



Questions and Answers about Ammonium Hydroxide Use in Food Production

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Q: What is ammonium hydroxide?

A: Ammonium hydroxide is ammonia combined with water. Ammonia (NH_3) is a compound consisting of nitrogen and hydrogen. Both ammonia and ammonium hydroxide are very common compounds, found naturally in the environment (in air, water, and soil) and in all plants and animals, including humans. Ammonia is a source of nitrogen, an essential element for plants and animals. Ammonia is also produced by the human body – by our organs and tissues and by beneficial bacteria living in our intestines.

Ammonia plays an important role in protein synthesis in the human body. In brief summary, all living things need proteins, which are comprised of some 20 different amino acids. While plants and microorganisms can synthesize most amino acids from the nitrogen in the atmosphere, animals cannot. For humans, some amino acids cannot be synthesized at all and must be consumed as intact amino acids. Other amino acids, however, can be synthesized by microorganisms in the gastrointestinal tract with the help of ammonia ions. Thus, ammonia is a key player in the nitrogen cycle and in protein synthesis. Ammonia also helps maintain the body's pH balance.

Q: How is it used in food processing?

A: Ammonium hydroxide and other ammonia-containing compounds are used extensively in food processing. Food and Drug Administration (FDA) regulations affirm ammonium hydroxide as safe ("generally recognized as safe" or GRAS) for use as a leavening agent, a pH control agent, and a surface-finishing agent in food with no limitation other than current good manufacturing practice. 21 C.F.R. § 184.1139. See also National Academy of Sciences, Food Chemicals Codex, 5th Ed. (2004), p. 24.

Q: Has FDA determined that use of ammonium hydroxide in food processing is safe?

A: Yes. FDA affirmed ammonium hydroxide as GRAS in 1974 after extensive review of the scientific literature and a rulemaking process. Ammonium hydroxide was one of 235 substances that were subjected to a full safety review by the Select Committee on GRAS Substances (SCOGS), an independent committee of the Federation of American Societies for Experimental Biology (FASEB) that reported its findings to FDA. The SCOGS report to FDA concluded that:

"Ammonia and the ammonium ion are integral components of normal metabolic processes and play an essential role in the physiology of man.... the Select Committee concludes that: There is no evidence in the available information on.... ammonium hydroxide..... that demonstrates, or suggests reasonable grounds to suspect, a hazard to the public

when [it is] used at levels that are now current or that might reasonably be expected in the future.” Select Committee on GRAS Substances (SCOGS) Review, Report No. 34, 1974.

GRAS status means that a substance is generally recognized, among experts qualified by scientific training and experience to evaluate their safety, as safe for its intended use. See *generally* 21 C.F.R. § 170.30.

Ammonium hydroxide is also recognized as safe by other countries' and international food safety agencies. The Joint Expert Committee on Food Additives (JECFA) of the U.N.'s Food and Agriculture Organization (FAO) and World Health Organization (WHO) also recognizes ammonium hydroxide as safe for use in a wide variety of foods. Ammonium hydroxide is approved for use in food in most countries including the European Union.

Q: In what foods is ammonium hydroxide used in processing?

A: The list of foods in which ammonium hydroxide is used as a direct food additive is extensive and includes baked goods, cheeses, chocolates, other confectionery (e.g., caramel), and puddings. Ammonium hydroxide is also used as an antimicrobial agent in meat products.

Ammonia in other forms (e.g., ammonium sulfate, ammonium alginate) is used in condiments, relishes, soy protein concentrates/isolates, snack foods, jams and jellies, and non-alcoholic beverages.

The World Health Organization has listed hundreds of food types that may be processed using ammonium hydroxide when used in accordance with good manufacturing practices. These include dairy products, confections, fruits and vegetables, baked goods, breakfast cereals, eggs, fish, beverages such as sports drinks and beer, and meats.

Q: If ammonia is safe, why do I think of it as a harmful chemical?

A: Probably because ammonia is also used as a sanitizer in many household and industrial cleaners. Although necessary for life, too much ammonia is harmful. Ammonia vapor at levels higher than those found in common household cleaners is an irritant to the eyes, mucous membranes, and lungs. Consuming ammonia orally can cause burns to the mouth, throat, and stomach. Theoretically, it is possible to estimate a lethal oral dose of ammonia based on animal studies, but the amount would be so high that ingestion would be inconceivable. Ammonia has a strong odor and taste, so amounts that would be harmful are unpalatable and highly unlikely to be ingested.

Q: Is ammonium hydroxide in food processing a safe substance?

A: Yes, provided it is used in accordance with good manufacturing practices (e.g., only food grade ammonium hydroxide is used). It has been used safely for decades. As noted above, FDA affirmed ammonium hydroxide as GRAS after extensive study back in 1974, and it had been used in food processing long before that date.

Q: How does it work to kill pathogens in meat?

A: Many food pathogens, including dangerous forms of E. coli can be found in the intestines of cattle. They are able to survive and grow in the high acid tissues of animals. Ammonium hydroxide and other compounds can damage these organisms and lower the acidity of meats and other foods, making it difficult for these pathogens to survive.

Q: What about use of ammonium hydroxide in meat products?

A: Ammonium hydroxide can be used as an antimicrobial to control pathogens, such as E. coli O157:H7, which may be present in beef. In the treatment, naturally occurring levels of ammonium hydroxide in beef are increased slightly to create a pH that eliminates harmful bacteria. The U.S. Department of Agriculture (USDA), after consultation with

FDA, has determined that this use of ammonium hydroxide is safe. [FSIS Directive 7,120.1 Attachment (Substances accepted by FSIS as safe and suitable for use in the production of meat and poultry products)].

Even when consuming meat products that have been treated with an effective pathogen control measure, consumers should always follow proper safe handling practices and should and cook all meats to recommended internal temperatures. This information is available on the USDA website at:

http://www.fsis.usda.gov/Fact_Sheets/Basics_for_Handling_Food_Safely/index.asp.