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# FLOATING LARVICIDE

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## ABSTRACT OF THE DISCLOSURE

Malaria, yellow fever and similar diseases are spread by water-spawned organisms particularly those that go through a larval stage in their life cycle. Mosquitoes are attacked in the larval stage with organic phosphorothioate larvicides, chlorinated hydrocarbons, and addition products of ethylene oxide and aliphatic alcohols such as oleyl alcohol which kill larvae when spread upon an infested water supply. Direct dispersion of the toxicant or toxicant with known carriers onto the infested waters has very limited periods of effectiveness against the larvae and simultaneously pollutes the water. It is discovered that delayed toxicant release, much longer protection, and less water pollution result when certain toxicants are dissolved into a particular elastomeric matrix and then pellets or pieces of the resulting composition (preferably in vulcanized form) are dispersed upon the infested water. Ethylenepropylene-diene terpolymer rubbers known as EPDM rubbers are suitable elastomers for this purpose. When the elastomeric-toxicant compositions are in floating contact with infested water, a toxic substance is released slowly from the composition into the water at the water surface and the composition is capable of maintaining a toxic concentration to larvae for periods of months in stagnant water. The larvicidal elastomeric (or rubber) compositions contain an organic toxicant dissolved in a vulcanized EPDM rubber matrix specially compounded and cured in such a fashion that the toxicant remains soluble and sufficiently mobile in the matrix as to diffuse to the surface of the matrix at a selected, controlled rate and to be released therefrom into the water environment by molecular release at a rate adapted best to carry out the larvicidal application.

## CROSS-REFERENCE TO RELATED APPLICATIONS

A related background application is U.S. Ser. No. 741,223 filed June 28, 1968, claiming a biocidal elastomeric-organic toxicant composition which is useful in the form of sinkable pellets or strips for biocidal activity. The present application is drawn to larvicidal EPDM-organic toxicant compositions which are useful in the form of floating pellets or strips for poisoning mosquito larvae in the specific water level where these organisms live, namely the zone just at and just below the water surface sometimes known as the infraneustral zone.

## BACKGROUND OF THE INVENTION

This invention relates to certain toxidants and the dissemination of them in controlling disease-spreading, water-spawned organisms by means of a floating medium. The invention is useful to public health authorities in killing the larvae of mosquitoes, responsible for transmitting malaria, yellow fever, dengue fever, and related diseases.

Prior to this invention, aquatic larvae have been combatted and destroyed either by poisoning the water breeding areas to their full depth, or by covering such water with oily film-forming materials which fatally damage the respiratory or other physiological processes of the organism. These basic techniques are generally effective but have well-recognized limitations.



While numerous toxicants are known for killing these disease-causing and disease-propagating organisms, there are many reasons why their use had not led to the elimination of these dread diseases. For example, the use of DDT against the mosquito has not been too effective because of great expense, limited effective life of the insecticide requiring frequent reapplications, the evolutionary development of DDT-resistant strains of mosquito, and widespread controversy over real or imaginary toxic effects of the insecticide on human and other animal and vegetable life, particularly on our wild animals, birds and fish. By and large, these pests have been combatted by direct application to the infested water of the pure toxicant or of the toxicant on or in a diluent carrier. This has resulted in very limited periods of effectiveness (i.e. measured in from days up to 6 weeks in stagnant water; much less in even slowly flowing water) necessitating frequent reapplication. DDT, oils and other mosquito larvicides are applied as often as twelve times a year in some areas of the southern United States. Applied in this fashion over any period of years, the total dosage of toxicant is enormous and never 100% effective. Also, direct application of toxicant may lead to at least temporary high local concentrations due to poor dispersion, which concentration can be very toxic to other forms of life.

The larvicidal compositions disclosed in copending application Ser. No. 741,223 filed June 28, 1968, are all materials which when compounded for slow release of the organic toxicant have specific gravities greater than 1.0, and hence the particles of these compositions sink to the bottom when they are dropped upon a water surface. Most of the materials of that invention are based on elastomers having high specific gravities, e.g. natural rubber—0.93, styrene-butadiene rubber—0.34, nitrile rubber—0.98, and the like. When 100 parts by weight of these named elastomers is combined with 5–60 parts by weight carbon black (sp. gr. 1.8) for control of toxicant release rate and with other materials for cure of the elastomer, the composition specific gravity is well over 1.0. The EPDM rubbers (sp. gr. 0.85 to 0.88) have lower specific gravities than the elastomers listed above and are disclosed in the form of the invention of the copending application as requiring loadings of the appropriate carbon blacks of at least (65 to 100 phr.) to obtain a specific gravity in excess of 1.0. These highly carbon black loaded EPDM compositions sink in water carrying the toxicant below the primary water zone for larvae inhabitation. Such a high carbon black content also drastically retards toxicant loss when organic phosphorothioate larvicides are used thus requiring much greater dosages for efficiency.

Larvae, as a life form, develop from eggs laid in or on water, generally shallow water and, after hatching, dwell near the water surface for feeding and respiratory purposes. The logical and most economical and most effective place to attack this life form is at the water surface and this is best done by employing a floating larvicide—e.g. like the hydrocarbon oil and alcohol mixtures cited above. A larvicide that sinks to the water bottom obviously must be employed in a greater quantity than one that can float because sinkable materials have to contain sufficient toxicant to insure that it is released, then spread through the entire volume of the treated water to insure that he critical zone just a few millimeters below the surface, is affected. A floating larvicide has the enormous advantage of being in the immediate larval environment at all times and of not appreciably affecting the volume of water below that zone in any manner.

Conventional larvicides such as DDT, some organophosphorous compounds, arsenic, etc., are very dangerous to store and to distribute, and they must be used with great