



W. R. Grace & Co.-Conn. Aluminum Oxide Product Stewardship Summary

I. Overview

W. R. Grace & Co.-Conn. is a global manufacturer and distributor of synthetic non-fibrous aluminum oxide (CAS# 1344-28-1). The synthetic form of aluminum oxide is intentionally manufactured, thereby differentiating it from naturally occurring alumina found as the mineral corundum. Non-fibrous aluminum oxide was taken off the United States Environmental Protection Agency's (USEPA) chemical lists in 1988. The aluminum oxide manufactured by Grace is used in catalyst products.

II. Chemical Identity- Physical and Chemical Properties

Chemical Identity:

Substance Name: Aluminum oxide

EC Number: 215-691-6

CAS Number: 1344-28-1

Primary Synonym: Alumina

Other synonyms: Calcined alumina, synthetic boehmite

Physio-chemical Properties:

Molecular weight	101.96
Appearance/physical state/color	White odorless powder
Melting Point/freezing point	2000 °C
Boiling Point	2980 °C
Density (typical)	3.2 - 4
Vapor Pressure	1 hPa at 2158 °C
Water Solubility	Very low (0.00002 g/L at 20 °C)

Purity/Impurities/Additives:

95%+ with trace amounts of other metal oxides, sulfates and/or chlorides.

III. Applications

Of the pure, inorganic chemicals, aluminas are among the largest in volume produced in the world today. Aluminum oxide is typically placed on the market as a particulate material. The main use is as raw material for aluminum metal production, and it is also used as raw material for a number of articles and products. The fine-grain calcined alumina is a dense impermeable ceramic material used for abrasives, refractories, electrical insulation, high temperature crucibles, and dental restoration. It is also used as a filler for paints, glass, and ceramics. The porous, granular synthetic alumina manufactured by Grace is used in industrial applications either as a catalyst or catalyst support.

IV. Manufacturing Processes

Synthetic alumina is prepared primarily in three forms: activated alumina, smelter-grade alumina, and calcined alumina. The synthetic hydrated alumina manufactured by W.R. Grace is manufactured using a wet process that involves an alkali metal aluminum solution (sodium aluminate) and an acid salt of aluminum, aluminum sulfate. The process steps involve precipitation, filtration, washing, drying. The hydrated aluminum powder can then be formed into catalyst particles by extrusion, or incorporated into various catalyst mixtures as a powder. The size of the primary alumina particles and the amount of aggregation and agglomeration are determined by the manufacturing processes' reaction conditions, e.g. pH profile during precipitation, temperature, concentration, and amount of agitation.

Hydrated aluminas are generally manufactured using a well defined pH profile during the course of the precipitation, giving primary particles in the range of 1-5 nanometers (nm) that quickly adhere to form aggregates up to 5 micrometers (μm) upon drying. After precipitation, the various hydrated alumina products are filtered, and also washed to remove any salts. The product is then be dried either by flash or spray dryers. The final product is a white, fluffy or powdery amorphous form of hydrated alumina with a high degree of purity.

V. Health Effects

Aluminum is the third most abundant element on earth after oxygen and silicon. It comprises 8% of the earth's crust. It is by far the most abundant metal on earth and exists for the most part as oxides and silicates in nature. Because of its environmental abundance, human exposure to aluminum on a daily basis is difficult to avoid.

Oxides and hydroxides of aluminum can be found in over the counter antacid preparations and are free of toxicity in healthy individuals with normal kidney function. Aluminum oxides have a very low toxicity profile in human experience as well as animal test models by a variety of routes of exposure. Aluminum oxides are non-mutagenic, non-carcinogenic and do not represent a reproductive hazard in amounts that would reasonably be ingested. Despite the extremely low acute toxicity, the health effects of

aluminum are of interest in view of the widespread occurrence of the element in the environment and in commerce.

A single model for human toxicity has been documented in dialysis patients who, with the combination of over exposure to soluble aluminum from dialysis, aluminum containing medications, and compromised renal function developed a neurotoxic encephalopathy. There have been suggestions that aluminum is associated with the pathogenesis of Alzheimer's disease, however this has remained speculative for many years. Human ingestion of aluminum oxides and aluminum hydroxides has not been shown to be hazardous.

Human exposure to aluminum oxides and hydroxide, by routine routes of exposure and in quantities found in the environment, could be expected to be entirely benign. It has required intravenous introduction of aluminum in patients with absent renal function to induce any recognized toxicity in humans from such aluminum compounds.

VI. Environmental Effects

In the environment, aluminum oxides do not bio-accumulate. Aluminum oxide, just like aluminum hydroxide and aluminum metal is insoluble in water under standard conditions. Based on these physical-chemical characteristics, it is likely that under physiological conditions, the absorption and associated bioavailability of aluminum hydroxide, aluminum oxide and aluminum metal will be low. Acute and chronic testing has shown aluminum oxides are not toxic to aquatic organisms. Testing on terrestrial and sediment organisms have not indicated any adverse effects. In summary, aluminum oxide is ubiquitous in nature and manufactured aluminum oxide would be indistinguishable from oxides of aluminum found in nature.

VII. Conclusion

Synthetic non-fibrous aluminum oxide manufactured and distributed in products by Grace is safe and contributes to the standard of living in a wide range of applications. The principal known risk to human health presented by aluminum oxide dust is related to the concentration of dust in the air acting as a nuisance dust.

VIII. W. R. Grace Contacts

Please feel free to contact one of the following Grace representatives should you desire additional information or have questions.

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IX. References, Literature and Other Sources of Information

ATSDR. Agency for Toxic Substances and Disease Registry. 2008. Toxicological Profile for Aluminum September 2008. Atlanta, GA.: US Department of Health and Human Services, Public Health Service.

European Aluminum Association. Fact Sheet 9: Potential Health Effects from Exposure to Aluminum and Aluminum Compounds. 20110728.

Hazardous Substances Data Bank (HSDB), Toxicology Data Network, United States National Library of Medicine, HSDB Number: 7331

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