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Ammonia

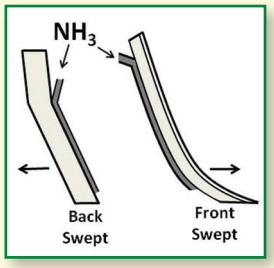
Module 3.3-3 Ammonia is the foundation for the nitrogen fertilizer industry. It can be directly applied to soil as a plant nutrient or converted into a variety of common N fertilizers. Special safety and management precautions are required.

Production. Almost 80% of the Earth's atmosphere is composed of N_2 gas, but it is in a chemically and biologically unusable form. In the early 1900s, the process for combining N_2 and hydrogen (H_2) under conditions of high temperature and pressure was developed. This reaction is known as the Haber-Bosch process:

[$3H_2 + N_2 \rightarrow 2\ NH_3$]

Chemical Properties

Anhydrous Ammonia (NH_3)	
N content:	82% N
Boiling Point:	-33°C (-27°F)
Aqua Ammonia (NH_4OH)	
N content:	20 to 24% N
pH:	11 to 12



A variety of fossil fuel materials can be used as a source of H_2, but natural gas (methane) is most common. Therefore, most NH_3 production occurs in locations where there is a readily available supply of natural gas.

Ammonia is a gas in the atmosphere, but is transported in a liquid state by compressing or refrigerating it below its boiling point (-33 °C). It is shipped globally in refrigerated ocean vessels, pressurized rail cars, and long-distance pipelines.

Agricultural Use. Ammonia has the highest N content of any commercial fertilizer, making it a popular source of N despite the potential hazard it poses and the safety practices that are required for its use. When NH_3 is applied directly to soil, it is a pressurized liquid that immediately becomes a vapor after leaving the tank. Ammonia is usually placed at least 4 to 8 inches below the soil surface, or in such a way to prevent its loss as a vapor back to the atmosphere. Various types of tractor-drawn knives and shanks are used to place the NH_3 in the correct location. Ammonia will rapidly react with soil water to form ammonium (NH_4^+), which is retained on the soil cation exchange sites. Ammonia is sometimes dissolved in water to produce aqua ammonia, a popular liquid N fertilizer. Aqua ammonia does not need to be injected as deeply as NH_3, which provides benefits during field application and has fewer safety considerations. Aqua ammonia is frequently added to irrigation water and used in flooded soil conditions.

Management Practices. Handling NH_3 requires careful attention to safety. At storage facilities and during field application, appropriate personal protection equipment must be used. Since it is very water soluble, free NH_3 will rapidly react with body moisture, such as lungs and eyes, to cause severe damage. It should not be transferred or applied without adequate safety training.

Immediately after application, the high NH_3 concentration surrounding the injection site will cause a temporary inhibition of soil microbes. However, the microbial population recovers as NH_3 converts to NH_4^+, diffuses from the point of application, and then converts to nitrate. Similarly, to avoid damage during germination, seeds should not be placed in close proximity to a recent zone of NH_3 application. Inadvertent escape of NH_3 to the atmosphere should be avoided as much as possible. Emissions of NH_3 are linked to atmospheric haze and changes in rain water chemistry. The presence of elevated NH_3 concentrations in surface water can be harmful to aquatic organisms.

Non Agricultural Uses. Over 80% of NH_3 production is used for fertilizer, either for direct application or converted to a variety of solid and liquid N fertilizers. However, there are many important uses for NH_3 in industrial applications. Household cleaners are made from a 5 to 10% solution of NH_3 dissolved in water (to form ammonium hydroxide). Because of its vaporization properties, NH_3 is used widely as a refrigerant.

Source: http://www.ipni.net/specifics