United States Patent Office 3,428,571
Patented Feb. 18, 1969

3,428,571

ADDITIVE FOR INHIBITING CAKING AND FREEZING OF SODIUM CHLORIDE AND FOR INHIBITING CORROSION IN THE PRESENCE OF SODIUM CHLORIDE BRINE

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No Drawing. Filed May 10, 1966, Ser. No. 548,838
U.S. Cl. 252—383 2 Claims
Int. Cl. C09j 3/00

ABSTRACT OF THE DISCLOSURE

A mixture of a block type copolymer of ethylene and propylene oxides, calcium chloride, sodium ferrocyanide decahydrate and an ammonium salt of an amido-polyphosphate as an additive for inhibiting caking and freezing of bulk particulate sodium chloride and for inhibiting corrosion which may occur incidental to the formation of brine solutions therefrom.

This invention relates to additives for particulate sodium chloride and is directed in particular to an additive having the simultaneous characteristics of inhibiting caking and freezing of sodium chloride and of inhibiting corrosion which may occur incidental to the presence of a sodium chloride brine.

The use of bulk particulate sodium chloride for the control and removal of ice and snow on vehicular thoroughfares has gained wide acceptance within recent years. Consequently, the storage and shipment of large quantities of bulk salt is involved in highway ice and snow control. Historically, the earliest problem encountered with respect to the shipment and storage of such salt was that of caking and it was also the first solved. The solution to this problem lies in the discovery that the addition of minor amounts of one or more water soluble complex iron cyanides will inhibit caking, see Patent No. 3,036,884, issued May 29, 1962. Next it was discovered that freezing of the salt mass, even when treated as above, particularly while in transit during winter months, can be a serious problem in this field. Since it is well known that caking and freezing of bulk particulate sodium chloride are separate and distinct phenomena, it is not surprising that the aforesaid water soluble complex iron cyanide anti-caking additives had little effect on the freezing tendency of bulk particulate sodium chloride.

However, it has been discovered recently that certain formulations comprising a synthetic surface active agent and either or both calcium chloride together with a water soluble complex iron cyanide are effective to inhibit both caking and freezing of bulk particulate sodium chloride. For complete details on such formulations, reference is had to our co-pending previous applications: 345,859, filed Feb. 19, 1964 and now abandoned; 443,668, filed Mar. 29, 1965 now Patent No. 3,378,493; 466,060, filed June 22, 1965 now Patent No. 3,382,175; 466,409, filed June 23, 1965 now Patent No. 3,383,317 and 467,739, filed June 28, 1965.

In addition to the aforesaid problems of caking and freezing, the additional problem of corrosion which may occur incidental to the presence of sodium chloride brines presents itself. The mechanism of corrosion associated with the use of rock salt for snow and ice removal, and particularly as it affects automobiles and structural metal elements along a highway (i.e., bridges, manhole covers, metal gratings and the like), is unquestionably of complex character particularly when one considers the fact that the strength of the brine solutions which may be involved

will vary over a wide range, from very dilute to fully saturated. Although the mechanism is complex, it is known that corrosion in sodium chloride brines, proceeds more rapidly in the presence of dilute sodium chloride brines, being at a maximum at about 2.5% brine, and that the effect diminishes rapidly from this maximum so that after about 15–20% brine strength the effect is relatively insignificant.

In connection with the last mentioned additives, it was observed that they displayed tendencies, in varying degrees, to inhibit corrosion of ferrous metals exposed to brines consisting of aqueous solutions of sodium chloride treated with the additives. If, however, one compares the anti-corrosive effects of these additives with the effect produced by well known anti-corrosion agents for sodium chloride brines, as for example sodium chromate or sodium hexametaphosphate, such additives do not compare with sufficient favor as to deserve commercial attention in this respect. At the same time, there is a need for an additive of the nature described having, in addition to its anti-caking and anti-freezing characteristics, the ability to combat corrosion to a degree which at least compares favorably with, and preferably surpasses, the effect of conventional anti-corrosion agents as aforesaid.

The present invention is concerned with such a multi-purpose additive. This invention is specifically directed to the discovery that a particular one of the formulations according to the aforementioned co-pending applications, when combined with another compound, not normally considered as an anti-corrosion agent, attains such a high degree of anti-corrosion effect as to equal or surpass the anti-corrosion effect of agents conventionally used with sodium chloride brines and does so without degrading the anti-freezing or anti-caking properties.

Specifically, we have found that one of the basic anti-caking and anti-freezing additives disclosed in application Ser. No. 443,668 and consisting of Pluronic L–35 (available from Wyandotte Chemical Co., Wyandotte, Mich.), calcium chloride, and a water soluble complex iron cyanide may be combined with Victamide (available from Victor Chemical Division of Stauffer Chemicals, New York, N.Y.) to produce an additive for bulk particulate sodium chloride which possesses all of the above characteristics and in which the anti-corrosion effect equals or surpasses that of conventional sodium chloride brine corrosion inhibitors.

A preferred embodiment of this invention is as follows:

	Pounds
Calcium chloride	4
Sodium ferrocyanide decahydrate	.4
Pluronic L–35	.1
Victamide	10

and when these materials are thoroughly mixed with and added in the amount specified to one ton of bulk particulate sodium, corrosion associated with brine solutions formed from such treated sodium chloride will be reduced by a factor of several times as compared with the use of a like amount of sodium chromate or sodium hexametaphosphate. The amount of Victamide may be varied to constitute as little as one pound per ton but as this level of concentration and up to about five pounds of Victamide in the above formulation, the additive produces an anti-corrosion effect which is only about on a par with the effect produced by the conventional agents.

The proportion of the calcium chloride, water soluble complex iron cyanide and Pluronic L–35, as pointed out in our copending application 443,668, may be varied. The calcium chloride must be present at least in the amount which would constitute three pounds of calcium chloride per ton of sodium chloride, taking into consideration the amount of calcium chloride which may be present natu-

rally in the sodium chloride. The water soluble complex iron cyanide should be present in the range of about .13–.22 pounds of ferrocyanide ion per ton of sodium chloride.

Pluronic L–35 is a block type copolymer of ethylene and propylene oxides and may be made according to the disclosure of Patent No. 2,674,619. In general, the material is prepared by adding propylene oxide to the two hydroxy groups of a propylene glycol nucleus. To both ends of this resulting hydrophobic base are added hydrophilic polyoxyethylene groups to constitute 50% of the final molecule. The molecular weight of the copolymer is approximately 1900.

Victamide is an ammonium salt of an amido-polyphosphate and has the following typical analysis:

	Percent
P_2O_5	76.1
NH_3:	
Free	15.4
Total	22.4
Amide N as NH_3	7
pH (1% solution)	5.6

Specifically, based upon one part of Pluronic L–35, the calcium chloride may be present within the range of about 30 to about 200 parts by weight, the Victamide may be present in about 10 to about 400 parts by weight and the water soluble complex iron cyanide may be present in an amount to provide 1.3–8.8 parts by weight of ferrocyanide ion. The source of the ferrocyanide ion may be any water soluble complex iron cyanide in which the water solubility is of classical nature.

What is claimed is:

1. An additive for inhibiting caking and freezing tendencies of bulk particulate sodium chloride and for inhibiting corrosion which may occur incidental to the formation of brine solutions therefrom, which consists of:

one part by weight of a block type polyol copolymer of ethylene and propylene oxides having a molecular weight of about 1900 and substantially equal amounts of the two oxides,

about 30–200 parts by weight of calcium chloride,

sodium ferrocyanide decahydrate providing ferrocyanide ion in about 1.3–8.8 parts by weight,

and about 10–400 parts by weight of an ammonium salt of an amido-polyphosphate having the following typical analysis:

	Percent
P_2O_5	76.1
NH_3:	
Free	15.4
Total	22.4
Amide N as NH_3	7
pH (1% solution)	5.6

2. The additive according to claim **1** wherein the calcium chloride is present in the amount of 40 parts by weight, the sodium ferrocyanide decahydrate is present in the amount of 4 parts by weight and the ammonium salt of an amido-polyphosphate is present in the amount of 100 parts by weight.

References Cited

UNITED STATES PATENTS

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U.S. Cl. X.R.

252—70, 194; 99—143; 252—385