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DUST-LAYING EMULSION

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This invention relates to agglomerant and adhesive materials, particularly useful in binding together and agglomerating dry, solid particles such as dusts and fines present in aggregates and minerals, and also useful in the treatment of soils, roads, and other paved and unpaved earth and other similarly loose materials which are easily disturbed by wind and/or traffic. It is particularly related to and designed for use in consolidating and stabilizing earth and soils and fines, and has particular utility as a dust-laying agent for roads, playgrounds, unpaved earth surfaces, and similar terrestrial areas.

The art of earth stabilization, road-making, and dust palliation by means of petroleum fractions has had a long history, and the prior art discloses the use of petroleum oil fractions, usually of residual and asphaltic character, either as such or in the form of emulsions.

A number of difficulties has detracted from the utility of the prior art practice employing these oil fractions. One important factor is the necessity for a low-cost product, since large quantities are required to treat an extended area effectively. The residual oil fractions have all been black because of their high content of asphaltic components and free carbon. The use of materials of this type, for example, as dust-laying agents, causes the earth to become blackened, and, particularly when used in driveways, parking places, and playgrounds, this material causes a soiling of clothes and body of the person coming in contact therewith.

It is characteristic of this type of material that it is brittle at relatively low temperatures, such as wintry weather, due to a high content of asphaltic components, and it becomes brittle in time, even in milder weather, due to oxidation and to the evaporation of low boiling components. The result is that earth if originally consolidated may soon be broken up.

Another considerable difficulty encountered in treating areas with asphaltic materials is the sensitivity of such materials to alkali.

For some applications, such as on school grounds where dark-colored oils are undesirable, the more expensive neutral oils (distillate fractions of petroleum) have been used. The use of light, neutral oils in quantities sufficient to lay the dust actually creates oily surfaces since the oil only fills the voids between the dust particles (in the same way that water is held by a sponge) until it evaporates if sufficiently volatile, or, if the sand layer is deep enough, until it percolates downward away from the surface, thus restoring the original dusty condition. The neutral oil thus acts similarly to water to wet the particles. It can be shown by experiment that

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there is actually no bond between neutral oil and the dust particles. Such a dust palliative is then useful but for a short period of time, and repeated treatment of the area is necessary. Although less obvious to the eye, the light colored neutral oils also provide a surface which will soil or stain clothing with oil spots.

An extensive investigation into the interaction between soils and earth-stabilizing materials, such as dust palliative oils and asphalts and emulsions thereof, has revealed that the difficulties of the prior art type of oils, asphalts, and emulsions thereof arise from the nature of the oils and asphalts employed.

I have discovered that the asphalts and oils of the prior art contain saturated hydrocarbon components, which have little or no bonding power to consolidate, agglomerate, and bond dust, soil, earth, or aggregate particles to each other. In fact, the saturated hydrocarbons fill the voids between the solid particles and act to lubricate and separate the particles from each other.

As a result of extensive investigation, I have found that it is the asphaltenes or the unsaturated components of the oil which impart the adhesive and bonding power to the oil. Thus, while an increase in the amount of oil used in treating a soil will increase the ratio of bond-imparting unsaturated components to the earth particles to be bonded, there is a simultaneous increase in the ratio of the saturated components to the said earth particles. It is thus possible to obtain but a limited increase in the amount of bond by increasing the amount of such oil employed in a given volume of earth treated. In fact, by increasing the amount of oil sufficiently the initial bonding obtained may be decreased. While I do not wish to be bound by any theory of this action, I believe that the saturated components, as stated above, are substantially unadsorbed by the earth particles and are contained in the interstices of the particles and act to lubricate and separate them, and by diluting the unsaturates, reduce their adhesive and bonding power.

I have found that I may avoid the above deficiencies of the prior art type of petroleum oil fractions and solve the difficulties inherent in the prior art procedures employing such oils, by removing from such oils the asphaltic components and the saturated hydrocarbon components, and isolating from these petroleum fractions a highly unsaturated resinous component, understanding these components in terms of the test methods referred to below.

I have found that the saturated hydrocarbon content should form but a minor fraction of the petroleum fraction employed for the purposes of

my invention, and usefully should be below 25%, preferably below 15%, to obtain a material with good bonding power for the earth particles. In fact, the lower the percentage of saturated hydrocarbons, the stronger the bonding power of the fraction for purposes of my invention. I obtain a better bond between solid particles by employing such a material than by employing a larger amount of a petroleum fraction having a higher content of saturated components, even though eventually the same ratio of unsaturated components to the earth particles are employed in both procedures. The resinous component is substantially free of black, asphaltic materials. Because of the high bonding power of the resinous component, a materially lesser amount of the component is necessary as compared to the requirements when using the petroleum fractions employed by the prior art. Thus, although the resinous components are colored, substantially no discoloration of the earth results when it is used as a dust-laying agent, earth or soil stabilizer, or in other such and similar uses.

I have found that there is present in crude oils of the naphthenic, substantially wax-free type a component or fraction of such viscosity characteristics as to be properly termed resinous. These components of such crude oils are the unsaturated components thereof which have such a large temperature coefficient of viscosity as to be highly viscous or semi-solid at ordinary temperatures, being thermoplastic solids of resinous or resinophoric character and thereby liquid at elevated temperatures. The resinous fraction which I have found particularly desirable is a material of honey-like to solid consistency at ordinary atmospheric temperature, and liquid at elevated temperature having the properties of thermoplastic resins, being substantially nonvolatile and substantially stable under atmospheric conditions in that it will not change to a hard, brittle product on prolonged exposure to air and sunlight. Unlike the saturated oils, these petroleum resins form a strong adhesive bond with the solid particles.

The above components of petroleum oil, which I have found particularly useful in the compaction and stabilization of earth and in the laying of dust, are those fractions which are undesirable in petroleum lubricating oils and which are usually removed in refining procedures, such as clay treatment, solvent extraction, acid treatment, and other refining procedures. These materials have, in addition to the physical and chemical characteristics which I have found to be desirable for my purposes, the advantage of being waste materials at the present time, or by-products from petroleum refining, and are, consequently, available at low cost.

Thus, for example, I may isolate these resinous components, having properties such as described herein, by solvent refining of waxy, naphthenic or mixed base oil fractions, either residual or distillates, and by de-waxing procedures, if necessary I may also obtain those desirable resinous materials by removing them from clays which have been employed in the clay treatment of residual or distilled oil fractions, and which clays carry the resins which they have adsorbed from oils which have been refined by such clays. Such methods for recovery of the adsorbed fractions from clays are well known in the prior art.

Thus, I have found that the components of the petroleum oil suited for my invention are the unsaturated, resinous components of the selective solvent extract fraction, preferably of a distillate produced from a naphthenic base crude, naturally substantially free of solid wax fractions. Many different selective solvents for extraction of such oil have been suggested for the manufacture of lubricating oils, as is evidenced by the art of selective solvent extraction of petroleum oils. Current commercial practice in the lubricating oil industry generally is to use sulfur dioxide sulfurdioxide-benzol mixture, furfural, or phenol. As is well known, these solvents selectively dissolve the unsaturated, naphthenic fraction and other reactive components of the oil (sometimes referred to as aromatic components) to produce an extract, and leave the unsaturated aliphatic and the saturated naphthenic fractions as the undissolved raffinate. However, the selectivity of the solvents is not sharp, and there may be a substantial quantity of the saturated hydrocarbon fractions dissolved in the extract. This may be minimized, as is well known in the art, by several expedients, such as temperature control, solvent to oil ratio, and rejection procedures such as supplementary solvent washes (as with light hydrocarbons), the addition of water, etc.

The preferred type of resins having the unique properties and giving the unique results described are found in those solvent extracts (most usefully produced from distillate fractions) which are substantially free of asphaltic materials and wax which are reddish in color in bulk and transparent in thin layers, and which contain a preponderant proportion of unsaturated components and but a minor proportion of saturated components and usefully less than 25% saturated components, preferably less than 15% of saturated components, and, in fact, the lower the percentage of saturated components the better.

As an example, and not as a limitation of my invention, extracts having, in addition to the desirable concentration of unsaturated components, the following characteristics are desirable for the purposes of this invention:

Mixed aniline point below about 40° C.; initial boiling point not materially less than 160° C. at 10 mm. Hg; specific gravity of 1 or more, and preferably not in excess of about 1.05, and more preferably 1.02 to 1.04; viscosity at 25° C. ranging from about 750 centipoises to in excess of 100,000, i. e., 200,000 centipoises or higher viscosities, and a viscosity at 90° C. of about 5 to about 300 centipoises.

Suitable characteristic resins are as follows:

PHYSICAL CHARACTERISTICS

	Example 1	Example 2	Example 3	Example 4	Example 5
Initial boiling point	160° C. at 10 mm. Hg.	180° C. at 10 mm. Hg.	Above 200° C. at 10 mm. Hg.	Above 220° C. at 10 mm. Hg.	180° C. at 10 mm. Hg.
Flash point	Above 250° C.	Above 250° C.	Above 250° C.	Above 250° C.	Above 250° C.
Mixed aniline point	33.5° C.	32.4° C.	32.5° C.	33° C.	40° C.
Viscosity at 25° C. (cps.)	12,000	800	100,000	100,000	40,000.
Viscosity at 90° C. (cps.)	30	10	100	90	40.
Specific gr	1.02	1.01	1.04	1.03	1.01.

The color of Examples 1, 2, 3, and 4—reddish brown in bulk, and transparent in thin layers. The color of Example 5—light yellow in bulk, and transparent in thin layers.

CHEMICAL COMPOSITION

	Example 1	Example 2	Example 3	Example 4	Example 5
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
Saturated hydrocarbons	10.8	15.7	6.9	6.0	13.5
Unsaturated hydrocarbons, Group I	15.5	13.9	18.9	23.8	27.8
Unsaturated hydrocarbons, Group II	55.0	58.0	47.1	45.7	58.0
Nitrogen bases	18.7	12.4	27.1	24.5	0.7

Wherever referred to in this specification, the term "saturated components" and its per cent content in the fraction, and the terms "unsaturated hydrocarbons, Group I," and "unsaturated hydrocarbons, Group II," and the percentage content, and the term "nitrogen bases" and its percentage content, and the term "asphaltenes" and its percentage content, shall mean those determined and defined in "Compounding Rubber With Petroleum Products." by Rostler and Sternberg, published in Industrial & Engineering Chemistry, vol. 41, pp. 598–609, March 1949.

The mixed aniline point shall be determined on the fraction diluted with equal parts of normal heptane by A. S. T. M. Method D611–47T; the viscosity and the specific gravity shall be determined by conventional procedure, as will be understood by those skilled in the art.

The direct application of these products to earth is not practical due to their high viscosity. In employing these fractions according to my invention, the solvent extract is emulsified with water. In this form I avoid the difficulties inherent in stickiness and high viscosity of the product which make the handling of the product difficult. However, I am able to retain the advantages and utilize the adhesive properties, high viscosity, and inherent high boiling point of the effective resinous components by employing the product as an emulsion in water. Diluting the extract with a hydrocarbon or other volatile organic solvent would reduce viscosity but would, at the same time, reduce the adhesive strength and create a fire hazard, besides being more expensive than water.

I have found that for the purposes of my invention the emulsion should preferably have the following characteirstics. It should be light yellow in color and be free-flowing, containing dispersed semi-liquid, resinous petroleum bodies, preferably within the range of 57 to 63 parts by weight and water as the continuous phase not less than about 25 parts by weight and preferably in the range of 37 to 43 parts by weight, and also an emulsifier. The resinous petroleum bodies should have a sufficiently high initial boiling point to give a flash point in excess of 400° F. and have a specific gravity of from 1 to 1.04 when measured at 60° F. as compared to water at 60° F. (60°/60°). The emulsion is stable in the sense that it will not break when stored for long periods in clean, closed containers at ordinary atmospheric temperature above freezing.

Many different emulsifiers may be used for such resins to produce such emulsions. For example, I may use: cetyl pyridinium chloride, fatty alcohol sulfates, water soluble petroleum sulfonates, such as those sold by Oronite Chemical Co. as "Oronite Wetting Agent," and sodium petroleum sulfonates, for instance, as sold by Golden

Bear Oil Co. as "Golden Bear Sulfonates," and constituting the water soluble sodium salts of the sulfonic acids extracted by alcohol in the refining of white oil with sulfuric acid; and bentonite.

This list is not intended to be exhaustive, and is but suggestive of the emulsifying agents which may be employed. Many agents useful for emulsifying petroleum oils are effective in various concentrations. Those listed above will be found to be useful in concentrations of 5% or less. based on the resin phase.

In addition to the emulsifying agent, stabilizers may be used to stabilize the emulsion against electrolytes which may be present in the water used for making or diluting the emulsion. The use of hard water or water treated with chlorine will require the addition of such stabilizers to the emulsion. Stabilizers will also guard against premature breaking of the emulsion by the soil before it has reached the interstices thereof. Such stabilizers include casein, glue, and various gums and synthetic protective colloids and thickeners. Again, it is desirable to use highly active ingredients so that the amount employed may, for practical reasons, be kept to a minimum. These synthetic, highly active stabilizers include, for example, hydroxy-ethylcellulose, sold by Carbide & Carbon Chemicals Corp. as "Cellosize," and methylcellulose, sold by Dow Chemical Co., as "Methocel," the grade preferred for my use being 25 centipoises, or one of lower viscosity; sodium carboxy-methylcellulose, sold by Drilling Specialties Co. as "Driscose," or as sold by Hercules Powder Co., as "Hercules CMC," the sodium salt of "Vinsol Resin," as sold by Hercules Powder Co. as "Vinsol NVX," "Vinsol Resin," a dark-colored resin having a specific gravity of about 1.218, a melting point of 234–239° F., largely insoluble in petroleum solvents, and derived from pine wood and containing phenol, aldehyde, and ether groups.

The following is an example of a formulation for dust-laying emulsions having the above preferred properties:

Example 6

A solution of 60 parts of the solvent extract of any one of the resins of Examples 1 to 5, inclusive, containing about 0.9 part of "Golden Bear sulfonates," as listed in the above table, is mixed, by strong mechanical agitation, with water containing 0.9 part of such sulfonates and 0.12 part of "Vinsol NVX" using sufficient water to make up about 100 parts. The mixture is agitated to produce a stable emulsion.

Such emulsions contain a dispersed resin phase of small particle size of a gravity close to that of water. The emulsion has sufficiently high viscosity to prevent coalescence or stratification on standing.

Emulsions of concentrations in excess of about 75 parts by weight of resin phase and less than 25 parts by weight of water are frequently too thick and become pasty, while concentrations

much below 50 parts by weight of resin phase and above about 50 parts by weight of water tend to stratify into a water layer and a concentrated emulsion layer which, however, is stable and may be readily remixed with the water layer. The dilute emulsions are also bulky and contain unnecessary water, which adds to storage and shipping costs. Therefore, while of course any dilution which gives a suitably stable emulsion may be employed, as indicated below, I prefer to make this initial emulsion concentrate of the order of 50–70 parts of dispersed resin phase, and 30 to 50 parts by weight of water continuous phase. The emulsions may be made more resistant to coagulation by electrolytes by adding stabilizer, as disclosed above.

I thus find it desirable to limit the composition to the preferred range of 57 to 63 parts by weight of resin and 37 to 43 parts by weight of water and use an emulsifier and stabilizer to give a stable emulsion. I have been able to formulate these emulsions in the manner described and illustrated above so that they are so stable that they will remain unbroken for three months or longer when stored in clean, closed containers at temperatures above freezing and below boiling.

In formulating these emulsions I find it desirable, where the emulsifier, or combination of emulsifiers, is suitably soluble to distribute the emulsifier between the resin and the water and mix the resultant solutions to produce the emulsion. For example, I have found the following to be a practical formulation for the emulsion of this invention:

	Parts by weight
Phase 1:	
Solvent extract (specific gravity 1.02), containing 8% saturated hydrocarbons	60
50% solution of "Golden Bear sulfonates" dissolved in a light extract (specific gravity 0.98)	1.80
Phase 2:	
Water	37.00
50% solution of "Golden Bear sulfonates" in water	1.80
Vinsol NVX	0.12

These phases are mixed under strong mechanical agitation.

These emulsions, formulated as described above, have been found to be highly effective in the stabilization and consolidation of earth, and particularly in the laying of dust, by spraying or otherwise incorporating the emulsions into the earth layer, or when employed for the laying of dust, a simple spraying operation over the road, playground, yard, or other area is suitable if necessary precautions in the use thereof are observed, as described below.

I may similarly emulsify the above resinous components using an equal weight of water and as emulsifier 1% of cetylpyridiniumchloride or ½% of "Duponol WA Paste" or 5% of bentonite. I may also emulsify the resin in the ratio of 60 parts of resin to 40 parts of water, using ½% of sodium oleate.

The above examples are merely illustrative and those skilled in the art will be able from the above teachings to adjust the formulations to produce the stable emulsions.

Due to the content of surface active agents as emulsifier, the emulsion has great wetting power for soil, and will ordinarily penetrate, when used in proper concentrations, as fast and as deep as water. It is sometimes desirable that the ground be prepared so that it is open and porous near the surface in order for the emulsion to penetrate a sufficient distance within a reasonable period of time.

The successful application of the emulsion depends primarily upon two factors: good penetration and saturation of the soil to the depth to which it will be disturbed by traffic. Disking, or other methods of roughening the surface to be treated, is, therefore, desirable where the surface consists of solidly compacted fine particles which may be non-porous.

If, because of soil condition, penetration is slow, saturation can be achieved by repeated light applications rather than by one heavy application. The effect of the emulsion is cumulative in the soil and the resinous material applied on the ground is not lost as long as it penetrates. Insufficient amounts, however, will not bind together all the fines, and the application should, therefore, be repeated until satisfactory saturation, or a satisfactory ground condition, has been attained.

The type of soil influences both the amount of fluid required to saturate it and the time required (i. e., number of applications) to reach the depth of penetration desired. Thus, a lesser volume of emulsion is required to saturate and penetrate into sand than for loam, and less is required for loam than for clay. Since the rate of penetration is rapid with sand, moderately fast with loam, and slow with clay, it appears that while with sandy soil one application, consisting of the total amount to be applied, will be satisfactory, with soils containing high amounts of clay, it is advisable to apply the total amount required in several applications. In order to increase the rate of penetration and generally the ease of application, the emulsion may be diluted, preferably near the point of use, with any convenient amount of water prior to application. If only one or two applications are to be made on soil containing high amounts of clay, wetting can best be accomplished by disking and/or mixing with a blade while applying the emulsion.

There is little change in the original color of a surface treated with the emulsion. The surface has the appearance of a freshly watered area, being slightly darker in shade than is the surrounding area. A surface properly treated with the emulsion is substantially free of dust. Heavy traffic such as trucks and tractors stir up no perceptible dust under conditions where, prior to treatment, heavy dust clouds were created by such traffic.

It is also notable that surfaces which have become rutted and heavily disturbed by traffic may be smoothed and compacted by ordinary procedures usually employed for this purpose. The new surface thus produced is, however, substantially free of dust, and the bond between the earth and dust particles, which is formed by the resinous bonding material of my invention, remains in place. It is sometimes desirable, since some mechanical disintegration and grinding action occurs during the above procedure, and since dust is ordinarily brought in from other places by wind action and is sometimes stirred up from lower layers of earth which have become exposed by the movement over the area of heavy vehicles or the hoofs of animals, to repair such areas by a supplementary application of the emulsion.

These results are possible because the bonding material is non-volatile, plastic, and not brittle, and remains so even when the surface is exposed

for prolonged periods to air and sun, under which conditions asphaltic materials oxidize and become brittle. This phenomenon is a property of the resinous, unsaturated components which produce a stable and flexible bond between the particles, whereas the asphaltenes (the effective components of asphalts) form a brittle bond which becomes more brittle on exposure and which finally, on prolonged exposure, have no more binding power for the particles. Such a surface, consisting of rigid and brittle lumps of earth particles bonded by asphaltenes, when broken up by traffic, especially by heavy machinery, cannot be re-worked to a smooth surface by blading and compaction as can a surface treated with the emulsion according to this invention. It is necessary to remove the disintegrated asphaltic layer and to replace it with a new surface.

Emulsions formulated according to my invention have uses in addition to the treatment of terrestrial areas and are also suitable for eliminating or consolidating the fines and dusts present in aggregates, minerals, ores, etc., such as in gravel, coal, and in friable manufactured products such as coke. This is accomplished by spraying these materials with an emulsion of suitable resin concentration.

Tests have shown that the resin phase of the emulsions of my invention, while to a certain degree phytocidal to growing plants, has no soil sterilization effect, and the emulsions may be used to prevent loss of top soil by preventing generation or loss of fines. The soil may thus be treated with the emulsion, avoiding the spraying of growing valuable vegetation, in the manner described above, without impairing the agronomic value of the soil thus treated; that is, soils may be treated with the emulsion without impairment of their vegetation bearing properties, and may thus be seeded at a later date if desired.

I have frequently found it desirable, however, especially when applying the emulsions to unpaved parking places, yards, roads, and other areas, to introduce into the emulsion phytocidal or soil sterilizing ingredients.

Many different types of herbicides and soil sterilants have been suggested by the prior art. For example, the chlorates, such as sodium chlorate, the borates, such as sodium pentaborate (or mixtures of the chlorates and borates, such as borax and sodium chlorate), arsenic, and other known soil sterilants which prevent the growth of vegetation may be used. The polynitrophenols, such as dinitrocresol and the polychlorophenols, such as pentachlorophenol, are well known herbicides which are fortifying agents for general contact weed killers, and may also be employed.

I have found that I can incorporate these ingredients into the emulsion, thus making preparations useful for binding dust and simultaneously killing weeds and/or sterilizing the soil. It is advantageous to add a stabilizer to the emulsion before incorporating the phytocidal or soil-sterilizing ingredient. The inorganic salts mentioned above are most preferably added in dry form to the stabilized emulsion under slight agitation. I have found that if the salt is added to the emulsion as a water solution, the emulsion is broken even in the presence of the stabilizer. The following is an example of an emulsion suitable for soil sterilization and dust laying, and is given for purposes of illustration, and not as a limitation of my invention.

Example 7

I stabilize the emulsion formulated as given in Example 6 by adding to each gallon of the emulsion (which contains 60 parts of petroleum resins) $\frac{1}{10}$ of a gallon of a 5% aqueous solution of "Methocel" (15 cps.); I then dilute this so-stabilized emulsion by adding 4 parts of water to 1 part of the emulsion. I then add, under slight agitation, 0.1 to 0.2 pound of sodium chlorate (the amount required to sterilize one square yard of soil for several years) to each gallon of fluid. This material is then spread on the area to be treated at the rate of 1 gallon per square yard. The so-treated area is thus freed of weeds, is free of dust, will not support vegetation for several years, and has the advantage, when used on shoulders or dividing strips of roads, due to its light color, of adding to the safety of traffic in that motorists will not mistake the dividing strips or shoulders for the road.

In using the polynitrophenols or polychlorophenols or other organic phytocidal chemicals, such as 2,4-dichlorophenoxyacetic acid and its derivatives (the so-called 2,4-D preparations) or trichloroacetic acid derivatives, I find that since they are readily soluble in the resin phase I may first incorporate these ingredients into the petroleum resins before forming the emulsion. Other herbicidal ingredients which are soluble in the resin phase may be used and are classed along with the above ingredients as herbicidal additives for the purposes of this invention. The concentration of such herbicides may be varied up to the solubility limit of the herbicide in the oil phase at ordinary temperatures. The higher the concentration of herbicide in the oil the more effective is the composition and the greater the permissible dilution with water. Thus, I desire to use from a small amount, i. e., less than .1% of the oil phase up to saturation percentages of the herbicide in the oil phase.

Thus, I prepare a 0.5 to 12.0% solution of the polynitrophenols or polychlorophenols, and form the emulsion in the manner described above, but use somewhat more emulsifying agent than for the dust-laying emulsion.

An example of an emulsion containing pentachlorophenol as the fortifying agent of the emulsion to be used as a general contact weed killer is the following preparation:

Example 8

The resinous phase is prepared by dissolving in 100 parts by weight solvent extract (specific gravity of about 1.04); 6 parts by weight commercial pentachlorophenol; and 1 part by weight sodium petroleum sulfonates.

The water phase is prepared by dissolving in 67 parts by weight water; 4 parts by weight sodium petroleum sulfonates; and 0.5 part by weight "Vinsol NVX."

The two phases are then mixed and homogenized in a high-speed homogenizing machine.

Another example of a composition of a commercial weed killer is as follows:

Example 9

Solvent extract (specific gravity, 1.02), containing 12% saturated hydrocarbons, 55.8 parts by weight; pentachlorophenol ("Santophen 20," produced by Monsanto Chemical Co.), 3.6 parts by weight; sodium petroleum sulfonates (produced by Golden Bear Oil Co.), 1.8 parts by weight; "Vinsol NVX," 0.6 part by weight; and water, 38.2 parts by weight.

The emulsion is prepared by dissolving one-half of the sodium petroleum sulfonates and the pentachlorophenol in the resin phase and the other one-half of the sodium petroleum sulfonates and all of the "Vinsol NVX" in the water. Both phases are then heated to 70–80° C. before emulsification.

The pentachlorophenol content of the above emulsion may be reduced to about 0.5 to 1% of the total weight of the emulsion.

These cencentrated weed-killer emulsions are, for practical applications, usually diluted with water to give ½% pentochlorophenol in the final spray.

The emulsions are characterized by being stable for practically an unlimited period of time if kept in clean, closed containers and if not exposed to extreme temperatures, that is, above freezing or below boiling.

While I have described a particular embodiment of my invention for the purpose of illustration, it should be understood that various modifications and adaptations thereof may be made within the spirit of the invention as set forth in the appended claims. The present application is a continuation in part of my copending application Serial No. 168,864 for a Petroleum Herbicide Emulsion filed June 17, 1950.

I claim:

1. As a composition of matter, a water emulsion of an agglomerant and adhesive material suitable for agglomeration and binding of earths and solid particles comprising water as the continuous phase and a dispersed phase comprising a resinous petroleum fraction substantially free of asphaltenes and containing saturated components in amount not substantially greater than about 25% of the said resinous petroleum fraction.

2. As a composition of matter, a water emulsion of an agglomerant and adhesive material suitable for agglomeration and binding of earths and solid particles comprising water as the continuous phase and a dispersed phase comprising a resinous petroleum fraction substantially free of asphaltenes and containing saturated components in amount not substantially greater than about 15% of the said resinous petroleum fraction.

3. As a composition of matter, a water emulsion of an agglomerant and adhesive material suitable for agglomeration and binding of earths and solid particles comprising water as the continuous phase and a dispersed phase comprising a thermoplastic resinous petroleum fraction having a viscosity at 25° C. in excess of about 750 centipoises and a specific gravity not less than one (measured at 60° F.) substantially free of asphaltenes and containing saturated components in amount not substantially greater than about 25% of the said resinous petroleum fraction.

4. As a composition of matter, a water emulsion of an agglomerant and adhesive material suitable for agglomeration and binding of earths and solid particles comprising water as the continuous phase and a dispersed phase comprising a thermoplastic resinous petroleum fraction having a viscosity at 25° C. in excess of about 750 centipoises and a specific gravity not less than one (measured at 60° F.) free of asphaltenes and containing saturated components in amount not substantially greater than about 15% of the said resinous petroleum fraction.

5. As a composition of matter, a water emulsion of an agglomerant and adhesive material suitable for agglomeration and binding of earths and solid particles comprising water as the continuous phase an amount at least equal to about 25 parts by weight and a dispersed phase comprising a thermoplastic resinous petroleum fraction having a viscosity at 25° C. in excess of 750 centipoises and a specific gravity (measured at 60° F.) of not less than one and not in excess of 1.05, substantially free of asphaltenes and containing saturated components in amount not substantially greater than about 25% of the said resinous petroleum fraction, said resinous fraction comprising an amount not in excess of 75 parts by weight and said emulsion also containing an emulsifier in addition to said parts by weight of water and petroleum fraction.

6. As a composition of matter, a water emulsion of an agglomerant and adhesive material suitable for agglomeration and binding of earths and solid particles comprising water as the continuous phase an amount at least equal to about 25 parts by weight and a dispersed phase comprising a thermoplastic resinous petroleum fraction having a viscosity at 25° C. in excess of about 750 centipoises and a specific gravity not less than one and not materially in excess of 1.05, substantially free of asphaltenes and containing saturated components in amount not substantially greater than about 15% of the said resinous petroleum fraction, said resinous fraction being not in excess of 75 parts by weight and said emulsion also containing an emulsifier in addition to said parts by weight of water and petroleum fraction.

7. As a composition of matter an emulsion comprising as the continuous phase water in amount ranging from 37 to 43 parts by weight and a thermoplastic resinous petroleum fraction having a viscosity in excess of about 750 centipoises and a specific gravity not less than one, and not materially in excess of 1.05, substantially free of asphaltenes and containing saturated components in amount not substantially greater than 25%, said resinous fraction being in amount ranging from 57 to 63 parts by weight and said emulsion also containing an emulsifier in addition to said parts by weight of water and petroleum fraction.

8. As a composition of matter an emulsion comprising as the continuous phase water in amount ranging from 37 to 43 parts by weight and a thermoplastic resinous petroleum fraction having a viscosity in excess of about 750 centipoises and a specific gravity not less than one, and not materially in excess of 1.05, substantially free of asphaltenes and containing saturated components in amount not substantially greater than 15%, said resinous fraction being in amount ranging from 57 to 63 parts by weight and said emulsion also containing an emulsifier in addition to said parts by weight of water and petroleum fraction.

FRITZ S. ROSTLER.

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