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SYNERGISTS TO AEROSOL INSECTICIDES

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3 Claims. (Cl. 167—22)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This application is made under the act of March 3, 1883, as amended by the act of April 30, 1928, and the invention herein described and claimed, if patented, may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment to us of any royalty thereon.

This is a division of our copending application for patent, Serial No. 412,960, filed September 30, 1941.

Our invention relates to materials which will increase the effectiveness of insecticides in aerosol form.

Certain agents which may or may not be toxic in themselves when added to aerosol insecticides greatly increase the rate of mortality. The increased toxicity obtained by the combination of such materials is often referred to as "synergism" and the added material a "synergist." Therefore, in these terms, the general object of our invention is the provision of materials suitable as synergists for aerosol insecticides.

Another object of our invention is the provision of agents which will not only increase the insecticidal action of materials known to possess some toxicity, but, which will also impart insecticidal properties to materials which are known to be non-toxic or to have a very low toxicity.

A further object of our invention is the provision of such agents acting as synergists, which can be applied by dispersion simultaneously with and by the same methods used for the preparation of aerosol insecticides.

We have found that materials suitable for the purposes of this invention belong most frequently to the class of chemical compounds which are surface active in non-aqueous solvents or which act as detergents in non-aqueous solvents. These compounds, in general, contain polar groupings such as the hydroxyl, the carboxyl, the amine, the ammonium, or the sulfonic acid, alone, in multiple, or in combination, which is attached to some long chain aliphatic radical, or, in some cases, an aromatic radical.

Substances acting as detergents or surface active agents in non-aqueous media can be easily applied by the usual methods of aerosol production, but this invention is not limited to these substances because different methods of aerosol production can be used with different types of synergists. In this class of chemical compounds we have found the fatty acids, the mono esters of fatty acids and ethylene or propylene glycol, of glycerine or sorbitol, to be especially suitable as well as fatty acids in combination with amines such as methanolamine, sulfonated aryl and alkyl radicals alone or combined with an amine.

There are many processes which can be used to apply these materials in the form of aerosols, such as spraying into the atmosphere, vaporization, by chemical reaction, by spraying on a heated surface, and so forth. Although this invention is not limited to any particular method of application, our preferred method of application comprises dissolving the synergist in the insecticide, if the insecticide is a liquid, or dissolving it in some solvent common to both if a solid, and spraying the solution on a heated surface, whereby an aerosol is formed composed of both the synergist and the insecticide.

A synergist to an insecticide in aerosol form is not necessarily also a synergist to an insecticide in spray form, even of the same compound. Actual tests have disclosed that an agent which possesses little or no effect as a synergist to an insecticidal spray may be extremely effective as a synergist to an insecticidal aerosol. The reason for this is not apparent, but it would seem that the mere wetting of the insect cannot explain the action.

The following results were obtained using synergists in accordance with this invention. These results were obtained on the basis of preliminary tests first carried out in a small chamber of 7 cu. ft. and then on a larger scale in a 216 cu. ft. chamber. In each test from 500 to 600 flies were used. Six-tenths of a pound of o-dichlorobenzene per 1000 cu. ft. gave only a 2% kill. However, when mixed with 0.16 lb. of oleic acid as a synergist, a 55% kill was obtained. This same quantity of oleic acid, when used alone under the same conditions gave only a 1% kill. Lauric acid when used alone in the same amount, namely, 0.16 lb. per 1000 cu. ft., gave only a 1% kill, but when used as a synergist with 0.6 lb. of o-dichlorobenzene per 1000 cu. ft. a 60% kill was obtained.

The same synergists were tested at other con-

centrations and it was found that little is gained by adding more than 10%.

The following is a list of substances which were tested as synergists at a concentration of 0.06 lb. in 0.6 lb. of o-dichlorobenzene per 1000 cu. ft. against the housefly, the percentage of kill in each case being indicated in the right hand column:

	Per cent kill
Spermaceti	37
Diglycol laurate	48
Sulfonated naphthalene	60
Salicylic acid	91
Propylene glycol oleate	28
Myristic acid	49
Propylene glycol laurate	74
Sorbitol laurate	59
Monoglycol laurate	56
Triethanolamine oleate	56
Lauryl sulfate	70

Other insecticides were used against the American and German cockroach at a concentration of 1.5 lbs. per 1000 cu. ft. One-tenth of the insecticide was replaced by a synergist. A mortality of 100% was obtained with the following: methyl chloroacetate plus lauric acid, epichlorohydrin plus lauric acid, epichlorohydrin plus oleic acid, ethyl dichloroacetate plus lauric acid, ethyl dichloroacetate plus oleic acid, beta-chloroethyl chlorocarbonate plus lauric acid, beta-chloroethylacetate plus lauric acid, tetrachloroethane plus lauric acid, and o-dichlorobenzene plus lauric acid. In all cases where oleic acid was effective, lauric acid was also found to be effective and vice versa. The kill without a synergist was always less than 100% and usually less than 50%.

In a 1100 cu. ft. room, naturally infested with cockroaches, more than 5000 were killed in 18 hours and none were found living, using 1½ lbs. of o-dichlorobenzene with 3% lauric acid and 2% oleic acid. Excellent results were also obtained in a 3200 cu. ft. room.

Tests were also conducted against the carpet beetle larva, the confused flour beetles and crickets. The halogenated esters in combination with any one of the synergists mentioned above are extremely toxic to the confused flour beetle and produce a high mortality to the carpet beetle larva.

Among 80 compounds tested against the housefly in the form of aerosols, in combination with synergists of the type mentioned above, are 3-chloroacenaphthene, 2-chlorofluorene, 3-chlorodibenzofuran, chlorinated diphenyls, halogenated naphthalenes, halogenated esters, halogenated ketones, carbazole, thiocresol and halogenated phenols. The synergist was shown to be responsible in each case for an increase in toxicity.

Having thus described our invention, we claim:

1. An insecticide in aerosol form comprising oleic acid and thiocresol.

2. An insecticide in aerosol form comprising lauric acid and thiocresol.

3. An insecticide in aerosol form comprising triethanolamine oleate and an agent chosen from the group consisting of methyl chloroacetate, ethyl dichloroacetate, beta-chloroethyl chlorocarbonate, and beta-chloroethylacetate.

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