Monsanto

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CHEMICAL SPECIALTIES DATA REPORT

The information in this report was compiled to assist you in your evaluation and development of special uses for Monsanto products. Every effort has been made to include pertinent material bearing on the subject. This information is intended to guide your development work, but Monsanto cannot take part in the specific formulation or evaluation of any finished product . . . since knowledge of such should be reserved to yourself and is often your most valuable trade secret.

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Date March, 1961

MONSANTO AROCLOR* RESINS FOR INSECTICIDE FORMULATIONS

A Discovery

A simple method of increasing the service life of expensive lindane sprays was developed several years ago by U. S. Department of Agriculture scientists at their Beltsville, Maryland, testing station. The technique was to incorporate Monsanto's "Aroclor" 5460, a resinous chlorinated terphenyl in the lindane solution. This pale yellow solid reduces volatility of the lindane -- slows it down to an effective, but not wasteful, evaporation rate. The result is an insecticide deposit on treated surfaces that lasts up to ten times longer than that left by straight lindane solutions.

Normally, simple solutions of lindane leave a crystalline residue that dissipates within a few weeks. On hard surfaces such as glass, metal or painted areas, the residues last only about a week. Because lindane is a well established and effective pesticide, U.S.D.A. researchers sought a way to improve the lasting qualities of lindane residues. Of numerous compounds tested, "Aroclor" 5460 gave the best results at lowest cost.

Test Work

A major objective of these studies was to develop a suitable formulation for application to crops and other plants. Although results under carefully controlled conditions were quite promising, subsequent tests by other agricultural experimenters gave only moderate success. Consequently, interest has been slow to develop in agricultural circles. Apparently, the vagaries of sunlight, weather, and plant growth represent too many variables for effective study of the formulation residues by direct application to exposed plants.

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* Aroclor: Reg. U. S. Pat. Off.

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A New Idea

But another possibility for putting the U.S.D.A. discovery to work has lain dormant until recently; this is the possibility of using to good advantage the ability of "Aroclor" resins to make the lindane adhere to smooth hard surfaces like metal, glass, painted areas, etc. This would consist of painting or spraying "Aroclor"/lindane formulations on such areas as the inside of garbage can lids, on window screens, doorsills, the painted walls of outbuildings, dairy plants, storage areas, etc., in order to obtain lasting control of flies, ants, roaches, silverfish and other troublesome pests. Suitable formulations can be readily packaged in shoe-polish type "dauber" bottles, aerosol spray cans, and bulk packages for mechanical spray application. Development of this idea is based on the following:

Advantages of Using "Aroclor" Resins in Insecticide Formulations

* A suitable "Aroclor" (Monsanto makes seven) can remarkably extend the effective life of lindane and other chlorinated insecticides as much as ten times (up to 2 and 3 months).

* "Aroclor" resins are very low in cost (around 20¢/lb.).

* Small quantities are sufficient (5 to 25 parts per hundred, by weight).

* Formulation is extremely simple -- the resin is dissolved in a suitable solvent compatible with the insecticide.

* Stable in inventory and in insecticide formulation. "Aroclor" resins are fire-resistant, non-oxidizable, non-corrosive, withstand weather extremely well.

* Non-staining "Aroclor"/insecticide films formed when the solutions dry are practically invisible. "Aroclor" 5460 has a pale yellow color as supplied. Other suitable "Aroclor" products are nearly colorless.

* "Aroclor" resins are odorless -- won't impart "chemical" odors.

* "Aroclor" resins are safe to handle as long as they are not volatilized and inhaled. They are practically non-volatile at ordinary temperatures, do not irritate or sensitize normal skin.

* The nature of the residue can be varied. Monsanto supplies a variety of "Aroclor" resins. These are chlorinated to various degrees and vary in physical properties as follows:

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Chlorinated Terphenyls

Aroclor 5460 - Yellow, transparent, friable solid (dries hard)
Aroclor 5442 - Yellow, transparent, sticky semi-solid (dries tacky)
Aroclor 4465 - Yellow, transparent, brittle resin (dries sticky)

Chlorinated Biphenyls

Aroclor 1262 - Light yellow, sticky, viscous semi-solid (dries sticky)
Aroclor 1260 - Pale yellow, soft, sticky semi-solid (dries sticky)
Aroclor 1254 - Pale yellow, viscous oil (dries "wet")

Experimental Work and Formulations

The following information was derived from preliminary reports on work done by U.S.D.A. research groups. These data are not to be construed as recommendations by either the U.S.D.A. or Monsanto, but rather are intended to serve as a guide or starting point for the development of private formulations.

Fifty to 200 milligrams of lindane per square foot of surface has given good insect control on nonporous surfaces. The ratio of lindane to "Aroclor" 5460 has been varied from 1:1 to 1:4. For most purposes a 1:1 or a 1:2 mixture is satisfactory.

Formulations as used in the U.S.D.A. experiments are:

1) For application as a solution.

Lindane	5 parts by weight
"Aroclor" 5460	5 parts by weight
Carbon Tetrachloride	750 parts by weight

(Carbon tetrachloride is toxic and should be handled with extreme caution. Less toxic solvents are easily obtained.)

2) For application as an emulsion.

Lindane	20 parts by weight
"Aroclor" 5460	20 parts by weight
Xylene	100 parts by weight
"Triton" X-100 (available from Rohm & Haas)	3 parts by weight

To obtain a stable 1% lindane emulsion, mix 1 part by weight of the above concentrate to 13 parts by weight of water.

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3) For use as a pressurized (aerosol type) spray.

a)	Lindane	5 parts by weight
	"Aroclor" 5460	5 parts by weight
	Methylene chloride	40 parts by weight
	"Freon" 12 (DuPont)	50 parts by weight
b)	Lindane	5 parts by weight
	"Aroclor" 5460	5 parts by weight
	Cyclohexanone	10 parts by weight
	Ortho-dichlorobenzene	35 parts by weight
	"Freon" 12 (DuPont)	45 parts by weight

Experimental Results - American Roaches

Using Formula 3a or 3b, the toxicant was applied onto a painted wall, depositing about 200 mg./sq. ft. of lindane and a like amount of "Aroclor" 5460.

When the toxicant coat was one month old, it gave 90-100% kill of American roaches when the roaches contained in a petri dish were placed against the surface of the treated wall for two hours.

The U.S.D.A. research team found that the lindane-"Aroclor" 5460 mixture (used at the rate of 50 mg. of actual lindane per sq. ft.) would kill 80% of all cockroaches exposed for 2 hours to a 60-day-old treated surface. It remained lethal to 66% of the roaches after 90 days. Regular lindane sprays used at the same rate killed only 4% of the roaches after 60 days.

Results with Houseflies

Deposits of 25 mg. of lindane plus 25 mg. of "Aroclor" 5460 applied from carbon tetrachloride onto glass and aluminum (hard surfaces) gave 100% kill of normal houseflies exposed for 2 hours to these treated surfaces after they had aged 18 weeks, the duration of the test.

Without the "Aroclor" the hard surfaces treated with lindane alone were effective only about a week.

A lindane plus "Aroclor" mixture sprayed as an aerosol onto leaves of a willow tree continued to kill houseflies after 2 months of outdoor weathering. Careful inspection of the treated leaves showed that the toxicant was held firmly to the surface and notwithstanding rain and weather, the coating remained in good condition. Also, within limits of a preliminary inspection there seemed to be no injury to the willow leaves.

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(Note: The primary purpose of this report is to provide information for the development of suitable insecticide formulations for application to "nonsensitive" surfaces such as metals, glass, paints, and other materials that will not be damaged by the application. Development of formulations for living plants requires sufficient test work to insure that the formulations will not be injurious to the plants or their products.)

Another Formulation Reported

A more recent development in these experiments is the following simple formulation:

"Aroclor" 5460	25%
Lindane	25%
Methylethyl Ketone (MEK)	50%

Work on this was reported in the August 14, 1954 issue of Chemical Week magazine.

This simple formulation appears to be most suitable for "painted on" formulations packaged in bottles but should be used with caution in mechanical spray equipment since the MEK solvent will soften rubber and certain plastics. The formulation could also be modified easily for aerosol packaging.

Since MEK evaporates rapidly, it should not seriously affect painted areas unless too heavy applications are made. The package label should include a caution to this effect. Also, MEK is flammable. Possible substitutes that are less flammable are methylchloroform or a mixture of methylchloroform and methylene chloride.

Formulating Other Insecticides

The beneficial effects of "Aroclor" 5460 apply generally to other chlorinated insecticides including chlordane, aldrin and dieldrin, but do not apply to phosphate type insecticides such as TEPP, parathion, methylparathion, malathion and chlorothion.

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For samples of the "Aroclor" products mentioned in this report, contact the nearest branch office (see attached list) or write to:

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
Plasticizers Department
800 North Lindbergh Boulevard
St. Louis 66, Missouri

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