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DEPOSITING AGENT FOR SOLID INSECTICIDES

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1 Claim. (Cl. 167-42)

This invention relates to a new and improved method of applying insecticidal materials in a finely divided state as suspensoids in water, and it pertains more particularly to a new and improved depositing agent for insecticides such as lead arsenate, cryolite, phenothiazine, etc.

The object of this invention is to provide a method and means for obtaining lethal deposits of insecticidal materials on apples or other fruits or foliage. The standard insecticide used by apple growers for controlling codling moth is lead arsenate, but the best known methods of applying lead arsenate fail to give a lethal deposit in one application, and present practice requires six or eight different sprays throughout the growing season. The object of this invention is to obtain a smooth, uniform deposit of lead arsenate (as distinguished from the blotchy or spotted cover heretofore obtained), and to deposit lead arsenate in amounts of at least 70 micrograms per square centimeter, and preferably in excess of 100 micrograms per square centimeter. It has been found that in the eastern states a lethal deposit is approximately 70 micrograms per square centimeter and on the Pacific coast and in the northwest the lethal deposit may be 100 micrograms or higher. By "lethal deposit" I mean the amount of insecticide which will insure protection against codling moth larvae.

Heretofore it has been necessary to employ a calyx spray and 6 to 8 cover sprays for controlling codling moth. I have discovered that if an insecticide is deposited in a smooth, uniform film in amounts sufficient to constitute a lethal deposit, the calyx spray may in some cases be entirely eliminated and the cover sprays be limited to 3 or 4. An object of my invention is to reduce the number of operating applications which are required for codling moth control and to improve the efficiency of said control.

A further object of my invention is to provide a depositing agent for lead arsenate and similar insecticides which will result in a smooth, even, impervious coating which is not washed off by ordinary rainfall but which can be easily removed by conventional washing solutions so that the washed fruit will easily comply with Government requirements with regard to the absence of lead residues.

When the usual spreading and wetting agents are used as depositing agents for lead arsenate they may improve the uniformity of deposit, but at the same time they actually decrease the total amount of insecticide which can be deposited per unit of surface. An object of my invention is to

provide a depositing agent which will give an absolutely smooth and uniform deposit and which will, at the same time, enable the deposition of lethal deposits. A further object is to provide a depositing agent which will cause the insecticide to adhere firmly to the fruit and leaves so that a minimum amount of insecticidal material will be carried away with the run-off or drips.

I have discovered that when hydroxy esters of high molecular weight organic acids such as glyceryl mono-oleate, glycol mono-oleate, etc. are added in amounts of about 4 to 16 ounces per 100 gallons to an aqueous slurry of lead arsenate (3 pounds per 100 gallons) and this slurry is sprayed on the apples or plant foliage, an entirely different type of deposit is obtained than is obtainable by the use of any other known spreading or wetting agents. The lead arsenate is distributed in a perfectly smooth, uniform coating. The hydroxy esters by themselves, however, do not permit the deposition of enough of the insecticide material to constitute a lethal deposit. I have discovered that when certain organic acids, sulfonated oils, sulfonated organic acids, or substituted amines are admixed with high molecular weight organic esters such as glycol oleate or glyceryl oleate, and particularly hydroxy esters of high molecular weight organic acids such as glycol mono-oleate or glyceryl mono- or di-oleate, a depositing agent is produced which not only results in a perfectly smooth, uniform and impervious coating, but which also effects the deposition of insecticidal material in amounts which are equal to or greater than the lethal deposits herein above described. The invention will be more clearly understood from the following detailed description.

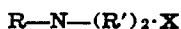
The best spreaders, wetting agents, sticking agents, etc. which have been heretofore available for depositing lead arsenate from aqueous suspensions thereof have given deposits of lead arsenate which range from about 20 to 50 micrograms per square centimeter. When glyceryl mono-oleate is employed instead of the prior art spreaders, a smooth, uniform cover is obtained, but even less of the lead arsenate is deposited than with spreaders such as calcium caseinate. However, when a mixture of 4 parts glyceryl mono-oleate with 1 part of naphthenic acid is employed in amounts of about 8 ounces per 100 gallons of spray, lead arsenate deposits of 100 micrograms or more per square centimeter are obtained with the same impervious and smooth, uniform flow cover. Using 1 pint per 100 gallons of a depositing agent consisting of equal parts of

glyceryl mono-oleate and mono-amyl amine naphthenate I obtained the same smooth, uniform deposit of 140 micrograms of lead arsenate per square centimeter.

It will be noted that my depositing agent consists of at least two components. The major component constitutes about 50 to 90% of the depositing agent and is preferably a hydroxy ester of a high molecular weight organic acid, but it may be a high molecular weight organic ester such as di-glycol oleate, or glyceryl oleate. The so-called blown, boiled or polymerized animal or vegetable oils, as exemplified by blown or polymerized sardine oil may be used as the ester or hydroxy ester which constitutes the major constituent of my depositing agent. The minor constituent is preferably a high molecular weight organic acid such as naphthenic or oleic acid or a substituted amine compound such as mono-amyl amine naphthenate or mono-amyl amine oleate. I have found, however, that this minor constituent which constitutes 10 to 50% of the depositing agent may consist of sulfonated animal, vegetable or mineral oils, such as sulfonated fish oil, sulfonated castor oil or petroleum sulfonic compounds. Mono-amyl amine naphthenate (80% naphthenic acid and 20% mono-amyl amine) may be used by itself as a depositing agent with good results but I prefer to employ the 2-component mixture as hereinabove described.

When insecticides such as lead arsenate are applied by means of oil-in-water emulsions, improved deposits may sometimes be obtained by the use of a small amount of bentonite. However, I have found that bentonite used alone does not increase the deposit of insecticides from my aqueous suspensions, and in fact actually decreases the deposit of the insecticidal material, the bentonite appears to give a stable colloidal suspension which flows over the fruit and leaves and then flows right off again, leaving practically no deposit. However, when a small amount of aluminum sulfate is mixed with the bentonite, about 1 part of aluminum sulfate to 3 to 5 parts of bentonite, the bentonite mixture effected an increased deposit of insecticide. This mixture is preferably added to the spray in amounts of 1/4 to 2 pounds per 100 gallons of spray. For example, I have found that when 1 pint of the depositing agent consisting of 3 parts glyceryl mono-oleate and 1 part oleic acid is added to 100 gallons of spray containing 3 pounds of lead arsenate, a deposit of 110 micrograms per square centimeter is obtained. When 8 ounces of bentonite and 2 ounces of aluminum sulfate are added to this mixture, the deposit of lead arsenate is increased to 150 micrograms per square centimeter. For most purposes the amount of bentonite-aluminum sulfate mixture should be used in amounts of about 1/3 to 3/4 pounds per 100 gallons of spray.

The substituted amine compound hereinabove referred to is preferably a compound of the type represented by the following formula:



where R is alkyl, aryl or aralkyl group; R' is a hydrogen or an alkyl, aryl or aralkyl group, and X is a carboxylic acid, substituted or not, having at least six carbon atoms. Preferred examples of such compounds are:

Mono-amyl-amine-oleate, $C_5H_{11}NH_2C_{17}H_{33}COOH$
Butyl-amine-naphthenate, $C_4H_9NH_2C_8H_{11}COOH$
Ethyl-amine-stearate, $C_2H_5NH_2C_{17}H_{33}COOH$

Methyl-ethyl-amine-oleate,



Triethyl-amine-oleate, $(C_2H_5)_3NC_{17}H_{33}COOH$

Examples of depositing agents which have proved to be effective are:

	Parts
Glyceryl mono-oleate plus 1 part naphthenic acid	4
Glyceryl mono-oleate and 1 part mono-amyl amine naphthenate	5
Glyceryl mono-oleate and 1 part mono-amyl amine oleate	5
Glyceryl mono-oleate and 1 part sulfonated castor oil	5
Di-glycol oleate and 1 part naphthenic acid ..	1
Glycol mono-oleate and 1 part naphthenic acid	1
Glyceryl mono-oleate and 1 part oleic acid	3

The depositing agent is preferably added to the water in the spray rig after the lead arsenate or other insecticide is incorporated therein, and it may be used in amounts of from 2 to 16 ounces, preferably 4 to 8 ounces per 100 gallons of water. The lead arsenate is suspended as a slurry in water in conventional apparatus in the usual manner, but in the actual application of the spray, care must be taken to see that all surfaces are coated with the necessary amount of spray material. Generally speaking, a more thorough spraying is required than is usually practiced with the old spot-type spray mixtures. With proper spraying the deposit is from 2 to 4 times as heavy as that obtainable from aqueous suspensions in the absence of my depositing agent, and is, in fact, above the known lethal concentration. With this type of depositing agent I can effect substantially complete control of codling moth with four cover sprays, thus effecting marked savings in the cost of spray material since conventional practice now requires as many as seven or eight applications.

While I have described the use of my improved depositing agents in connection with lead arsenate, it should be understood that the invention is equally applicable to the depositing of other suspensoids such as phenothiazine, cryolite, and in fact any insecticidal material which may be suspended in water and applied by means of conventional spray rigs.

The invention is particularly well adapted for the deposition of nicotine and nicotine compounds such as nicotine sulphate, nicotine oleate, nicotine naphthenate, etc. When nicotine is employed I have found it desirable to use the bentonite mixture (consisting of bentonite with about 5% to 25% of aluminum sulphate) in amounts of about 1 to 4 pounds per 100 gallons of spray. The bentonite mixture not only increases the deposit of nicotine, but appears to "fix" the nicotine and prevent it from running off the leaves with the drips. I prefer to employ naphthenic or oleic acids with the nicotine, particularly when the high molecular weight organic ester such as glyceryl oleate is used. For example, a preferred formula of this type is:

Water	gallons... 100
Glyceryl oleate	ounces... 8
Nicotine naphthenate	do... 16
Bentonite-aluminum sulphate mixture	pounds... 4

and other clays may be substituted at least in part for the bentonite, but I have found that the bentonite mixture hereinabove described gives the best results.

When insecticides such as nicotine are employed no washing of the fruit is necessary, but in the case of lead arsenate, cryocide, etc., it is necessary that the fruit be washed in order that it may meet the Government tolerance requirements. In this connection it should be pointed out that the glyceryl oleate and other components of my depositing agent are readily susceptible to washing with slightly acid or slightly alkaline solutions.

While I have described in detail preferred embodiments of my invention, it should be understood that I do not limit myself to any of the details herein described, except as defined by

the following claim which should be construed as broadly as the prior art will permit.

I claim:

5 A depositing agent for the application of insecticidal material from aqueous suspensions thereof, which agent consists essentially of a mixture of a hydroxy ester made by reacting a polyhydric alcohol having from 2 to 4 carbon atoms with a high molecular weight fatty acid,
10 a salt made by reacting a lower alkyl amine with a carboxylic acid having at least 6 carbon atoms, and small amounts of bentonite and aluminum sulfate.

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