use it to produce nitric acid. The $\text{NO}_2(\text{g})$ reacts with water to produce nitric acid (HNO_3) and nitrogen monoxide (NO). The nitric acid is separated by distillation, and the NO can be recycled and reacted to form NO_2 through the above reaction.

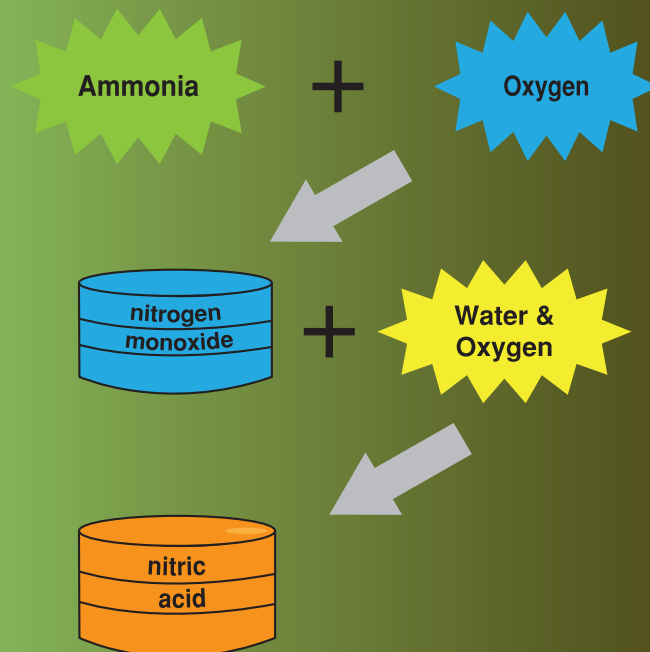


The nitric acid can then be used in the manufacture of countless numbers of different nitrogen-containing compounds. For example, ammonia will react with the nitric acid to produce ammonium nitrate, one of the most important forms of nitrogen fertilisers.

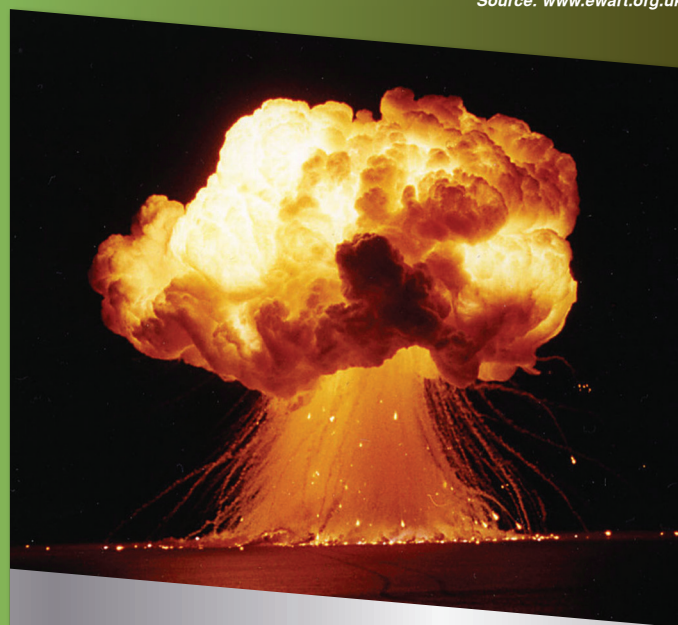


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Making nitric acid



Source: www.ewart.org.uk

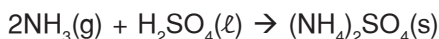


Did you know?

Ammonium nitrate is used as an explosive. It is also used in cold packs, as hydrating the salt is an endothermic process - it takes in heat and the reaction mixture will feel cold.

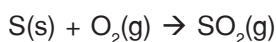
Sulfuric acid

There is a similar reaction of ammonia with sulfuric acid to produce ammonium sulfate that is also used as a fertiliser:

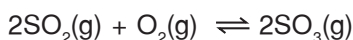


The manufacturing of sulfuric acid:

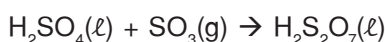
Sulfuric acid is manufactured using the contact process. Sulfur is reacted with oxygen according to the following reaction:



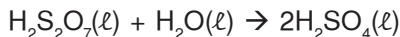
The sulfur dioxide is then converted into sulfur trioxide:



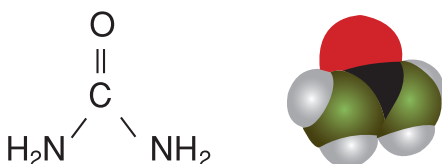
If water is added to sulfur trioxide sulfuric acid will be formed. However, this reaction is so uncontrollable that it creates a fog of sulfuric acid. Instead, the sulfur trioxide is first dissolved in concentrated sulfuric acid to form fuming sulfuric acid, or oleum:



This can then be reacted safely with water to produce concentrated sulfuric acid - twice as much as you originally used to make the fuming sulfuric acid.



Urea



Different representations of urea

Source: Wikimedia Commons

In 1828, the German chemist Friedrich Wöhler obtained urea by treating silver cyanate with ammonium chloride in a failed attempt to prepare ammonium cyanate.



This was the first time an organic compound was artificially synthesised from inorganic starting materials, without the involvement of living organisms. More than 90% of world production of urea is destined for use as a nitrogen-release fertiliser. Urea has the highest nitrogen content of all solid nitrogenous fertilisers in common use (46,7%). Therefore, it has the lowest transportation costs per unit of nitrogen nutrient.

This material was obtained from the book Molecules That Changed The World. Learners - if you use any part of it you need to write it in your own words and include the following in your reference list: Nicolaou, K. C.; Montagnon, T. 2001. Molecules that change the world. Wiley. 2001.

Fire at AECI factory in Somerset West

16 December 1995

A veld fire spread to stockpiled sulfur at the AECI factory in Somerset West. The 15 000 tons of sulfur ignited and smoke plumes quickly engulfed the nearby disadvantaged community of Macassar. Two young men died the same night, and an estimated 15 000 people were poisoned to varying degrees.

Pets also died, as did garden plants and crops as a result of acid rain. During the late 1990s the Desai Commission of Enquiry into the fire found AECI's conduct was "casually negligent". Now, following years of litigation, AECI has recently paid out an estimated R8 million to the victims of Macassar.

This article was published in the Helderberg Sun. Learners - if you use any part of it you need to write it in your own words and include the following in your reference list: Helderberg Sun. 2000. Fire at AECI factory in Somerset West. [Online]. Available: http://folc.ca/sulphur_storage/fires.htm [1 July 2010].

Disaster strikes Texas City

16 April 1947

The Texas City Disaster was a major 20th-century industrial accident in Texas City in the United States. The incident started with a mid-morning fire on board the French-registered vessel SS Grandcamp in the Port of Texas City. The fire detonated approximately 2 300 tonnes of ammonium nitrate and the resulting chain reaction of fires and explosions killed at least 581 people. The 32,5% ammonium nitrate, used as fertiliser and in high explosives, was manufactured in Nebraska and Iowa and shipped to Texas City by rail before being loaded on the Grandcamp. It was manufactured in a patented explosives process, mixed with clay, petrolatum, rosin and paraffin to avoid moisture caking. It was packaged in paper sacks, then transported and stored at temperatures that increased its chemical activity. Longshoremen reported the bags were warm to the touch prior to loading.

Attempts at control failed as a red glow returned after each effort. Shortly before 9:00, the Captain ordered his men to steam the hold, a firefighting method where steam is piped in to put out fires in the hope of preserving the cargo. The cargo hold and deck began to bulge as the forces increased inside. At 09:12, the ammonium nitrate reached an explosive threshold and the vessel then detonated, causing great destruction and damage throughout the port. The tremendous blast sent a 4,5 m wave that was detectable over nearly 160 km of the Texas shoreline.

This article was obtained from Wikipedia. Learners - if you use any part of it you need to write it in your own words and include the following in your reference list: Wikipedia.org. 2010. Texas City Disaster. [Online]. Available: http://en.wikipedia.org/wiki/Texas_City_Disaster [1 July 2010].