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COMPOSITION FOR DUSTPROOFING COAL

John Fred Miller, Lakewood, Ohio, assignor to
Solvay Sales Corporation, New York, N. Y., a
corporation of New York

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This invention relates to a process for dustproofing coal. More particularly, this invention relates to an improvement in the art of dustproofing coal with calcium chloride, which improvement permits a reduction in the amount of calcium chloride required to accomplish effective dustproofing and effects the production of substantially non-corrosive, dustproof coal.

It is well known that coal upon handling tends to develop a considerable quantity of dust which is the cause of appreciable nuisance to the handler of the coal and renders the coal unsightly in appearance, thus detracting from its sales value; hence, the desirability of dustproofing the coal has long been recognized. It has been suggested that to accomplish this purpose coal may be treated with a solution of calcium chloride so as to form a hygroscopic layer on the surface of the coal which, by virtue of the water absorbed thereby, would serve to lay the dust on the coal; however, the corrosive effect of calcium chloride upon metallic equipment with which the coal comes in contact detracts from the value of this treatment. In an endeavor to accomplish dustproofing of coal without rendering the dustproofed coal corrosive to metallic equipment, it has been proposed that the coal be sprayed with a heavy mineral oil so as to lay the dust. However, to effectively dustproof coal in this manner the oil must be uniformly distributed thereon, which in practice is difficult to accomplish, particularly with coal having surface moisture. Further, the oil treatment tends to be somewhat impermanent due to absorption of the oil by the coal with the consequent destruction of the dustproofing layer. Since the only practical way of applying the oil to the coal is by spraying the oil thereon, a considerable fire hazard is engendered by the use of such an oil spray for treating large quantities of coal. In addition, the oil on the coal tends to stain any surface with which it may come in contact and does not, therefore, satisfy the demand of coal dealers for a clean fuel, even though it may prevent the formation of dust.

In order to remedy the above difficulties several compositions have been developed containing either calcium chloride or oil, or both these materials, designed to accomplish effective dustproofing of the coal without causing the coal to become corrosive to metallic equipment with which it comes in contact. To the best of my knowledge, however, none of these compositions are satisfactory from an economic standpoint and in many cases they are somewhat difficult to pre-

pare in a form suitable for application to the coal, so that the average mine operator or coal dealer cannot readily be persuaded to employ them. As a result, a cheap and effective composition for dustproofing coal is still greatly desired by the coal industry.

It is an object of this invention to provide calcium chloride compositions capable of being used for dustproofing coal without imparting corrosive characteristics to the coal.

It is another object of this invention to provide calcium chloride compositions capable of effectively dustproofing coal with the consumption of substantially less of the calcium chloride than when calcium chloride alone is used.

Another object of this invention is to provide a new, efficient and highly economical process for dustproofing coal.

In accordance with this invention coal is dustproofed by the application thereto of an aqueous solution containing calcium chloride and an alkali metal sulfate of an organic alcohol selected from the group consisting of branched-chain primary and secondary alcohols containing from 11 to 15 carbon atoms, the side chains of which contain not more than 4 carbon atoms and the hydroxyl group being located on a carbon atom other than one of the terminal carbon atoms of the longest carbon chain of the alcohol, and preferably relatively small amounts of a substance which inhibits corrosive action of the calcium chloride. I have surprisingly found that effective dustproofing of the coal with the compositions of my invention may be effected with the consumption of an amount of the calcium chloride substantially less than the amount of calcium chloride which would be required to accomplish the same dustproofing effect if an aqueous solution of this substance alone were employed; therefore, the use of the compositions of my invention for dustproofing coal is considerably more economical than the use of a straight calcium chloride solution as heretofore practiced. Furthermore, the compositions of my invention are more completely absorbed by the coal than are compositions containing only calcium chloride and this factor, combined with the fact that less calcium chloride may be used, serves to greatly diminish the inherent corrosiveness of such compositions so that by the use of my compositions dustproof coal may be produced which is substantially non-corrosive. In addition, no inflammability hazards, such as are present in the treatment of coal with oil, are involved in the application of the compositions of my invention.

to coal. The compositions of my invention may be applied to untreated coal or to coal which has previously been treated with oil, as is frequently the case with coal received from mines, since the presence of the sulfated alcohol in my compositions neutralizes the repellent effect normally exerted by oil toward an aqueous solution of calcium chloride. It will be evident, therefore, that because of the simple, safe and economical procedure for dustproofing coal provided by the use of the compositions of my invention, these compositions constitute exceedingly suitable materials for dustproofing coal on a commercial scale.

The use of an alkali metal sulfate of an organic alcohol selected from the group above set forth is of importance in achieving the desirable results of my invention, since the wetting characteristics of this class of materials are such that their presence permits the desired reduction in the amount of calcium chloride required to effect dustproofing of the coal, effects more uniform distribution of the calcium chloride over the surface of the coal, preventing formation of highly corrosive droplets of calcium chloride solution on the coal, and enhances absorption of the compositions by the coal; chiefly because of these factors, coal dustproofed with solutions of calcium chloride containing such sulfated alcohols is considerably less corrosive than coal treated with a solution containing only calcium chloride. These sulfated alcohols display unique properties when admixed with calcium chloride solutions. Thus, for example, tests were conducted in which a definite amount of bituminous coal was placed on the surface of aqueous solutions containing such sulfated alcohols and other sulfated or sulfonated surface active agents, and the time required for the coal to sink in these solutions measured; the results of tests established that the wetting characteristics of the sulfated alcohols selected from the above group were not appreciably better than, and in some cases were definitely inferior to, other sulfated or sulfonated surface active agents, several minutes being required for the coal to sink in each case. However, the same amount of coal sank in solutions containing calcium chloride and a small amount of a sulfated alcohol of the above type with extreme rapidity, e. g., 30 seconds in one test; calcium chloride alone is not responsible for this unusual effect since the coal remained floating indefinitely in a straight calcium chloride solution of the same concentration. These tests also established sulfated or sulfonated surface active agents which do not fall within the above group cannot satisfactorily be used in admixture with calcium chloride since they are either not soluble in the calcium chloride solution, react with the calcium chloride present in this solution to form insoluble calcium salts which precipitate, or, if soluble in such solutions without the formation of calcium precipitates, they do not have wetting characteristics such that a marked reduction of the amount of calcium chloride needed to dustproof the coal may be realized.

The sulfated alcohol I prefer to employ in the preparation of the compositions of my invention is the sodium salt of the sulfated 7-ethyl 2-methyl undecanol-4 since this substance is readily available, is very compatible with calcium chloride and is extremely effective in reducing the amount of calcium chloride needed to dustproof the coal to be treated. However, other sulfated alcohols derived from alcohols selected from the group consisting of branched-chain primary and sec-

ondary alcohols containing 11 to 15 carbon atoms, the side chains of which contain not more than 4 carbon atoms and the hydroxyl group being located on a carbon atom other than the terminal carbon atoms of the longest carbon chain of the alcohol, may also be employed; as an example of such substances there may be mentioned 3,8 diethyl nonanol-6 and 3-ethyl 8-methyl decanol-6.

The corrosion inhibitor preferably employed in accordance with my invention may suitably be a soluble chromium compound having inhibiting action, preferably a hexavalent chromium compound such as sodium or potassium dichromate. However, other hexavalent chromium compounds such as ammonium or sodium chromate or complex salts containing ammonium and chromium may be employed as well as organic chromium-containing inhibitors such as the chromglucosates. Furthermore, other inhibitors such as those extracted from the destructive distillation of organic products and sold under the name of "Rodines" may be utilized.

The proportions of the ingredients in my novel compositions may vary considerably. Thus, for example, the amount of the sulfated alcohol present in the compositions may vary, depending particularly upon the type of coal treated, since if a porous coal, such as Illinois coal, is to be treated, less of the sulfated alcohol should be used than when a relatively nonporous coal, such as Pocahontas coal, is dustproofed; however, generally an amount of sulfated alcohol equivalent to from 0.03% to 2.0% of the total solid content of the compositions is suitable. The proportion of the corrosion inhibitor preferably included in the compositions may vary, depending upon the effectiveness of the particular inhibitor employed, but generally between about 0.03% and about 2.5% of the total solid content of the compositions is suitable. The calcium chloride content may vary from 70% to 99.9% of the total solid content of the compositions.

Aqueous solutions of the compositions of my invention may be prepared in a form for direct application to coal by simply adding calcium chloride, the sulfated alcohol and, as is preferred, the corrosion inhibitor to a suitable amount of water and agitating the mixture so as to form a solution. However, from a marketing standpoint it is desirable to make up solid compositions containing the calcium chloride, sulfated alcohol and, preferably, the corrosion inhibitor for sale to coal dealers who may then prepare the aqueous solutions for treating the coal by merely dissolving the mixtures in water. Such solid compositions may be prepared by merely admixing the various ingredients, provided the sulfated alcohol is in solid form and not in an aqueous solution, to form a homogeneous mass. Frequently, however, it is desirable to utilize an aqueous solution of the sulfated alcohol, since sulfated alcohols of the above type are usually marketed in the form of their aqueous solutions by the manufacturers thereof. In such a case the compositions may be prepared by mixing the aqueous sulfated alcohol solution with an inert water-soluble material such as salt, sugar or lignin waste (Goulac) in order to form a paste, and then blending the paste with the remaining ingredients of the composition. Furthermore, the small amount of the sulfated alcohol solution required for use in the preparation of my compositions may, if desired, be added directly to the center of the desired amount of calcium

chloride, whereby it becomes absorbed therein without liquefying the mass. The composition may also be formed into briquettes in any suitable manner and sold as such.

The aqueous solution containing the calcium chloride compositions of my invention may be applied to the coal in any suitable manner, preferably by spraying the coal therewith, although the coal may be dipped in the solution, drained and permitted to dry, if desired. The coal so treated may be substantially as mined or may have oil thereon from an oil dustproofing treatment. The concentration of the aqueous solution employed may vary but preferably a solution containing between about 10% and about 50% solids is employed. It will be found in every case that dustproofing of the coal may be accomplished employing an amount of calcium chloride considerably less than would be required if a straight calcium chloride solution were used; in some cases, for example, effective dustproofing of the coal may be accomplished employing an amount of my compositions containing about one-half the amount of calcium chloride that would be required to effect dustproofing of the coal if a solution containing the same concentration of calcium chloride alone were used. None of the substances contained in my compositions detrimentally affects the combustibility of the coal.

In view of the above it will be evident the compositions of my invention constitute an important forward step in the art of dustproofing coal and, hence, will be of interest to those engaged in the marketing of this important fuel in a clean, dustless condition.

Since certain changes may be made in carrying out the above process and certain modifications in the compositions which embody the invention may be made without departing from its scope, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A composition for dustproofing coal comprising calcium chloride and relatively small amounts of an alkali metal sulfate of an organic alcohol selected from the group consisting of branched-chain primary and secondary alcohols containing from 11 to 15 carbon atoms, the total number of carbon atoms in the side chains being not in excess of 4 and the hydroxyl group being located on a carbon atom other than the terminal carbon atoms of the longest carbon chain of the alcohol.

2. A composition for dustproofing coal comprising calcium chloride and relatively small amounts of a substance which inhibits the corrosive action of calcium chloride and an alkali metal sulfate of an organic alcohol selected from the group consisting of branched-chain primary and secondary alcohols containing from 11 to 15 carbon atoms, the total number of carbon atoms in the side chains being not in excess of 4 and the hydroxyl group being located on a carbon atom other than the terminal carbon atoms of the longest carbon chain of the alcohol.

3. A composition for dustproofing coal comprising between about 70% and about 99.9% calcium chloride, between about 0.03% and about 2.5% of a substance which inhibits the corrosive action of calcium chloride, and between about 0.03% and about 2% of an alkali metal sulfate of an organic alcohol selected from the group consisting of branched-chain primary and secondary

alcohols containing from 11 to 15 carbon atoms, the total number of carbon atoms in the side chains being not in excess of 4 and the hydroxyl group being located on a carbon atom other than the terminal carbon atoms of the longest carbon chain of the alcohol.

4. A composition for dustproofing coal comprising calcium chloride and relatively small amounts of a chromium compound which inhibits the corrosive action of calcium chloride and an alkali metal sulfate of an organic alcohol selected from the group consisting of branched-chain primary and secondary alcohols containing from 11 to 15 carbon atoms, the total number of carbon atoms in the side chains being not in excess of 4 and the hydroxyl group being located on a carbon atom other than the terminal carbon atoms of the longest carbon chain of the alcohol.

5. A composition for dustproofing coal comprising calcium chloride and relatively small amounts of sodium dichromate and the sodium sulfate of 7-ethyl 2-methyl undecanol-4.

6. A composition for dustproofing coal comprising between about 70% and about 99.9% calcium chloride, between about 0.03% and about 2.5% sodium dichromate, and between about 0.03% and about 2% of the sodium sulfate of 7-ethyl 2-methyl undecanol-4.

7. An aqueous solution for dustproofing coal containing dissolved therein a composition comprising calcium chloride and relatively small amounts of an alkali metal sulfate of an organic alcohol selected from the group consisting of branched-chain primary and secondary alcohols containing from 11 to 15 carbon atoms, the total number of carbon atoms in the side chains being not in excess of 4 and the hydroxyl group being located on a carbon atom other than the terminal carbon atoms of the longest carbon chain of the alcohol.

8. An aqueous solution for dustproofing coal containing dissolved therein a composition comprising calcium chloride and relatively small amounts of a substance which inhibits the corrosive action of calcium chloride and an alkali metal sulfate of an organic alcohol selected from the group consisting of branched-chain primary and secondary alcohols containing from 11 to 15 carbon atoms, the total number of carbon atoms in the side chains being not in excess of 4 and the hydroxyl group being located on a carbon atom other than the terminal carbon atoms of the longest carbon chain of the alcohol.

9. An aqueous solution for dustproofing coal containing dissolved therein between about 10% and about 50% of a composition comprising between about 70% and about 99.9% calcium chloride, between about 0.03% and about 2.5% of a substance which inhibits the corrosive action of calcium chloride, and between about 0.03% and about 2% of an alkali metal sulfate of an organic alcohol selected from the group consisting of branched-chain primary and secondary alcohols containing from 11 to 15 carbon atoms, the total number of carbon atoms in the side chains being not in excess of 4 and the hydroxyl group being located on a carbon atom other than the terminal carbon atoms of the longest carbon chain of the alcohol.

10. An aqueous solution for dustproofing coal containing dissolved therein a composition comprising calcium chloride and relatively small amounts of sodium dichromate and the sodium sulfate of 7-ethyl 2-methyl undecanol-4.

11. An aqueous solution for dustproofing coal containing dissolved therein between about 10% and about 50% of a composition comprising between about 70% and about 99.9% calcium chloride, between about 0.03% and about 2.5% sodium dichromate, and between about 0.03% and about 2% of the sodium sulfate of 7-ethyl 2-methyl undecanol-4.

12. A process for dustproofing coal which comprises applying thereto an aqueous solution of a composition comprising calcium chloride and relatively small amounts of an alkali metal sulfate of an organic alcohol selected from the group consisting of branched-chain primary and secondary alcohols containing from 11 to 15 carbon atoms, the total number of carbon atoms in the side chains being not in excess of 4 and the hydroxyl group being located on a carbon atom other than the terminal carbon atoms of the longest carbon chain of the alcohol.

13. A process for dustproofing coal which comprises applying thereto an aqueous solution of a composition comprising calcium chloride and relatively small amounts of a substance which inhibits the corrosive action of calcium chloride and an alkali metal sulfate of an organic alcohol selected from the group consisting of branched-chain primary and secondary alcohols containing from 11 to 15 carbon atoms, the total number of carbon atoms in the side chains being not in excess of 4 and the hydroxyl group being located on a carbon atom other than the terminal carbon atoms of the longest carbon chain of the alcohol.

14. A process for dustproofing coal which comprises applying thereto an aqueous solution of a composition comprising between about 70% and about 99.9% calcium chloride, between about 0.03% and about 2.5% of a substance which inhibits the corrosive action of calcium chloride,

and between about 0.03% and about 2% of an alkali metal sulfate of an organic alcohol selected from the group consisting of branched-chain primary and secondary alcohols containing from 11 to 15 carbon atoms, the total number of carbon atoms in the side chains being not in excess of 4 and the hydroxyl group being located on a carbon atom other than the terminal carbon atoms of the longest carbon chain of the alcohol.

15. A process for dustproofing coal which comprises applying thereto an aqueous solution of a composition comprising calcium chloride and relatively small amounts of a chromium compound which inhibits the corrosive action of calcium chloride and an alkali metal sulfate of an organic alcohol selected from the group consisting of branched-chain primary and secondary alcohols containing from 11 to 15 carbon atoms, the total number of carbon atoms in the side chains being not in excess of 4 and the hydroxyl group being located on a carbon atom other than the terminal carbon atoms of the longest carbon chain of the alcohol.

16. A process for dustproofing coal which comprises spraying the coal with an aqueous solution containing between about 10% and about 50% of a composition comprising calcium chloride and relatively small amounts of sodium dichromate and the sodium sulfate of 7-ethyl 2-methyl undecanol-4.

17. A process for dustproofing coal which comprises spraying the coal with an aqueous solution containing between about 10% and about 50% of a composition comprising between about 70% and about 99.9% calcium chloride, between about 0.03% and about 2.5% sodium dichromate, and between about 0.03% and 2% of the sodium sulfate of 7-ethyl 2-methyl undecanol-4.

JOHN FRED MILLER.