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NONCAKING SILICOFLUORIDE COMPOSITIONS

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1

The present invention relates to powdered silicofluoride compositions which do not form hard cakes when stored under adverse conditions of temperature and humidity.

Water-soluble silicofluoride salts, such as sodium, ammonium, magnesium, etc. salts, are widely used as laundry sours. Unfortunately, however, when the powdered silicofluoride salts are stored under conditions of high temperature and/or high relative humidity, they form hard cakes which are very difficult to break up. The difficulties associated with this pronounced caking tendency are obvious and, in spite of the diligent efforts of those skilled in the art, no practical method has heretofore been discovered to overcome this condition.

Accordingly, it is an object of this invention to provide powdered water-soluble silicofluoride compositions which do not cake when stored under conditions of high temperature and/or high relative humidity.

It has now been discovered that the caking tendency of the water-soluble silicofluoride salts can be eliminated or very substantially reduced by incorporating therein a minor amount of magnesium oxide. The quantity of magnesium oxide required to prevent caking will be dependent upon the particular silicofluoride salt in which it is incorporated as well as the physical characteristics of the magnesium oxide itself, but in general an amount in the range of 0.3–1.0%, by weight, is satisfactory. It will be recognized that concentrations less than 0.3% can be used where storage conditions are not particularly adverse and concentrations greater than 1.0% may also be employed. In particular, it is sometimes necessary to use magnesium oxide in amounts up to 2.0% or even more to effectively prevent the caking of zinc silicofluoride salts. The magnesium oxide employed should preferably be of a light grade, such as extra light calcined magnesia, having a bulk density of 10 lbs. per cubic foot or less.

The following examples are set forth to more clearly illustrate the principle and practice of this invention to those skilled in the art.

Example 1

The caking tendency of ammonium silicofluoride was determined by placing 75 grams of the salt in a 3.5" I. D. Petri dish and storing it in a humidor that was maintained at 104° F. and 75% relative humidity. By the end of 48 hours, the ammonium silicofluoride had formed a hard cake. Experience has shown that this so-called accelerated Petri dish storage test correlates well with actual caking tendencies under normal storage conditions.

2

A second ammonium silicofluoride composition was prepared by incorporating 0.3%, by weight, magnesium oxide in the ammonium silicofluoride described immediately above. The magnesium oxide was a light grade having a bulk density of 7.4 lbs. per cubic ft. This composition was also stored in an open Petri dish at 105° F. and 75% relative humidity, but unlike the pure ammonium silicofluoride it did not form a cake even after 18 days storage.

Example 2

Magnesium silicofluoride was subjected to the Petri dish storage test described in Example 1 and formed a very hard cake after 2 days. A second composition was prepared by incorporating 0.3% of the magnesium oxide described in Example 1 in the magnesium silicofluoride. Upon being stored 28 days, the composition containing the magnesium oxide formed only a slight, easily broken cake.

Example 3

A mixture of silicofluoride salts comprising 40% of the ammonium salt and 60% of the magnesium salt was subjected to the Petri dish storage test and formed a very hard cake after 2 days. When 0.4%, by weight, of the magnesium oxide described in Example 1 was incorporated in the above described mixture, the resulting composition did not form a cake even after 18 days.

Example 4

To illustrate the effect that the magnesium oxide concentration has upon caking tendency, the magnesium oxide described in Example 1 was incorporated into the mixed ammonium and magnesium silicofluoride described in Example 3 over a concentration range of 0.05–1.0%, by weight. The results of the Petri dish storage test are set forth in the table below:

MgO Concentration, Weight Percent	Comment
0.05	Caked hard in less than 4 days.
0.1	Do.
0.2	Caked hard in 5 days.
0.3	Formed slight cake in about 18 days.
0.4	No caking in 18 days.
0.8	No caking in 28 days.
1.0	Do.

It is seen from the above table that the caking

tendency decreases with increasing magnesium oxide concentration and that excellent anticaking properties are obtained at less than 1% magnesium oxide content with the particular silicofluoride salt combination tested. Other data indicate that with the zinc silicofluoride salt, the concentration of magnesium oxide should be increased to approximately 1–2%.

The manner in which magnesium oxide functions to prevent the caking of water-soluble silicofluoride salts is not presently known. However, it appears to be unique and specific in its action in that many chemically related compounds are not effective in preventing such caking. For example, magnesium citrate, trisodium pyrophosphate, magnesium chloride, magnesium sulfate, sodium metaphosphate, calcium carbonate, calcium oxide, magnesium carbonate, starch, talcum, magnesium silicate and zinc oxide were tested, but found to be ineffective in preventing the caking of water-soluble silicofluoride salts.

What is claimed is:

1. A mixture consisting essentially of a compound selected from the group consisting of ammonium, magnesium and zinc silicofluorides and mixtures thereof and containing in intimate admixture therewith a minor proportion of magnesium oxide not in excess of 5%, but in an amount sufficient to prevent caking.

2. A mixture consisting essentially of a compound selected from the group consisting of ammonium, magnesium and zinc silicofluorides and mixtures thereof and containing in intimate admixture therewith a minor proportion of a light magnesium oxide not in excess of 5%, but in an amount sufficient to prevent caking, said magnesium oxide having a density of less than about 10 pounds per cubic foot.

3. A mixture consisting essentially of a compound selected from the group consisting of ammonium, magnesium and zinc silicofluorides and mixtures thereof and containing in intimate admixture therewith approximately 0.3–1.0%, by weight, of a light grade magnesium oxide having a density of less than about 10 pounds per cubic foot.

4. A mixture consisting essentially of ammonium silicofluoride and containing in intimate admixture therewith approximately 0.3–1.0%, by weight, of a light grade magnesium oxide having a density of less than about 10 pounds per cubic foot.

5. A mixture consisting essentially of magnesium silicofluoride and containing in intimate admixture therewith approximately 0.3–1.0%, by weight, of a light grade magnesium oxide having a density of less than about 10 pounds per cubic foot.

6. A mixture consisting essentially of a mixed water-soluble silicofluoride salt (approximately 40% ammonium silicofluoride and 60% magnesium silicofluoride) and containing in intimate admixture therewith approximately 0.3–1.0%, by weight, of a light grade magnesium oxide having a density of less than about 10 pounds per cubic foot.

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