

TECHNICAL INFORMATION 1365

SIPERNAT[®], ZEOFREE[®], and AEROSIL[®] for Spray Drying Operations



INTRODUCTION

Spray drying is a common process to isolate solid products from emulsions, dispersions or solutions. A wide range of products are produced by spray drying:

- **Food products**
(e.g., tomato powder, soup mixes, flavors, non-dairy creamer, egg powder)
- **Milk and Dairy products**
(e.g., milk powder, whey powder)
- **Feed products**
(e.g., calves' milk replacer, vitamin preparations)

- **Polymer and resin powders**
(e.g., re-dispersible powders, cellulose ethers, superplasticizers)
- **Agrochemicals**
(e.g., pesticides)
- **Pharmaceutical ingredients**
(e.g., celluloses, lactose, API preparations)

Although the powders are completely different, running a stable and cost-efficient process that achieves a product with high quality are common targets of all operators.

Effect of Evonik's silica and silicate products in spray drying operations

When feeding Evonik's SIPERNAT®, ZEOFREE® or AEROSIL® silica and silicate products into the spray tower, the silica or silicate binds to the drying particles and forms a protective layer on their surface. This protective layer of silica or silicate avoids agglomeration of the particles inside the tower, strongly reduces their stickiness and thereby prevents adhesion of the product

to the walls of equipment and piping. The flow behavior, quality and functionality of the dried powder in the long term, during transportation and storage when exposed to humidity, temperature and/or compression load will be strongly improved compared to an operation without the silica or silicate additives, having a positive influence on material quality.



Evonik silica keeps your spray tower clean

Figure 1 shows the effect of the hydrophobic fumed silica on a spray drying operation of a vinyl acetate acrylic terpolymer. With an addition of only 1 w.-% of the additive, the inside wall and lid of the spray

tower keeps clean. This guarantees a trouble-free long-time operation without cleaning shutdowns and improved yield, optimizing the production costs and sustainability.

Figure 1

View inside of a spray drying tower for the production of a vinyl acetate acrylic terpolymer after same time of operation.

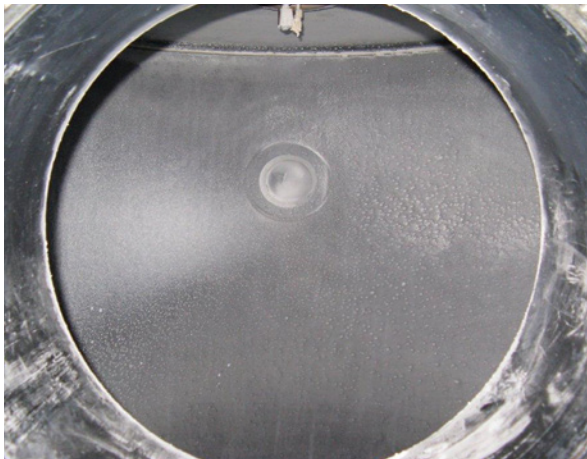


Figure 1a
1 % AEROSIL® R 972



Figure 1b
w/o silica

Processing recommendations

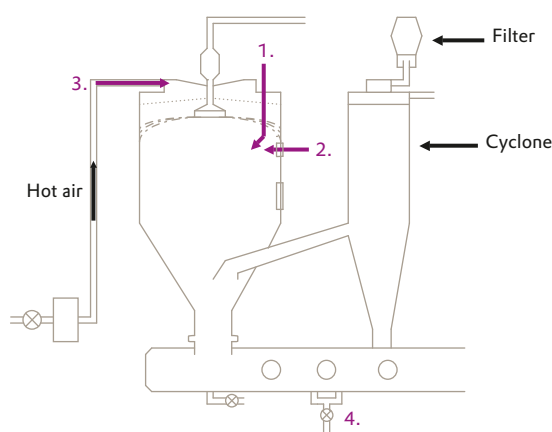
As rule of thumb, the performance improves with a higher and more homogeneous coverage of the spray dried particles with SIPERNAT®, ZEOFREE® or AEROSIL® silicas or silicates.

Hydrophobic silica grades such as SIPERNAT® D 17 precipitated silica or AEROSIL® R 972 fumed silica are water repellent and also disperse easier in the process. These features typically result in a better processability as well as improved long-term resistance against caking of the spray powder compared to hydrophilic silica grades. However, the hydrophobic layer built around the spray powder can have a negative influence on the use of such powders in aqueous formulations. Furthermore, hydrophobic silica grades can face regulatory restrictions in some applications (e.g., Food and Feed formulations) and vary on the region and/or countries. Therefore, we recommend addressing any concern directly to your sales and/or technical contacts at Evonik.

The place where the SIPERNAT® and ZEOFREE® precipitated silica or silicate or AEROSIL® fumed silica is fed into the spray drier is important for the performance of the additives. **Figure 2** shows options of different ways to introduce the silica or silicate into the operation. Preferentially, the silicas or silicates should be added with a gas phase close to the atomizer that generates the droplet which shall be dried. This can either be achieved through special dosages at the top or side of the spray tower (locations 1 or 2) or with the hot gas stream used for drying (location 3). Post-addition of the silica after the spray drier is another possibility but this will not keep the drier clean and will need additional mixing.

Figure 2

SIPERNAT®, ZEOFREE®, and AEROSIL® silicas or silicates can be dosed in different feed locations into the spray drying system



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Possible feed locations into the drying process are:

- | | |
|----------------------------------|---------------------------------|
| 1. Through the head of the tower | 3. In the hot drying gas stream |
| 2. At the top side of the tower | 4. Post-mixing step |

Product recommendation

Table 1 lists typical SIPERNAT® and ZEOFREE® precipitated silicas and silicates as well as AEROSIL® fumed silica grades used in industrial spray drying applications.

For specific applications with special requirements a full range of specialties not listed in the table is available.

The amount of SIPERNAT®, ZEOFREE® or AEROSIL® silicas or silicates to be used will depend on the application, the process configuration and the expected performance. As a guide, typical working ranges are

- Chemical applications: 0.5 % – 5 %
- Food applications: 0.5 % – 1 %
- Feed applications: 0.5 % – 3 %
- Agrochemical applications: 0.5 % – 5 %

For a more specific guidance on the selection of a specific SIPERNAT®, ZEOFREE® or AEROSIL® silicas or silicates please contact a representative of the technical service at Evonik.

Table 1

Typical SIPERNAT®, ZEOFREE® & AEROSIL® grades used in spray drying applications

Silica Grades	Characteristics	Comments
AEROSIL® R 972	Hydrophobic fumed silica	
AEROSIL® 200	Hydrophilic fumed silica	
AEROSIL® 200 F	Hydrophilic fumed silica	Special Food/Feed grade
AEROSIL® 380	Hydrophilic fumed silica	
AEROSIL® 380 F	Hydrophilic fumed silica	Special Food/Feed grade
SIPERNAT® D 17	Hydrophobic precipitated silica	
SIPERNAT® 22 S	Hydrophilic precipitated silica	Available with special Food/Feed specification
SIPERNAT® 50 S	Hydrophilic precipitated silica	Available with special Food/Feed specification
SIPERNAT® 340	Hydrophilic precipitated silica	Regulatorily restricted for Food/Feed use in Europe
SIPERNAT® 350	Hydrophilic precipitated silica	Available with special Food/Feed specifications
SIPERNAT® 380	Hydrophilic precipitated silica	Feed/Food contact registration in evaluation
SIPERNAT® 622 S	Hydrophilic precipitated silica	Available only in China
SIPERNAT® 820 A	Hydrophilic sodium aluminum silicate	
SIPERNAT® 823 A	Hydrophilic sodium aluminum silicate	Food/Feed regulations are only met in the Americas
SIPERNAT® 823 D	Hydrophilic sodium aluminum silicate	Food/Feed regulations are only met in the Americas
ZEOFREE® 5162	Hydrophilic precipitated silica	Available only in the Americas and Asia

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The Silica specialists at Evonik – Inside to get it right.