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SPRAY OIL AND EMULSION

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This invention relates to mineral spray oils, soluble oils and emulsions for agricultural purposes, the principal object of the invention being to provide valuable and effective media for commercial spraying.

The invention resides in a soluble or emulsifiable oil comprising any well known type of highly refined non-phytocidal mineral spray oil containing in solution a small quantity of an oil-soluble and substantially water-insoluble agent in the nature of an airblown fatty oil containing a large or at least a substantial proportion of the triglycerides of non-hydroxy fatty acids having one double bond. Such a fatty oil is rapeseed or colza oil, sufficiently blown to render it suitable for the purpose but not blown to the point where it is insoluble in oil. The invention also resides in such a soluble oil, i. e., a mineral spray oil, containing the stable type of blown fatty oil, employed in conjunction with a water-soluble emulsifying agent. In other words, the invention also resides in an emulsifiable oil comprising mineral spray oil, an oil-soluble, water-insoluble, blown fatty oil of the type mentioned in combination with a water-soluble oil-insoluble emulsifier. The invention further resides in such an emulsified oil containing an oil-soluble constituent and a water-soluble constituent wherein the water-soluble constituent is a water-soluble salt of sulfated higher fatty alcohol, of which sodium lauryl sulfate is a preferred example.

The invention resides further in an emulsifying oil composition or emulsion comprising a mineral spray oil, an oil-soluble, substantially water-insoluble material other than a blown fatty oil of the indicated type, where such oil-soluble agent is of other form adequate to lower surface tension in resultant emulsions, such as oleic acid, undecylenic acid or the so-called oil-soluble or heat-treated castor oils, in combination with water-soluble, substantially oil-insoluble salts of sulfated fatty alcohols as above indicated, of which sodium lauryl sulfate is a preferred example.

In practicing the invention any of the well known grades of agricultural mineral spray oil is employed as the main oil body. These oils ordinarily have high unsulfonatable residues, for example about 90%, which value is frequently known as de Ong number, and represents that proportion of the oil not subject to sulfonation by a well known sulfonation test described in Industrial and Engineering Chemistry, vol. 18 (1926), page 175. Briefly, the oil is treated with sulfuric acid exactly 37 normal (100%) in a water bath at 95° C. to 100° C.—ordinarily at 210° F. to 212° F.—for a period of one hour. The above acid is added to the oil in proportions of 20 cc. of acid to 5 cc. of oil in two dumps in a Babcock cream test bottle, the mix being agitated every 10 minutes. After phase separation, the unsulfonated material is the unsulfonatable residue, the percentage of which constitutes the test for the oil and is often called "de Ong number."

These oils have low viscosities, for example about 85 to 90 seconds Saybolt Universal at 100° F., and light color such as 1 or 2 N. P. A. Such oils being in general well known in the art need not be further described here.

In selecting a blown fatty oil suitable for the purpose, blown rapeseed oil (colza oil) is generally preferred. Such oils are required to be blown sufficiently to have maximum emulsifying properties but are not blown to the point where insolubility in oil is induced. If not sufficiently blown they possess poor emulsifying properties, whereas if they are excessively blown they tend to come out of solution. If desired, moderately blown oils may be obtained on the open market. In general any fatty oil, animal or vegetable, containing a sufficient quantity of triglycerides of non-hydroxy fatty acids containing one double bond to impart these desired properties may be blown to possess the desired characteristics and then used for the present purpose. Animal and vegetable oils contain mixtures of the mentioned triglycerides (some diglycerides being present) of various fatty acids in quantity sufficient for the purpose, it being necessary, however, that there be an appreciable quantity of such single double-bonded triglycerides of non-hydroxy fatty acids. Such other oils include lard oil which contains triglycerides of a non-hydroxy oleic acid having one double bond. In the preferred rapeseed oil the fatty acid present as glycerides consists of more than 50% erucic acid which is a non-hydroxy acid of one double bond having the formula $C_{22}H_{42}O_2$.

When small quantities in the order of about 1% of blown oils of the indicated type such as commercial blown rapeseed oil are added to a light or medium or light-medium spray oil, they dissolve in the oil and a so-called soluble oil is obtained which is suitable for use in both hard and soft waters and may be emulsified in the water with vigorous agitation (but is not spontaneously emulsifiable), the resultant emulsions being usually satisfactory both as to stability and as to wetting properties when sprayed upon foliage. While about 1% of the blown oils such as

blown rapeseed oil is very desirable for these purposes, it is of course possible to vary the percentage, for example from about 0.25% to 2% or 3% or perhaps higher. Where the percentage is too low the desired effects are not obtained and where the percentages run much higher than indicated no appreciably greater benefits are observed.

Whereas the above described soluble oil in the form of mineral spray oil and small percentages of blown fatty oils of the indicated type may be emulsified by agitation and used in that form, it is also very desirable to prepare water emulsions from such an oil by adding a small quantity of a water-soluble emulsifier which is substantially insoluble in the oil, in contradistinction to the oil-soluble blown fatty oil which is substantially insoluble in water. As such water-soluble oil-insoluble emulsifiers to be employed in conjunction with the indicated blown fatty oils, it is preferred to use water-soluble oil-insoluble salts or esters of sulfated higher alcohols. These water-soluble emulsifiers include the sodium and potassium salts of such sulfated fatty higher alcohols. As a particular example, sodium lauryl sulfate is preferred. Again, a water-soluble and oil-soluble emulsifier may be substituted, at least for some uses, and for this purpose a triethanolamine salt of the higher fatty acids is preferred, especially triethanolamine oleate; also other such ethanolamine soaps which are soluble in both oil and water may be employed.

From these materials concentrated emulsions may be prepared which are subject to ready dilution to produce stable dilute emulsions. In preparing such concentrated emulsions a mineral spray oil containing around 1% by volume of blown rapeseed oil or other indicated quantity thereof or of other indicated blown oil, is emulsified by adding to about 90 parts thereof about 10 parts of water containing about 10% by weight of sodium lauryl sulfate or kindred indicated sulfated fatty alcohol salt. The emulsion is easily produced by simple agitation, as distinguished from the vigorous agitation required to place the oil itself in form of emulsion. Having obtained such a concentrated emulsion, this may be added to water, in other words readily diluted with water, to yield a stable dilute spray emulsion. Such diluted emulsions are in general well known in the spraying arts and are produced with sufficient water to yield an oil content of around 2% when ready for spraying in the field. In preparing the concentrated emulsions the amount of water and the amount of sulfated fatty alcohol salt may be varied from the proportions indicated. In general the water will run from 5% to 15% of the total concentrated emulsion, and the sulfate may vary from perhaps 5% to 20% of the water content, or from about 0.5% to 2% of the concentrated emulsion. In other words, a concentrated emulsion would have a constitution somewhat as follows:

	Per cent
Mineral spray oil (85 viscosity, 90 de Ong)	85 to 95
Oil-soluble emulsifier (blown oil)	0.25 to 3
Water soluble emulsifier such as sodium lauryl sulfate	0.50 to 2
Water	15 to 5

Similar proportions are employed and similar emulsions obtained when using the indicated ethanolamine soaps instead of the sulfates.

While the ranges of the oil-soluble and water-soluble emulsifiers are indicated as having the range up to as high as 3% or thereabouts, it is to be noted that ordinarily no substantial additional benefit is to be obtained when about 1% of each is exceeded based on the indicated water content of the concentrated emulsion. Of course when the concentrated emulsion is reduced with water to about a 2% oil-content spraying emulsion, the respective contents of the effective ingredients with respect to the total are correspondingly reduced.

Another feature of the invention resides in the fact that where using the indicated water soluble salts of the sulfated fatty alcohols, these salts exert a highly efficient emulsifying action upon a modified mineral spray oil where the blown fatty oil content is replaced with any organic fatty acid or fatty oil having an approximately equivalent oil solubility and surface tension lowering capacity. Such substitute materials are represented by oleic acid, undecylenic acid and the heat treated "oil soluble" castor oils.

It has also been found desirable to add a very small proportion (e. g. in the order of a few tenths of one per cent) of ammonia hydroxide solution in preparing the concentrated emulsion because this has been found to produce a somewhat better oil deposit on foliage when the final dilute emulsion is sprayed. For example, the addition of 0.1% NH_4OH solution of 0.90 specific gravity (26%) to the concentrated emulsion has resulted in raising a 97% kill from sprays free from ammonia in citrus spraying to a 99% kill, which is indicative of greater oil deposit.

As an example of a suitable concentrated emulsion which may be later diluted with water to yield a field spray containing 2% to 3% oil according to prevailing practices, the following may be considered a practical average:

	Per cent
Mineral spray oil (75 to 85 vis., 90 to 93 de Ong, 1 to 2 N. P. A. color)	89
Blown rapeseed oil	1
Sodium lauryl sulfate	0.8
Ammonium hydroxide sol. 9 sp. gr	0.1
Water	9.1
	100.0

The ammonia may be increased to perhaps 0.3% or even more, but greater proportions offer no appreciable further advantage. Where the advantage of the ammonia is of no particular consequence it may of course be omitted.

In selecting a spray oil, it is to be understood that any of the well known spray oil stocks may be used, for example those ranging in viscosities from 65 to 95 seconds Saybolt Universal at 100° F., with N. P. A. colors of 1 to 3, and having de Ong numbers of 95 down to 85 or even lower. In other words any light mineral fraction suitable for agricultural spraying may be used in practising this invention.

It is to be understood that the above disclosures are merely illustrative of the generic invention and are not to be taken as limiting.

I claim:

1. A mineral oil emulsion comprising mineral spray oil, a small proportion of oil-soluble air-blown rapeseed oil, a small proportion of sodium lauryl sulfate, and less than about one percent of ammonium hydroxide sufficient to assist spreading of the oil.

2. An emulsifiable oil for horticultural spray-

ing comprising mineral spray oil containing a small proportion in the order of 1% of an oil-soluble blown non-hydroxy fatty oil having a single double bond, and containing water and a small proportion less than about 1% of ammonium hydroxide to assist spreading.

3. An emulsifiable horticultural spray oil comprising mineral spray oil, a small proportion in the order of 1% of an oil-soluble blown non-hydroxy fatty oil having only one double bond, and a small proportion less than about 3% based on the oil of a water-soluble emulsifying salt, the composition being free from soap, and containing water and a small proportion less than about 1% of ammonium hydroxide to assist spreading.

4. An emulsion for horticultural spraying substantially free from soaps and comprising water, a non-volatile mineral oil, between about 0.25% and 3% based on the oil of oil-soluble blown fatty oils having a substantial proportion of tri-glycerides of non-hydroxy fatty acids having only one double bond, between about 0.1% and 1% of ammonium hydroxide, and between about 0.5% and 3% based on the oil of a water-soluble salt of sulfated higher fatty alcohols.

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