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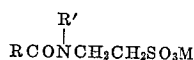
PESTICIDAL WETTABLE POWDER FORMULATION

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No Drawing. Filed May 20, 1963, Ser. No. 281,801
12 Claims. (Cl. 71-65)

This invention relates to wettable powders, and more particularly to wettable powders which are capable of being readily dispersed in water to form relatively stable, low-foaming aqueous dispersions. The invention also relates to a wetting agent excellently adapted for utilization in the preparation of readily dispersible wettable powder formulations.

The utilization of supplemental agents having wetting, dispersing, and/or suspending properties is widespread in the preparation of formulations containing water-insoluble powders, such as insecticides, herbicides, fungicides, nematocides, fertilizers, and other industrially employed powders, to render the powders dispersible in water. In the ideal situation the wettable powder formulations are fast wetting when dispersed in water and form suspensions having relatively high solids contents which are low foaming and do not exhibit tendencies toward sedimentation with age. With the increased usage of wettable powders, particularly pesticidal wettable powders, attempts have been made in the art to find supplemental wetting and dispersing agents which are capable of providing wettable powders having the desired characteristics. Such attempts heretofore, however, have not proven to be completely successful and the resulting wettable powder formulations undesirably have been deficient in at least one of the wetting, suspensibility, or foaming categories. Accordingly, due to the absence of more suitable wetting and dispersing agents, industry has been forced to utilize wettable powder formulations which have less than the desired characteristics.

For example, alkyl sulfo esters, i.e., esters of sodium isethionate and long chain fatty acids of the formula $\text{RCOOCH}_2\text{CH}_2\text{SO}_3\text{M}$ and alkyl sulfo amides, i.e., substituted amides of sodium aminoethionate and long chain fatty acids of the formula



wherein M is alkali metal, R is an aliphatic hydrocarbon radical of 10-22 carbon atoms and R' is H or lower alkyl (1-6 carbon atoms) or cycloalkyl (3-8 carbon atoms), are commonly employed as wetting-dispersing agents in preparing pesticidal wettable powders. The resulting powders are characterized by excellent wetting and suspensibility properties, but undesirably form aqueous dispersions which are relatively high foaming. Consequently, suspensions formed from such powders are incapable of being used completely satisfactorily in many types of application equipment. Moreover, due to the formation of foam upon the use of a dispersion containing the powder, an appreciable portion of the powder is trapped therein with a corresponding reduction in the efficiency of the particular treatment contemplated.

One conventional alternative approach in preparing pesticidal wettable powders involves the utilization of non-ionic surface active agents. Although suspensions prepared from the resulting powders exhibit lower foaming than those obtained from Igepons, the nonionic-containing powders heretofore available are slower wetting, generally inferior with respect to suspensibility, and demonstrate a tendency to flocculate.

Accordingly, it is the primary object of the present invention to provide a wettable powder which has superior

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over-all properties as compared to wettable powders heretofore available.

It is another object of the present invention to provide a wettable powder which is characterized by relatively fast wetting properties.

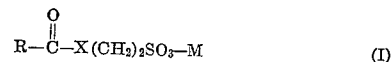
It is an additional object of the present invention to provide a wettable powder which can be easily dispersed in water to form a relatively stable suspension which advantageously exhibits little tendency toward sedimentation, even with age.

It is still a further object of the present method to provide a wettable powder which is readily dispersible in water to form a relatively low-foaming suspension.

It is a particular object of the present invention to provide a wettable pesticidal powder which is fast wetting in water and forms aqueous suspensions characterized by excellent suspensibility and low-foaming properties.

It is another particular object of the present invention to provide a wetting agent which is excellently adapted for utilization in the preparation of wettable powder formulations.

Broadly described, the present invention provides a wetting agent for utilization in preparing wettable powders, said wetting agent comprising (1) a surface-active substance of the formula

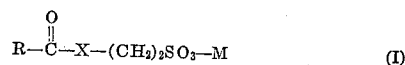


wherein R is an acyclic hydrocarbon radical, said surface-active substance having an average of from about 10 to about 22 carbon atoms per molecule in R, M is an alkali metal, and X is selected from the group consisting of —O— and



wherein R₁ is selected from the group consisting of hydrogen, alkyl having from 1 to about 6 carbon atoms, and cycloalkyl having from 3 to about 8 carbon atoms; (2) from about 5 to about 50 parts by weight per 100 parts of said surface-active substance of a nonionic surfactant; and (3) from 0 to about 50 parts by weight per 100 parts said surface-active substance of an acid material having an average of from about 12 to about 20 carbon atoms per molecule selected from the group consisting of rosin acids, fatty acids, alkali metal soaps of said acids, and mixtures thereof.

The present invention also provides a wettable powder formulation comprising (A) a water-insoluble powder, (B) from about 0.3 to about 25 parts by weight per 100 parts said powder of a dispersing agent selected from the group consisting of water-soluble lignin sulfonates and alkyl naphthalene sulfonates and (C) from about 0.3 to about 25 parts by weight per 100 parts said powder of a wetting agent consisting of a mixture of (1) a surface-active substance of the formula



wherein R is an acyclic hydrocarbon radical, said surface-active substance having an average of from about 10 to about 22 carbon atoms per molecule in R, M is an alkali metal, and X is selected from the group consisting of —O— and



wherein R₁ is selected from the group consisting of hydrogen, alkyl having from 1 to about 6 carbon atoms, and cycloalkyl having from 3 to about 8 carbon atoms; (2) from about 5 to about 50 parts per 100 parts of said

surface-active substance of a nonionic surfactant; and (3) from 0 to about 50 parts by weight per 100 parts of said surface-active substance of an acid material having an average of from about 12 to about 20 carbon atoms per molecule selected from the group consisting of rosin acids, fatty acids, alkali metal soaps of said acids, and mixtures thereof.

The "surface-active substance" employed in the wetting agents and wettable powders of the invention includes a single compound corresponding to Formula I, given hereinabove, wherein R has from about 10 to about 22 carbon atoms, mixtures of such compounds, and mixtures of compounds corresponding to Formula I wherein R has from about 7 to about 24 carbon atoms and the average number of carbon atoms per molecule in the radical R is in the range of from 10 to about 22. The radical R may be straight or branched-chain in structure and saturated or unsaturated in nature. For example, R may be n-heptyl, n-nonyl, n-decyl, n-undecyl, i-dodecyl, n-tridecyl, i-tetradecyl, n-heptadecyl, n-tridecenyl, n-tetradecenyl, n-heptadecenyl, eicosyl, n-heneicosyl, decosyl, tetracosyl, and the like. Such radicals are obtained by the use of acids RCO_2H , in preparing the esters and amides comprising the surface-active substances including, without limitation, octanoic, decanoic, lauric, tridecanoic (oxo process), myristic, palmitic, arachidic, behenic, carnaubic, stearic, pentadecanoic (oxo process), oleic, myristoleic and palmitoleic acids, and mixtures of such as acids, such as coconut oil acid, peanut oil acid, safflower oil acid, linseed oil acid, and tall oil acid.

Surface-active substances of the type described above are sold commercially under the trade names Igepon A and Igepon T. Specific examples of suitable surface-active substances include, without limitation the lauric acid ester of sodium isethionate, the palmitic acid ester of potassium isethionate, the i-tridecanoic acid ester of sodium isethionate, the myristic acid ester of sodium isethionate, the stearic acid ester of sodium isethionate, the myristoleic acid ester of sodium isethionate, the coconut oil acid and oleic acid esters of sodium isethionate, sodium N-cyclohexyl-N-palmitoyl-taurate, sodium N-methyl-oleoyl-taurate, sodium N-coconut acid-N-methyl-taurate, potassium N-i-propyl-N-myristoyl-taurate, sodium N-methyl-N-tallow acid-taurate, sodium N-methyl-M-tall oil acid-taurate, and sodium N-n-hexyl-N-palmitoyl-taurate.

The "water-insoluble" powders contemplated for utilization in the present invention are any water-insoluble or very slightly water-soluble solid powders conventionally employed or adapted to be employed in the preparation of wettable powder formulations. Suitable powders include, without limitation, pesticidal powders active as insecticides, nematocides, fungicides, bactericides, tickicides, miticides, herbicides, and the like, such as sulfur, DDT (1,1,1-trichloro-2,2'-di[p-chlorophenyl]ethane), Lindane (gamma-1,2,3,4,5,6-hexachlorocyclohexane), tetramethylthiuram disulfide, zinc ethylene bisdithiocarbamate, Aldrin (1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,3,5,8a-endo, exodimethanonaphthalene), Isodrin (stereoisomer of Aldrin having the endo, endo configuration), Dieldrin (the 6,7-epoxy derivative of Aldrin), Endrin (the endo, endo isomer of Dieldrin), Captan (N-[trichloromethylthio]-4-cyclohexene-1,2-dicarboximide), 2,4-D (2,4-dichlorophenoxyacetic acid), cuprous oxide, copper oxychloride, copper arsenate, N,N'-dimethylurea, maleic hydrazide, Malathion (S-[1,2-dicarbethoxyethyl]-O,O-dimethyl phosphorodithioate, Parathion (O,O-diethyl-O-nitrophenyl phosphorothioate), Ovatram (4-chlorophenyl-4-chlorobenzene sulfonate), etc., and powdered materials employed in industrial formulations including carbon, silica, calcium carbonate, mica, talc, montmorillonoid clays, such as bentonite, pigments, such as metallic aluminum and copper phthalocyanine, etc.

A portion of the water-insoluble powder ingredient of the wettable powder formulations of the invention may be present as an inert filler or diluent. The primary pow-

der ingredient desired in the formulations, such as a powder having pesticidal activity in a formulation to be used as a pesticide, is referred to hereinafter in the specification and claims as the "active" powder ingredient. The amount of the "diluent" powder present suitably may range up to about 300 parts by weight and higher, per 100 parts of the active powder ingredient. The particular inert diluent powder employed in a specific embodiment of the formulations of the invention, depends, inter alia, upon the nature of the active powder ingredient and the contemplated use of the wettable powder formulation. Specific examples of diluent powders employed, include, without limitation, clays, such as Barden clay, attapulgit, bentonite, and kaolinite, diatomaceous earth, fuller's earth, calcium limes, calcites, dolomites, gypsum, chalk, mica, talc, silicas, pyrophyllites, reprecipitated calcium o-phosphates and calcium carbonates, as well as other water-insoluble powders of natural or synthetic origin. It will be noted that in one instance a substance may be present as the active powder ingredient of a particular wettable powder formulation and in another instance as an inert diluent powder. The classification of the powder in each particular instance, of course, depends upon the contemplated use of the powder formulation.

Water soluble ligninsulfonates employed for the purpose of this invention are, for example, the sodium, calcium, and magnesium salts of ligninsulfonic acid and also of partly desulfonated ligninsulfonic acid such as those disclosed in U.S. Patent 2,371,136. Such materials are well known and commercially available and are sold for example under trade names Dazad 23 and Polyfon H (sodium ligninsulfonates), Marasperse C (calcium ligninsulfonate), Marasperse N (sodium ligninsulfonate), Marasperse CN (partly desulfonated calcium ligninsulfonate), Darvan 2 (purified sodium ligninsulfonate), and Maratak A and Super Spruce (magnesium ligninsulfonates).

Likewise the alkyl naphthalene sulfonates are well known in the art and are sold under such trade names as Nekal BX (General Aniline & Film Corporation), Maspertine (Du Pont), Marcowet 446-C (Chas. Pfizer), Naccosal A (Allied Chemical Co.), Neomerpin N (Du Pont), and Alkanol B (Du Pont). These are used in the form of their alkali metal (usually sodium) or ammonium salt. Specific compounds of this type are disclosed in Schwartz & Parry, *Surface Active Agents*, Interscience Publishing, New York (1949), pp. 116-119 and include mono- and di-propyl- and butyl-naphthalene sulfonates.

The term "nonionic surfactant" as employed herein in the specification and claims is intended to refer to any conventional nonionic compound having surface-active properties and mixtures of such compounds. Examples of suitable nonionic surfactants include, without limitation, the ethylene oxide ethers of alkyl phenols, such as the nonylphenol polyoxyethylene ethers; the ethylene oxide ethers of fatty alcohols, such as tridecyl alcohol polyoxyethylene ethers; the ethylene oxide ethers of alkyl mercaptans, such as dodecyl mercaptan polyoxyethylene thioethers; and ethylene oxide esters of the fatty acids, such as the lauric acid esters of polyethylene glycols and lauric acid esters of methoxypolyethylene glycols; the ethylene oxide ethers of fatty acid amides, such as the condensation products of lauramide and polyethylene glycols; the condensation products of ethylene oxide with partial fatty acid esters of sorbitol, such as the lauric esters of sorbitan polyethylene glycol ether; and other similar materials. In the preferred embodiments of the wetting agents and wettable powder formulations of the present invention, the nonionics, sold commercially as Igepals and Tritons, i.e., alkyl-aryloxypoly(ethyleneoxy)ethanols, are utilized as the nonionic surfactant ingredient.

The "acid material" employed in the present invention is selected from the group consisting of rosin acids, higher fatty acids having from about 12 to about 20 carbon atoms, mixtures of such acids, mixtures of acids having

from about 8 to about 22 carbon atoms, wherein the mixture is characterized by having an average of from about 12 to about 20 carbon atoms per molecule, alkali metal soaps of these acids, and mixtures of such acids and soaps. The fatty acid material may be straight or branched in structure, and saturated or unsaturated in nature. Specific examples of suitable acid materials include, without limitation, lauric, tridecanoic (oxo process), myristic, palmitic, stearic, arachidic, oleic, linoleic, myristoleic, palmitoleic, abietic, hydrogenated abietic, and disproportionated abietic acids, coconut oil acid, tallow oil acid, soybean oil acid, peanut oil acid, tall oil fatty acid, tall oil, and the sodium and potassium soaps of such acids and acid mixtures. In preferred embodiments of the present invention tallow oil acid and sodium soap is utilized as the acid material.

In preparing the wettable powder formulations of the present invention it will be understood that supplemental water-soluble or insoluble agents functioning as water-conditioning agents, coloring agents, and the like suitably may be added. For example, in the pesticidal wettable powders, of the invention, supplemental adjuvants, including, inter alia, water conditioners, such as sodium polyphosphates, thickening agents, such as casein, gelatin, carboxymethylcellulose, gums, and oxidized polyethylene wax, extender resins, such as coumarone-indene resins, also may be incorporated into the formulation.

In preparing the wetting agents and wettable powder formulations of the invention, the ingredients employed suitably may be combined in any sequence in any conventional mixing means. For example, all of the ingredients initially may be combined in granular form and the mixture subsequently reduced to powder form in a ball mill and the like, or the separate ingredients initially may be reduced to powder form by any conventional technique and then all mixed together.

The invention having been broadly described, the following examples are given to show specific embodiments thereof. It will be understood that the examples are given for illustration purposes and not by way of limitation.

Example 1

In evaluating the properties of the wetting agents of the invention in preparing wettable powder formulations, various surface-active compounds and combinations of surface-active compounds were tested as the wetting agent ingredient in a pesticidal powder formulation having the following basic formulation.

Ingredient:	Percent by weight
DDT -----	75
Hi Sil -----	15
Barden clay -----	7
Marasperse N -----	1.5
Wetting agent -----	1.5

The wetting agent was first absorbed on a basic inert carrier, Micro-Cel, to present an acceptable free-flowing powder. The usual ratio was 70 parts wetting agent to 30 parts Micro-Cel. The other ingredients were manually mixed together with the wetting agent. The formulation was then micro-pulverized and finally air-milled through a two-inch air micronizer. The finished formulations were tested for wetting, foaming, and dispersing properties in accordance with test procedures adapted from the specifications of the World Health Organization, International Cooperation Administration, and the United States Government. The following is a brief description of each test employed:

Wetting.—A five gram sample of the finished formulation is added to a 250 milliliter beaker containing 100 milliliters of standard hard water (342 p.p.m.). The time required to completely wet the entire sample is noted. An acceptable wetting time is considered to be less than three minutes, which is the requirement of the International Cooperation Administration specification. The revised World Health Organization specification carries no wetting requirement, although the earlier specification required an acceptable formulation to have a wetting time of less than one minute.

Foam and sediment.—The material used in the wetting test is stirred and drained into a 100 milliliter graduate,

TABLE I

Run No.	Wetting Agent	Wetting (Sec.)	Foam Ht. in mls.		Sediment (ml.)	Solids (percent)
			Irramed.	30 Mins.		
1.....	Igepon T ¹	30	10	5	2	3.1
2.....	Igepon CN-42 ²	120	1	0	23	1.6
3.....	Igepal CO-430 ³	105	1	0	4	3.3
4.....	Igepal CO-630 ⁴	90	1	0	1	2.5
5.....	Igepal DM-430 ⁵	240	2	0	4	3.1
6.....	Agent a ⁶	165	1	0	7	2.6
7.....	Agent b ⁷	300	3	0	25	0.4
8.....	Agent c ⁸	200	2	0	42	0.2
9.....	Agent d ⁹	120	1	0	32	1.2
10.....	Agent e ¹⁰	165	2	2	2	3.4
11.....	Atlox WA ¹¹ 1.05% active (2.1% as is) plus 1.5% Marasperse N (recommended usage).....	300	2	0	14	2.7
12.....	Atlox WA 1.05% active (2.1% as is) plus 1.5% Marasperse N.....	300	2	1	33	0.2
13.....	80 Igepal CO-630, 20 Igepal CO-210 ¹²	90	1	0	38	0.9
14.....	80 Agent f, ¹³ 20 Agent g ¹⁴	180	1	0	41	0.3
15.....	80 Agent a, ²⁰ 20 Agent h ¹⁵	210	1	0	8	2.5
16.....	80 Agent i, ¹⁶ 20 Igepal CO-210 ¹⁷	90	1	0	2	3.4
17.....	88 Agent k, ¹⁸ 12 Agent l ¹⁹	75	2	0	50	0.1
18.....	90 Igepal CO-430, 10 Agent l.....	110	3	0	38	0.8
19.....	20 Igepon T, 80 Igepal CO-430.....	80	2	1	41	0.7
20.....	50 Igepon T, 50 Igepal CO-430.....	60	7	5	22	1.7
21.....	80 Igepon T, 20 Igepal CO-430.....	26	5	4	0	4.2

¹ Sodium-N-methyl-N-oleoyl-taurate.

² Sodium-N-cyclohexyl-N-palmitoyl-taurate.

³ Nonylphenoxypoly(ethyleneoxy)ethanol, sp. gr. 1.02-1.03.

⁴ Nonylphenoxypoly(ethyleneoxy)ethanol, sp. gr. 1.05-1.07.

⁵ Dinonylphenoxy poly(ethyleneoxy)ethanol, sp. gr. 0.990-1.000.

⁶ Nonylphenoxy poly(ethyleneoxy)ethanol, sp. gr. 1.02.

⁷ Nonylphenoxy poly(ethyleneoxy)ethyl chloride.

⁸ Sodium salt of complex organic phosphate ester.

⁹ Sodium salt of complex organic phosphate ester.

¹⁰ Sodium N-methyl-N-stearoyl-taurate.

¹¹ Atlas Chemical Industries, wetting agent for Wettable Pesticidal Powders.

¹² Nonylphenoxypoly(ethyleneoxy)ethanol, sp. gr. 0.98-0.99.

¹³ Dinonylphenoxy poly(ethyleneoxy)ethanol, sp. gr. 1.04-1.05.

¹⁴ Dinonylphenoxy poly(ethyleneoxy) ethanol.

¹⁵ Condensation product of dinonylphenol plus 1.5 moles of ethylene oxide

¹⁶ Alkylpoly(ethyleneoxy)ethanol, sp. gr. 0.98.

¹⁷ Nonylphenoxypoly(ethyleneoxy) ethanol.

¹⁸ Nonylphenoxypoly(ethyleneoxy)ethanol, sp. gr. 1.18.

¹⁹ Sulfonated aliphatic polyester.

stoppered, and repeatedly inverted through twenty complete cycles. Foam in milliliters is noted immediately after the agitation is stopped and again after allowing the sample to stand undisturbed for thirty minutes. The sediment level is also noted and recorded at the same points in time. No absolute limits are employed as standards, although relatively low levels of both foam and sediment are desirable.

Suspensibility.—The top 50 milliliters of solution used in the foam and sediment test is withdrawn from the graduate and evaporated to dryness to determine the percentage of solids therein. The figure obtained gives an indication of the suspensibility power of the dispersing-wetting agent without the necessity of lengthy analysis. Theoretical maximum for this test would be 5 percent, indicating a perfect dispersion. This test is a modification of the World Health Organization and International Cooperation Association tests.

The results of these initial tests appear in Table 1.

It can be seen from the results tabulated above that the use of an Igepon by itself as the wetting agent yields an excessive amount of foam, while the nonionics tested by themselves are not completely satisfactory as wetting agents due to the slow wetting and low suspensibility power of powders prepared therefrom. On the other hand, it will be apparent that powders formulated in accordance with the present invention show excellent over-all properties.

Example II

Formulations prepared in accordance with the invention and others prepared utilizing different formulas for the wetting agents were tested initially with the procedure described in Example I and then portions of the formulations were tested in a second series of tests for wetting, sieving, and suspensibility carried out after a tropical heat storage according to the International Cooperation Association and the World Health Organization specifications. The manner of carrying out these tests appears below:

Tropical heat storage.—Twenty grams of the wettable powder tested, formulated as in Example I, are placed in a 250 milliliter beaker. A loose fitting disc is placed on the powder and weighted to exert an even pressure of 25 grams per square centimeter thereon. The beaker is then placed in an oven at 55° C. for 24 hours, after which the pressure assembly is removed and the powder is allowed to cool at room temperature. The following tests are then run on the powder three hours after removal from the oven.

Sieving.—Ten grams of the pretreated powder is slurried with 100 milliliters of tap water. This slurry is transferred to a clean 74 micron sieve and washed with a moderately vigorous spray of water at a rate of 4 to 5 liters per minute for 10 minutes. The residue remaining on the sieve is evaporated to dryness and weighed. The World Health Organization specifications require that not more than 2% (dry weight) of the powder sample treated shall remain on the sieve when tested in this manner.

Suspensibility.—A sample of 8.33 grams of the pretreated powder is slurried with 30 milliliters of standard hard water in a 100 milliliter beaker and allowed to stand for 15 minutes. The slurry is then washed with hard water into a 250 milliliter graduated cylinder and diluted to 250 milliliters. The cylinder is stoppered and repeatedly inverted through 30 complete cycles within one minute. The cylinder is then allowed to stand undisturbed at room temperature for 30 minutes. At the end of the 30 minute period the top 225 milliliters of the suspension is siphoned off with a minimum of disturbance. The remaining 25 milliliters of suspension are analyzed for DDT and the suspensibility is calculated in accordance with the World Health Organization specification, which requires that a minimum of 50% of the initial sample shall be in suspension when tested in this manner.

The results of the tests are set forth below in Tables 2 and 3:

TABLE 2.—PERFORMANCE OF FORMULATIONS BEFORE TROPICAL HEAT STORAGE

Run No.	Wetting Agent	Wetting (Sec.)	Foam Ht. in mls.		Sediment (ml.)	Solids (percent)
			Immed.	30 Mins.		
22	Igepon T-77	30	10	5	2	3.1
23	Igepal CO-430	180	3	0	3	3.2
24	Atlox WA at 1%	300	2	0	14	2.7
25	Atlox WA at 2.1%	300	2	1	33	0.2
26	Agriwet 9086 at 1.5%	130	6	5	24	0.9
27	Agriwet 9086 at 2.5%	70	6	5	1	3.4
28	80 Agent i, 20 Igepal CO-210	180	4	0	20	1.2
29	72 Igepon T-43, 18 Igepal CO-430, 10 Igepal CO-210	56	8	5	2	3.2
30	80 Igepon T-43, 20 Igepal CO-430	38	5	3	1	3.5
31	72 Igepon T-43, 18 Igepal CO-430, 10 Amber Flakes ²	32	5	1	1	3.5
32	72 Igepon T-43, 18 Igepal CO-430, 10 Tallow Fatty Acid.	49	4	3	1	3.5

¹ Nopco Chemical Co., wetting agent for Pesticidal Wettable Powders.

² Tallow Fatty Acid, Sodium Salt.

³ Flocculated.

TABLE 3.—PERFORMANCE OF FORMULATIONS AFTER TROPICAL HEAT STORAGE

Run No.	Wetting Agent	Wetting (Sec.)	Sieve Residue (percent)	Sediment (ml.)	Suspensibility (percent)
	Specification Requirement	<180	<2		>50
33	Igepon T-77	8	1.1	8	74
34	Igepal CO-430	180	0.6	17	73
35	Atlox WA at 1%	38	6.3	150	73
36	Atlox WA at 2.1%	38	4.9	160	75
37	Agriwet 9086 at 1.5%	30	11.4	132	48
38	Agriwet 9086 at 2.5%	20	0.03	12	72
39	80 Agent i, 20 Igepal CO-210	180	1.8	133	55
40	72 Igepon T-43, 18 Igepal CO-430, 10 Igepal CO-210	12	<0.1	21	41
41	80 Igepon T-43, 20 Igepal CO-430	8	<0.1	15	66
42	72 Igepon T-43, 18 Igepal CO-430, 10 Amber Flakes	7	<0.1	13	74
43	72 Igepon T-43, 18 Igepal CO-430, 10 Tallow Fatty Acid.	7	<0.1	9	85

¹ Flocculated.

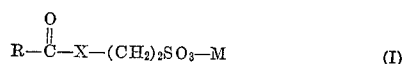
The results tabulated in Tables 2 and 3 clearly show the significant improvement obtained with respect to overall properties by the use of the formulations of the invention.

While all of the above tests were carried out using DDT as the active ingredient, it will be appreciated that any of the other conventional toxicants or industrial powders could be used in its place. Moreover, the particular dispersing agent and inert carriers used in the above tests are not to be considered as limitative, since any of the materials well known for these purposes could be substituted for those used in the tests, while maintaining the improved characteristics realized with the wetting agents of the instant invention.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of this invention.

What is claimed is:

1. A pesticidal wettable powder formulation comprising (A) a water-insoluble pesticidal powder, (B) from about 0.3 to about 25 parts by weight per 100 parts said powder of a dispersing agent selected from the group consisting of water-soluble lignin sulfonates and alkyl naphthalene sulfonates, and (C) from about 0.3 to about 25 parts by weight per 100 parts said powder of a wetting agent consisting of a mixture of (1) a surface-active substance of the formula



wherein R is an acyclic hydrocarbon radical, said surface-active substance having an average of from about 10 to about 22 carbon atoms per molecule in R, M is an alkali metal, and X is selected from the group consisting of —O— and



wherein R₁ is selected from the group consisting of hydrogen, alkyl having from 1 to about 6 carbon atoms, and cycloalkyl having from 3 to about 8 carbon atoms; (2) from about 5 to about 50 parts per 100 parts of said surface-active substance of a nonionic surfactant; and (3) from 0 to about 50 parts by weight per 100 parts of said surface-active substance of an acid material having an average of from about 12 to about 20 carbon atoms per molecule selected from the group consisting of rosin acids, higher fatty acids, alkali metal soaps of said acids, and mixtures thereof.

2. The wettable powder according to claim 1 wherein said nonionic surfactant is an alkylaryloxypoly(ethylene-oxy)ethanol.

3. The wettable powder according to claim 1 wherein said fatty acid material is tallow oil acid.

4. The wettable powder according to claim 1 wherein said surface-active substance is the coconut oil acid ester of sodium isethionate.

5. The wettable powder according to claim 1 wherein said surface-active substance is the oleic acid ester of sodium isethionate.

6. The wettable powder according to claim 1 wherein said surface-active substance is sodium N-cyclohexyl-N-palmitoyl-taurate.

7. The wettable powder according to claim 1 wherein said surface-active substance is sodium N-methyl-N-oleoyl-taurate.

8. The wettable powder according to claim 1 wherein said surface-active substance is sodium N-coconut acid-N-methyl-taurate.

9. The wettable powder according to claim 1 wherein said surface-active substance is sodium N-methyl-N-tallow acid-taurate.

10. The wettable powder according to claim 1 wherein said surface-active substance is sodium N-methyl-N-palmitoyl-taurate.

11. The wettable powder according to claim 1 wherein said surface-active substance is sodium N-methyl-N-tall oil acid-taurate.

12. The wettable powder according to claim 1 wherein said pesticidal water-insoluble powder consists of up to about 300 parts by weight per 100 parts of said pesticidal water-insoluble powder of an inert diluent.

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