AMMONIA AS A REFRIGERANT

Zainab Gulisthan

Globally, there is growing interest in ammonia as a refrigerant. Restrictions on chlorine and fluorine containing refrigerants have focused attention on ammonia to emerge as one of the widely used refrigerants that, when released to the atmosphere, do not contribute to ozone depletion and global warming. Ammonia is an efficient refrigerant used in food processing and preservation, as well as much other refrigeration and air-conditioning processes. Ammonia has desirable characteristics as a refrigerant, which have been well known for over a century. It is corrosive and hazardous when released in large quantities. Because of its irritating odor, persons will not voluntarily stay near concentrations that is health threatening. Although ammonia will burn in a narrow range of high
Concentrations, it is difficult to ignite and will not support combustion after the ignition source is withdrawn.

BACKGROUND/HISTORY OF USE

Ammonia (chemical symbol NH_3) is produced both naturally and as a byproduct of numerous manmade reactive processes. Large amounts of naturally occurring ammonia gas come from live stock animals, soil surfaces, and even the human body. Manmade processes that emit ammonia to the atmosphere include fuel combustion processes and sewage treatment plants. The nitrogen component of ammonia was first recognized as an important fertilizer around 1840, and ammonia was first used as a refrigerant around 1850.

CURRENT USES OF AMMONIA

Ammonia is an alkaline, colorless chemical compound that is well recognized as the basis for household cleaning products, and also has many agricultural, industrial and commercial uses. It is available in four generally recognized grades - fertilizer, refrigerant, federal and metallurgical - depending on its level of purity. Refrigeration grade ammonia is 99.98 percent pure and is relatively free of water and other impurities. It is readily available, inexpensive, operates at pressures comparable with other refrigerants, and is capable of absorbing large amounts of heat when it evaporates.

REFRIGERATION USES OF AMMONIA

With increased regulation being placed upon the use of chlorofluorocarbon (CFC), hydrochlorofluorocarbon (HCFC) and hydrofluorocarbon (HFC) based refrigerants, and the pending phase-out of HCFCs altogether, alternative refrigerants for use in existing refrigeration systems are actively being investigated. These alternative refrigerants must have thermodynamic characteristics similar to those of halocarbons and be safe for humans and the environment.

Ammonia is one alternative refrigerant for new and existing refrigerating and air-conditioning systems. Ammonia has a low boiling point (-28°F @ 0 psig), an ozone depletion potential (ODP) of 0.00 when released to atmosphere, and a high latent heat of vaporization (9 times greater than R-12). In addition, ammonia in the atmosphere does not directly contribute to global warming. These characteristics result in a highly energy-efficient refrigerant with minimal environmental problems. From a purely economic analysis, without unnecessary regulatory burdens, ammonia should find broader applications as a refrigerant than it currently enjoys.

ENVIRONMENTAL ASPECTS

Ammonia is not a contributor to ozone depletion, greenhouse effect or global warming. Thus; it is an “environmental friendly” refrigerant. Ammonia has no cumulative effects on the environment and a very limited (a few days6) atmospheric lifetime. Because of the short lifetime of ammonia in the atmosphere, it is considered to be “biodegradable.” It is even used to reduce harmful stack gas emissions by injection into boiler and gas turbine exhaust streams. Ammonia may be released to the atmosphere by sources such as decaying organic matter, animal excreta, fertilization of soil, burning of coal, wood, etc., and by volcanic eruptions. Ammonia may be released to water as effluent from sewage treatment and/or industrial processes and as runoff from fertilized fields or areas of livestock concentrations.
Ammonia may be released to soils from natural or synthetic fertilizer applications, livestock excrement, the decay of organic material from dead plants and animals, or from the natural fixation of atmospheric nitrogen.

References

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