W. R. Grace & Co.-Conn.
Calcined Kaolin Product Stewardship Summary

I. Overview

W. R. Grace & Co.-Conn. is a global manufacturer and distributor of Calcined kaolin clay. The material is an inert inorganic and predominantly amorphous substance which is poorly soluble in water and exhibits a mean particle size of about 8 µm, but tends to form agglomerates of approx. 200-400 µm. Calcined kaolin clay may contain respirable quartz (crystalline silica) at <1%.

II. Chemical Identity - Physical and Chemical Properties

Name: Kaolin, calcined
CAS number: 92704-41-1
IUPAC name: Calcined kaolin
Molecular formula: not applicable (UVCB)
Molecular weight range: >= 229.33 — <= 250.95
Degree of purity: ca. 100.0 % (w/w)

Property (units)	Typical
Purity, % (by weight)	> 98.0
Impurity, % AlCl3 (by weight)	< 2.0
Color	White
pH	3.6-4.5
Tapped (bulk) density (g/L)	30-250
Particle size	
Primary particle (nm)	5-50
Aggregate (µm)	0.1-1
Agglomerate (µm)	1-250[1]

[1]Agglomerate particle size is typically 100 µm

III. Applications and uses

Calcined kaolin is used in a wide variety of applications that include industrial processes, agrochemicals, construction, agriculture, the paper, pulp and board industry as well as use in hygiene and sanitary products, cosmetics, pharmaceuticals and the food industry. Calcined kaolin has broad range of uses in these applications including serving as a binding agent, filler, fixing agent, heat transfer agent, catalyst support and processing aid.

IV. Manufacturing Processes

Calcined kaolin is produced by thermal treatment (calcination) of high-quality naturally occurring kaolin clay at a temperature greater than 450 °C and a heating time of approximately 30 minutes. The process typically converts 20-80% of the clay into calcined kaolin

The heating process drives off water from the mineral kaolinite ($Al_2Si_2O_5(OH)_4$), the main constituent of kaolin clay, and collapses the material structure, resulting in an amorphous aluminosilicate ($Al_2Si_2O_7$), metakaolinite. By calcining kaolin both the surface and chemically combined water are removed, rendering the clay non-plastic. The process is known as dehydroxylation, and presented by the following equation:

$Al_2Si_2O_5(OH)_4 + 2H_2O$ ---> $Al_2Si_2O_7 + 2H_2O$.

Thermal transformation of kaolinite, as studied in numerous investigations, has shown that heating parameters such as temperature, heating rate and time, as well as cooling parameters (cooling rate and ambient conditions) significantly influence the dehydroxylation process.

V. Health Effects

There are similarities amongst calcined kaolin, synthetic amorphous silica, and other nontoxic silicates in chemical structure, composition, production and processing in addition to similarities in physical and chemical properties. Although, there is limited experimental toxicology data on calcined kaolin, the toxicologic properties of this substance are assumed to be the same as that of synthetic amorphous silica. The health and toxicological information that is available on calcined kaolin, as well as physiochemical information, supports this assumption.

There is an extensive body of literature regarding synthetic amorphous silica and other silicates. These substances have a long history of safe use in commercial and consumer products. Amorphous silicas are applied to the skin and even ingested in food products. Synthetic amorphous silicas have nearly 100 year history of manufacturing and consumer use and they have been demonstrated to have very little potential for any adverse health effects. By extension calcined kaolin would be anticipated to be equally safe in any and all of its applications within industry and to the end consumer.

VI. Environmental Effects

When and if calcined kaolin finds its way into the environment at the end its life cycle, it is insoluble. It presents no hazard to drinking water or aquatic systems. It is anticipated that the substance would combine indistinguishably with soils or sediments. Since it is inorganic and insoluble it would not be expected to enter the food chain or drinking water. It has not been identified as toxic in any environmental tests or studies.

VII. Conclusion

Much like synthetic amorphous silicas, calcined kaolin is a safe product with a very low potential for adverse effects in humans, animals or on the environment. Most of the applications for calcined kaolin are in industrial settings. However, it also serves as the inert auxiliary agent in the manufacture of a variety of pharmaceuticals and as such enjoys a status GRAS (generally regarded as safe) when it is added to food, beverages, and pharmaceuticals.

In no animal study was calcined kaolin found to be toxic, carcinogenic, sensitizing or corrosive. Calcined kaolin is neither mutagenic nor a reproductive hazard. In the industrial settings of mining and milling, long term unprotected inhalation of kaolin in the presence of a number of other air contaminants has been seen to affect respiratory functions and lead to chest x-ray changes. In exposed workers, it is not certain that these findings are related to the inhalation of kaolin or other associated contaminants in the industrial environment. This extensive type of chronic inhalation exposure is not expected to occur in commercial applications for calcined kaolin.

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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