APPLICATION OVERVIEW

CAB-O-SIL® FUMED SILICA
AGRICULTURE AND LAWN CARE

CABOT®

Grow your investment

For years, Cabot has delivered meaningful value to commercial growers by producing high quality fumed silica that enables key benefits in agriculture:

- Enhancing seed germination rates in the field and retarding seed spoilage during storage
- Ensuring dry fertilizer and crop protection inputs can be evenly applied over farmland by optimizing free flow and by inhibiting caking during storage and application
- Ensuring that active ingredients in water- and oil-based dispersions can be uniformly applied over farmland by inhibiting agglomeration and settling in liquid products

Application overview

Commercial growers are focused on the next harvest, putting their investments into optimizing yield and value of their crops. They seek to maximize profits by enhancing the value of the crop output from land while minimizing costs.

Seed, nutritional and crop protection products are the farmers' tools, but they seek to enhance the efficiency with which these products are used to minimize costs. Cabot's fumed silica helps growers maximize yield and profits by performing a simple but critical function in the effective delivery of dry and liquid agricultural products to farmland.

Making the right decisions to help ensure better yield should include consideration of Cabot's fumed silica performance additives. Cabot can help growers protect their investment and achieve better returns across seed, nutrition, and crop protection inputs.

What Is Fumed Silica?

Fumed silica, also known as pyrogenic silica, is an amorphous, synthetic silica produced by vapor phase hydrolysis of chlorosilanes in a hydrogen oxygen flame. In the flame process, primary particles are fused into branched, three-dimensional secondary particles or aggregates. In the collection system, aggregates are mechanically entangled to form agglomerates. The appearance of fumed silica is a white, low bulk density powder. Figure 1.

The surface of untreated fumed silica has hydroxyl groups which makes the surface hydrophilic. Fumed silica can be made hydrophobic by chemically modifying the surface with hydroxyl groups. The degree of hydrophobicity is a function of the chemistry of the treating agent. Figure 2.

FIGURE 1

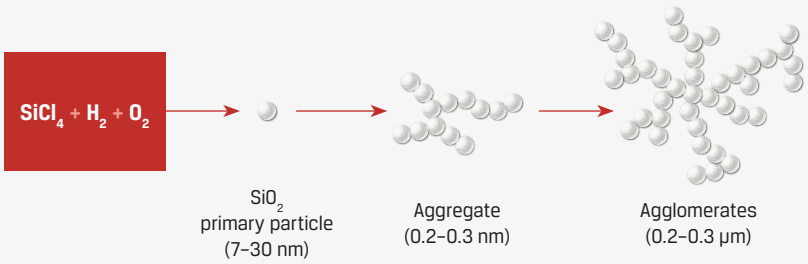
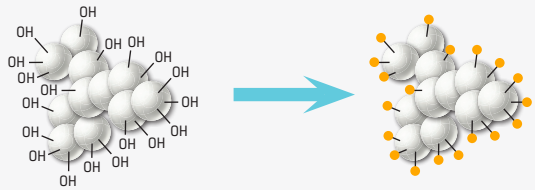


FIGURE 2



Fumed Silica as a Seed Coating

Commercial growers select top quality seed products proven to produce high quality yield across crops, regions, and growing conditions. When incorporated into seed coatings, Cabot's fumed silica delivers key benefits to farmers:

- it suppresses pre-mature germination by controlling the rate of moisture penetration, resulting in higher germination rates and crop yield
- it inhibits seed from rotting when stored in warehouses with moisture or elevated humidity, resulting in less waste for agriculture retailers and commercial growers

The moisture adsorption capacity of untreated fumed silica products increases with increasing surface area, or decreasing particle size. The addition of untreated (hydrophilic) fumed silica in a seed coating or granule can increase penetration of water through the coating or into a granule, whereas the addition of treated (hydrophobic) fumed silica in a seed coating can reduce or slow penetration of water through the coating to the seed.

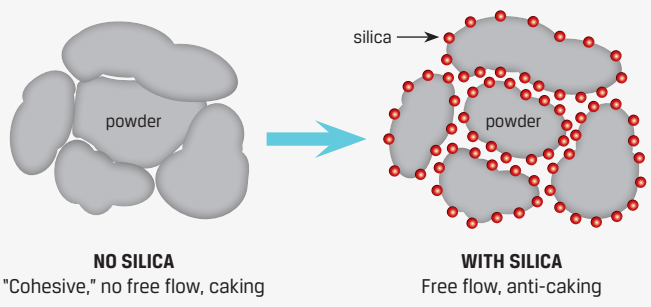
Fumed Silica for Dry Fertilizer Products

Commercial growers select proven plant nutrition products that work harder to help maximize yield potential and boost the profitability of every acre. Fumed silica delivers key benefits:

- When added to dry fertilizer or crop protection inputs, it acts as a free-flow aid that helps minimize dust and prevent caking, thus promoting even application of fertilizers. This improves the accuracy and precision of fertilizer applications and helps improve plant nutrition
- Hydrophilic fumed silica also enables easy dispersion of powder-based fertilizer or crop production inputs in water, so that active ingredients are evenly applied on fields

CAB-O-SIL fumed silica provides powder free-flow and anti-caking properties. It acts as a spacer between powder particles to reduce attractive forces. As the silica loading increases, the powder flowability improves, transforming fertilizer from sticky to free flowing. Figure 3.

FIGURE 3



NO SILICA
"Cohesive," no free flow, caking

WITH SILICA
Free flow, anti-caking

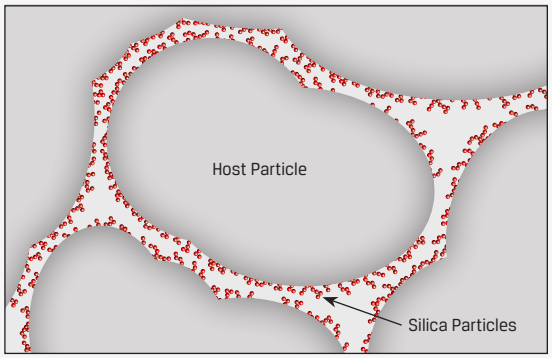
Fumed Silica for Water- and Oil-Based Dispersions

Commercial growers use trusted products to protect crops from diseases, weeds, and pests, thereby maximizing yield and profits. Fumed silica delivers critical benefits when added to water- and oil-based dispersions, including:

- Fumed silica promotes long-term suspension of active ingredients in water- and oil-based formulations
- By inhibiting agglomeration and settling of active ingredients, fumed silica allows a consistent concentration of active ingredients during application
- Fumed silica acts as an emulsion stabilizer and suppresses phase separation in liquids
- Fumed silica does not promote microbial growth and it forestalls clogging of nozzles

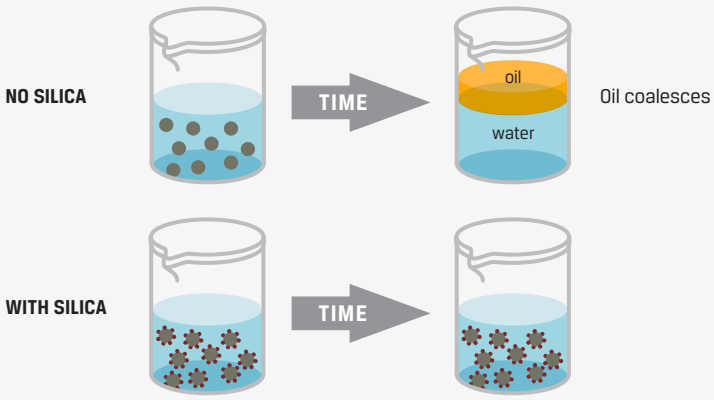
Anti-settling (Suspension)

CAB-O-SIL fumed silicas function as a rheology modifier, or thickener of liquids. The three-dimensional network (see below) of fumed silica particles in the liquid provides suspension or anti-settling of solids and insoluble ingredients.



Emulsion stabilization

Locating CAB-O-SIL fumed silica at the interface between the two phases in the liquid increases stability by preventing droplet coalescence. Fumed silica is compatible with both hydrophilic and oleophilic surfaces, can be a good choice as an inorganic, particulate emulsifier.



Fumed Silica in Lawn & Turf Applications

Cabot fumed silica delivers key benefits to both the Turf & Ornamental market as well as to homeowners who want a green, weed-free lawn. Professional turf applications include landscaping, sod management, golf course management and greenhouse growing. Customers in these markets rely on many of the same products used in agriculture, including dry and liquid nutrition and crop protection inputs. Cabot fumed silica performance additives help turf & ornamental customers meet their goals.

Turf & Ornamental customers use premium products in a range of specialty markets, all of which benefit from the addition of Cabot's fumed silica:

- When added to dry fertilizer or crop protection inputs, it acts as a flow aid and helps prevent caking, thus enabling even distribution of the products over the field or lawn
- When mixed with water- or oil-based crop protection inputs, fumed silica retards phase separation and settling and stabilizes emulsions, thereby ensuring that active ingredients are evenly dispersed over turf
- By reducing agglomeration of active ingredients, fumed silica also helps to prevent clogging of spray nozzles

Product Selection Guide

		CAB-O-SIL® FUMED SILICA PRODUCT			
Type of Crop Input	**Examples**	**Hydrophilicity**		**Hydrophobicity**	
Dry products	Powders, granules, seed	CAB-O-SIL M-5	○	CAB-O-SIL TS-610	○
		CAB-O-SIL H-5	◐	CAB-O-SIL TS-530	◐
		CAB-O-SIL EH-5	●	CAB-O-SIL TS-720	●
Liquid products	Suspensions	CAB-O-SIL M-5	○	–	
	Oil dispersions	CAB-O-SIL M-5	○	CAB-O-SIL TS-610	○
				CAB-O-SIL TS-720	●
	Emulsions	CAB-O-SIL M-5	○	CAB-O-SIL TS-610	○

Comparison is for constant silica loading

○ ◐ ● Lower → Higher

At Cabot, we are committed to developing new technology innovations as we work to achieve our sustainability goals and optimize the performance of our customers' products by increasing the efficiency of their formulations.

Watch your investment grow by applying fumed silicas to your products and for more information contact **Elizabeth.Sims@cabotcorp.com**.

NORTH AMERICA
Cabot Corporation Business
and Technology Center
157 Concord Road
Billerica, MA 01821-7001
USA
T +1 800 462 2313
F +1 978 670 7035

SOUTH AMERICA
Cabot Brasil Industria
e Comericio Ltda.
Rua do Paraiso 148 - 5 andar
04103-000 São Paulo,
Brazil
T +55 11 2144 6400
F +55 11 3253 0051

EUROPE
SIA Cabot Latvia
74A Gustava Zemgala gatve
Riga LV-1039
Latvia
T +371 6705 0700
F +371 6780 6478

MIDDLE EAST & AFRICA
Cabot Dubai
P.O. Box 17894
Jebel Ali Free Zone
LOB 15, Office 424
Dubai
United Arab Emirates
T +371 6705 0700
F +371 6705 0985

ASIA PACIFIC
Cabot China Ltd.
558 Shuangbai Road
Shanghai 201108
China
T +86 21 5175 8800
F +86 21 6434 5532

JAPAN
Cabot Specialty Chemicals Inc.
Sumitomo Shiba-Daimon Bldg. 3F
2-5-5 Shiba Daimon,
Minato-ku
Tokyo 105-0012
Japan
T +81 3 6820 0255
F +81 3 5425 4500

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cabotcorp.com

03/2021