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METHOD OF PRODUCING A PREPARED FUEL

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My process relates to the treatment of solid fuels to reduce their tendency to form dust upon agitation. In particular it relates to spraying or otherwise causing the deposit of a dust-settling medium upon the surface of solid fuel. The medium, which may be complex as regards chemical composition may contain an odoriferous material added to produce a particular odor and it may also contain a coloring matter or product that through change will produce a color effect upon the solid fuel.

One of the objects of my invention is the elimination of fuel dust formed during delivery and use of solid fuels, without adding thereto a corrosive material such as calcium chloride. Another object is to give a more pleasant odor to certain fuels that have only a faint odor, an unpleasant odor or no odor at all. A further object is the production of a socalled dustless solid fuel that does not retain or absorb excessively large amounts of water vapor such as a fuel heavily loaded with calcium chloride. Still another object is the simultaneous coloring, coating and perfuming of a solid fuel in the treatment for eliminating the dust-forming properties.

I have found that in wetting the surface of a solid fuel the use of a solution comprising largely salts such as calcium chloride is commonly employed; fuels thus prepared tend to cause corrosion of metal, not only in the transportation of the fuel but during storage in the households or elsewhere.

My process differs from others with which I am familiar in that the wetting medium is not a corrosive salt. Briefly my process comprises the wetting of the surface of a solid fuel with a medium comprising an oil having a high boiling point, that is, with an oil that is not highly volatile. Water may be present in said medium in varying amounts even to much more than fifty per cent of the whole. The water and oil may exist initially as an emulsion or they may be applied simultaneously from separate sources. I prefer to apply the wetting medium comprising an oil and water, by discharging it in a fine state of division under superatmospheric pressure, the oil containing a perfume material when it is so desired in predetermined amounts, and the water containing in solution or suspensions when so desired a pigment or the equivalent.

The oil may be a heavy tar, a petroleum product boiling at a high temperature, tar preparations, asphaltic preparations or similar product. When a light color is not essential I prefer to use a tar that has been freed from some of the fractions distilling at relatively low temperatures. For example benzol and naphthalene are not desirable in the oil or tar used. I find that by employing the prepared tar as the oil-medium only a small amount of it is necessary per ton of coke or coal treated, particularly when it is used along with water in producing a substantially dustless fuel. The moisture is absorbed by the fuel (coke in this example) and the tar wets the outer surface and oxidizes in air to a non-tacky surface. Under these conditions the absorbed water does not evaporate so readily as when water alone is employed as the wetting medium. Another advantage in using tar is that it is a fuel available almost everywhere at a very low price. Because of its cheapness it can be used at a minimum application cost—the sale price of the coke being in some instances as high as that of the tar per pound. The amount used may vary from about a gallon or two gallons per ton of fuel treated upwardly according to the effect desired. In mixtures with other oil-like materials less tar may be used. More of it is required or rather more of it can be used when treating a fuel such as coke than in treating a fuel having less surface for absorption. Likewise a greater total amount of wetting material can satisfactorily be used with coke than with certain coals.

The perfume material used is preferably dissolved in the oil or water according to its solubility characteristics. Diphenyl oxide is an example of a perfume material that is effective, cheap and required only in small amounts. Phenetol, methyl salicylate, pine oils, cedar oils and similar odoriferous materials may be used as the perfuming component, dissolved, preferably in the oil-like constituent.

Lime in the form of $Ca(OH)_2$ may be used in solution or in suspension in the water component of the wetting medium and as thus used it contributes a light color to the solid fuel, varying in intensity with the amount used. Lime, alkalies or soaps may be used in the water and they function as an emulsifying agent causing the dispersion of oil or tar in water. Kaolin also behaves in the same manner. Carbon black tends to form emulsions of the reverse type, namely those in which the water exists as the inner phase; it also may be used when desired.

Summarily my process comprises depositing on the surface of solid fuel a film or coating of fluid comprising initially an oil-like material that is not readily volatile and water; the two components are preferably in the form of an emulsion as applied and the oil-like component preferably

contains a perfume material therein. The whole mass may also include a pigment or the equivalent that will remain as a surface coating on said fuel.

Because carbon and coal are preferentially wetted by oil the moisture absorbed is more tenaciously retained by the fuel when an oil-like material is applied simultaneously with or immediately after the wetting with water. An oxidizale material such as heavy tar is preferable in most cases to a non-oxidizing oil.

It will be noted that there are two distinct kinds of emulsions of oil and water. One in which water is the inner phase and one in which the oil is the dispersed phase. In my previous application of which this is in part a continuation, Serial No. 507,762 filed January 9, 1931, attention was more particularly focused on the emulsions in which the water is the outer phase namely emulsions in which the oily matter is dispersed in the water. This application is more particularly concerned with emulsions in which the oil or oily matter is the outer phase.

I find that there are conditions under which the use of an emulsion in which the oil is the outer phase is distinctly advantageous. For example when a coal or coke to be treated is wet such as after exposure to rain it is not capable of taking up as much water as when it has been exposed to the atmosphere under clear weather conditions. In this instance it is obviously preferable to reduce the amount of water in the mixture (emulsion) used to spray the fuel. When this is done with that type of emulsion in which the oil is the dispersed phase the emulsion at normal atmospheric temperatures becomes buttery and stiff when the oil comprises more than 50% of the emulsion; at 70% of oil it is very stiff and not so readily sprayed from a nozzle as a mist as when in a more fluid condition. With an emulsion of the reverse type, water being the dispersed medium, the product (emulsion) is fluid even though oil be present in amounts somewhat less than 50% to more than 90% of the whole. The factor "fluidity" is important in the spraying of emulsions particularly when the emulsions are cold.

I find further that in making emulsions in which the water is the dispersed medium, an effective dispersing agent is a soap of a heavy metal —a soap normally classed as an insoluble because it is substantially insoluble in water. Such a soap may comprise a lime-resin soap, an oleate or stearate of one of the heavy metals, combinations of them or the equivalent. The water soluble soaps produce emulsions of the reverse type. Besides being a preferred emulsifying agent the insoluble soaps (soaps of the heavy metals) function as a fixative for the perfume materials which I commonly choose to incorporate in the oil. These soaps have a very low vapor pressure and they retard the vaporization of the perfume materials; this is a desirable feature and permits the use of perfumes that would otherwise be unsatisfactory because of their high degree of volatility, that is, high vapor pressure. Another benefit derived from the use of this class of emulsifying agents, namely heavy metal soaps, is the tenacity with which they adhere to carbonaceous materials such as coal and coke. The coating obtained on a solid fuel by the use of this type of emulsion may be thicker than that obtained without the metal soaps; the thickness may depend upon the amount of said soap used in the emulsion.

In certain manufacturing processes and in laundries it is essential that the air be free from dust and dirt and at such places it is required that the fuel used be as free from dust as possible. In such cases it is highly desirable to employ a spray that will deposit a heavier coating than that possible with ordinary oil water mixtures; soaps of the heavy metals are particularly satisfactory for use in preparing the spray for such purposes.

In the use of the soaps of the heavy metals I prefer to employ emulsions containing water in amounts varying from 5 to about 60 or 65 per cent, the remainder being oily matter, soap perfume material with or without additional coloring matter or suspended solids. An emulsion containing 10 to 50 per cent water, 90 to 50 per cent of oil (or oily matter) containing admixed therewith the perfume material and the soap of a heavy metal. A color (pigment) material may be added to this preparation when desired. The amount of the soap required is somewhat of a variable depending on the oil used and the amount of water used and the particular soap; however it will suffice to say that emulsions of the desired type may be prepared by using the soaps in amounts of less than 1 per cent to much more than 10 per cent. The amount of perfume material used is a matter of the odor effect desired and the nature of the perfume material used; it usually comprised a very small percentage of the emulsion.

Although I do not limit myself to exact proportions of the ingredients of the emulsion I use, an example of the composition of an emulsion suitable for obtaining the desired result is as follows:

Water	6 gallons
Oil or tar or the equivalent of other oily matter	6 gallons
Soap of a heavy metal	1 pound to 10 pounds

The perfume material if not classed as, and included above as, an oil may be added to the above in amounts found to be desirable to produce the odor effect sought. Likewise pigment may be added to the above in amounts found to be desirable. However when using pigments that tend to cause the emulsification of oil in water it is necessary to so proportion the relative amounts of soap and pigment that the water is the dispersed phase. In other words a greater amount of soap is required when such a pigment is used.

Because some coals wet with oil more readily when the oil or emulsion containing oil is warm I sometimes (in the cold weather particularly) prefer to use the emulsion warm. The same effect may be obtained by using steam along with the emulsion.

The emulsion of water in oil may be prepared as follows: Add to a chosen soap of a heavy metal, for example a lime resin soap, sufficient benzol or other solvent to dissolve at least an appreciable portion of the soap. Add this solution to the oil to be used in making the emulsion and mix well, then pour this mixture into the chosen amount of water while agitating the water. The benzol can be dispensed with when desired by taking care to incorporate the soap uniformly throughout the oil before mixing it with water; the benzol or other solvent used shortens the mixing time required and makes possible the use of less soap than otherwise in obtaining a given result.

Having described my invention so that one skilled in the art can practice it, I claim:

1. A method of producing a prepared fuel, comprising, depositing on the surface of a solid fuel a fluid being as applied substantially an emulsion comprised of water dispersed in an oil, said water comprising about 5 to 65 per cent of said emulsion.

2. The method of producing a prepared fuel, comprising, depositing on the surface of a solid fuel a fluid being as applied substantially an emulsion of water dispersed in an oil containing admixed therewith as an emulsifying agent a soap of a heavy metal that is substantially insoluble in water.

3. The method of producing a prepared fuel, comprising, depositing on the surface of a solid fuel a fluid being as applied substantially an emulsion comprising an oil, water and a metal soap that is substantially insoluble in water, the oil being the outer phase of said emulsion.

4. The method of producing a prepared fuel, comprising, depositing on the surface of a solid fuel a fluid being as applied substantially a water-in-oil emulsion containing a metal soap that is substantially insoluble in water, said water being finely dispersed in the oil by virtue of the emulsion-stabilizing properties of said soap, said oil containing in solution a relatively small amount of diphenyl oxide.

5. The method of producing a prepared fuel, comprising, depositing on the surface of a solid fuel a fluid being as applied substantially a water-in-oil emulsion comprising an oil, water and a lime soap, said emulsion being stabilized with water in the dispersed phase by virtue of said soap.

6. The method of producing a prepared fuel, comprising, depositing on the surface of a solid fuel a fluid being as applied substantially an emulsion comprising oil containing a relatively small amount of diphenyl oxide, water and a metal soap that is substantially insoluble in water, said emulsion comprising about 5 to 60 per cent of water dispersed as the inner phase in said oil, being stabilized by said soap.

7. The method of producing a prepared fuel, comprising, depositing on the surface of a solid fuel a fluid being as applied substantially an emulsion comprising an oil, water and a metal soap that is substantially insoluble in water, the oil being the outer phase of said emulsion and comprising about 50 to 90 per cent of the whole.

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