

Title**Chemical Composition of a low-mammalian toxicity insecticide.****Description**

This invention relates to the chemical composition of a low mammalian-toxicity insecticide which kills flying and crawling insects through a combination induced stuporous effect and desiccation of its body fluids by synergistically blending alcohol with twin-chain quaternary ammonium compound, non-ionic surfactant and essential oil.

The said chemical composition, when sprayed on an insect, will damage the insect's epicuticle. The insect epicuticle is a protein-polyphenol complex made up of lipoproteins, fatty acids and the protective waxy molecules, and is the insect's primary defense against water loss or desiccation.

The use of synergistic combination of twin-chain quaternary ammonium compound, ethyl or isopropyl alcohol, non-ionic surfactant, and essential oil as a safe and fast acting insecticide to combat flying and crawling insects through a combination of stuporous effect and desiccation of the body fluids of insects has been an area of considerable research and investigation of the applicants.

Flying and crawling insects have jointed legs and an exoskeleton, with no internal skeleton like vertebrate animals. Flying and crawling insects have tough outer skin called the epicuticle; consisting of protective waxy molecules and a protein-polyphenol complex made up of lipoproteins and fatty acids. This epicuticle protects the insect from becoming desiccated. The epicuticle of an insect is damaged when the protective waxy molecules are emulsified. Once the epicuticle is damaged, the insect dies due to desiccation of its body fluids.

The applicants have discovered the chemical composition of a safe and fast acting insecticide killing flying and crawling insects through induced stuporous effect and desiccation of the insect by synergistically blending twin-chain quaternary ammonium, alcohol, non-ionic surfactant, and essential oil.

The invention includes the use of emulsifier using twin-chain quaternary ammonium compound- Didecyl dimethyl Ammonium Chloride or Alkyl Dimethyl Benzyl Ammonium Chloride, alcohol either Ethyl Alcohol, Isopropyl as a synergistic stuporous agent and to soften the epicuticle and to remove the protective wax coating from the cuticle of the insect, non-ionic surfactant either Alcohol Ethoxylate or Nonyl Phenol Ethoxylate as the wetting and co- emulsifying agent, and peppermint essential oil as a co-stuporous agent.

BACKGROUND OF THE INVENTION

The exoskeleton of insects acts as an impermeable, protective layer against desiccation. It is composed of an outer epicuticle, underlain by a procuticle that itself may be further divided into an exocuticle and endocuticle.

The endocuticle provides the insect with toughness and flexibility and the hard exocuticle serves to protect vulnerable body parts.

However, the outer cuticular layer (epicuticle) is a protein-polyphenol complex made up of lipoproteins, fatty acids, and waxy molecules, and is the insect's primary defense against quick excessive water loss or desiccation.

Many insect orders secrete an additional cement layer over their protective wax layer, likely to protect against the abrasion or removal of waxy molecules.

This layer is composed of lipids and proteins held together by polyphenolic compounds and is secreted by the dermal glands of insects. In general, the rate of water loss in insects is low at moderate temperatures.

Once a species-specific critical temperature (T_c) is reached, as temperatures continue to increase, rapid water loss occurs. The rapid water loss can also occur when the epicuticle is damaged by the said chemical composition. The epicuticle of an insect is damaged when the protein-polyphenol complex made up of lipoproteins, fatty acids, and waxy molecules is emulsified.

In some insects, the rate of cuticular water loss is controlled to some extent by the neuroendocrine system, for example immediately following head removal; decapitated cockroaches exhibit a large increase in transpiration across the cuticle, leading to severe dehydration. The introduction of said chemical composition of into freshly separated bodies results in a sharp increase in cuticular water loss.

For decades, distribution and use of hazardous insecticides has been an issue of concern for both the environment and the users. Hazardous insecticides have been shown to be linked with a high incidence of severe or irreversible adverse effects on human health or the environment.

Examples are **Organochlorine compounds based insecticide** such as Endosulfan and **Organophosphorous based insecticide** such as Dichlorvos are effective insecticides but have the disadvantage of being toxic for warm-blooded animals. Toxic insecticides caused hundreds of poisonings each year throughout Asia.

Organochlorine compounds work on insects by opening the sodium ion channel in the neurons or nerve cells of insects, causing them to fire spontaneously. The insect will go into spasms and eventually die. DDT was the earliest of these chlorinated hydrocarbons, but DDT and many others in this class have been banned from general use in most countries.

Numerous studies have linked organochlorine pesticide exposures with cancers and other health effects. Exposure to DDT has been linked to pancreatic cancer and non-Hodgkin's lymphoma. Exposure to DDT early in life is associated with an increased breast cancer risk later in life. Many other organochlorine pesticides, such as mirex, chlordane and toxaphene, are known to be carcinogenic as well.

Organophosphates also work on the nervous system, keeping the nerve cells from communicating with each other. Normally, nerve cells in the brains or muscles of humans or insects send tiny electrical pulses down tendril to the end of the cell where the pulse has to jump across a gap – known as a synapse – to another nerve cell.

A chemical known as Acetylcholine(ACh) is an organic, polyatomic cation that acts as a neurotransmitter in both the peripheral nervous system(PNS) and central nervous system (CNS) in many organisms, including humans moves from one cell to the other and binds with the new cell, sending the electrical pulse down the new cell. These insecticides – and nerve gas agents that are closely related – prevent the ACh from coming loose from the new cell, so it can't receive any more impulses. The insects can't function and die. Malathion is a common insecticide in this class and was famous for treating infestations of the Mediterranean Fruit Fly and West Nile Virus-carrying mosquitoes.

Organochlorine-Most act on neurons by causing a sodium/potassium imbalance preventing normal transmission of nerve impulses, while some act on the GABA (γ -aminobutyric acid) receptor preventing chloride ions from entering the neurons causing a hyperexcitable state characterized by tremors and convulsions; usually broad-spectrum insecticides that have been taken out of use.

Organophosphate-Causes acetylcholinesterase (AChE) inhibition and accumulation of acetylcholine at neuromuscular junctions causing rapid twitching of voluntary muscles and eventually paralysis; broad-range insecticide, generally the most toxic of all pesticides to vertebrates.

The long-term consequences of acute organophosphate (OP) poisoning are better understood for adults than children. Memory and attention deficits, as well as increased depression, anxiety and irritability are reported following adult OP poisoning. Because the nervous system is still developing in childhood, children are believed to be at increased risk for long-term sequelae following both acute and chronic organophosphate exposure.

The above mentioned compounds and other toxic Insecticides usually work like nerve gas agents used in warfare. In theory, they are applied at low doses so that only the insects will be directly affected. Yet, there are major concerns within the scientific and environmental communities that some of these insecticides will become more and more concentrated as they move up the food chain. Bald eagles, for example, can show higher concentrations of an insecticide than the small song birds the eagles eat, and the small song birds show a higher concentration than the insects they eat who were initially treated with the insecticide.

Insecticides are classified according to the method of application and the way they enter the insect's body. Many insecticides take effect in more than one way.

Cytotoxic Insecticides work by being toxic to cells of the insects. Upon exposure, insects are typically knocked out. The insecticide eventually acts as poison to their bodies, eventually causing them to die.

Stomach Insecticides are applied on the surface of plants, fabrics, and wood, or are added to bait. The insecticide is eaten, along with the food material, by insects that chew, such as ants, caterpillars, and grasshoppers.

Contact Insecticides are sprayed or dusted on the insect's body. The poison is absorbed through the body wall. Most soft-bodied insects are vulnerable to contact insecticides.

Fumigants are insecticidal gases. Insects that lurk out of reach of sprays are killed when they breathe the gas. Fumigants are used by professional exterminators to rid houses of cockroaches and bedbugs and to kill beetles in grain bins. The soil may be fumigated to destroy grubs that attack roots.

Residual Insecticides are applied to foliage, the bodies of livestock and pets, and to screens and walls. Insects absorb deadly doses by touching the poisoned surface.

Systemic Insecticides are absorbed by plant tissues, so that when insects feed on the sap they are poisoned.

Receptor for Neurotransmitter insecticides work by interfering with an insect's nerve cells, preventing them from passing signals throughout the insect's body. When the cells are unable to communicate, vital body functions shut down and the insect dies.

The applicants' invention of low mammalian-toxicity insecticide uses a combination of **induced stuporous effect and desiccation** process to kill the insects. When sprayed on the insect, the said insecticide works by inducing the insect into a state of stupor and then allowing the synergistic chemicals of the said insecticide to react on the epicuticle, by emulsifying the protecting wax molecules and the damaging the protein-polyphenol complex of the epicuticle of the insect resulting in desiccation of its body fluids.

SUMMARY OF THE INVENTION

The applicants have discovered the chemical composition of a safe and low mammalian-toxicity insecticide that kills flying and crawling insects through a combination of induced stuporous effect and desiccation on the insects by synergistically blending alcohol, twin-chain quaternary ammonium compound, non-ionic surfactant and essential oil.

In an embodiment of the invention the ethyl alcohol (C_2H_5OH) is used primary for desiccation of the body fluids of the insects, and with its secondary functions inducing the insect into a state of stupor and works synergistically with an emulsifier and non-ionic surfactant to soften the protective wax coating from the epicuticle of the insects.

In another embodiment of the invention twin-chain quaternary ammonium compound-Didecyl Dimethyl Ammonium Chloride Molecular Formula($C_{22}H_{48}ClN$) or Alkyl Dimethyl Benzyl Ammonium Chloride is used as an emulsifier for removing the wax coating from the epicuticle of the insect.

The said twin-chain quaternary ammonium compound is instrumental in emulsifying the wax components from the epicuticle of the insect, keeping them emulsified, suspended, and dispersed so they do not settle back onto the surface of the cuticle of the insect.

In yet another embodiment of the invention; non-ionic surfactant- secondary alcohol ethoxylate is used as wetting agent to help the said pesticide spread over and penetrate the waxy epicuticle of the insect or to penetrate through the small hairs present on the body of the insect,

The said non-ionic surfactants are composed of alcohols and fatty acids have no electrical charge and are compatible with most pesticides, lowering the interfacial wax tensions on the epicuticle of insects and lifting the wax off the epicuticle of the insect.

The non-ionic surfactant, twin chain quaternary ammonium compound and the ethyl alcohol are instrumental in removing wax from the epicuticle of the insect and keeping them in emulsified suspended form.

In yet another embodiment of the invention, the peppermint essential oil is used as a synergistic stuporous agent to induce the insect into a state of stupor, to allow time for the said insecticide to react with the wax coating on the epicuticle of the insect.

The foregoing has a broad outline of the more pertinent and important features of the present invention, in order that the detailed description that follows may be better understood so that the present contribution to the art can be more fully appreciated.

Additional features of the invention will be described hereinafter which form the subject of the invention. It should be appreciated by those skilled in the art that the conception and the specific embodiments disclosed may be readily utilized as a basis for modifying or designing other structures for carrying out the same purposes of the present invention. It should also be realized by those skilled in the art that such equivalent constructions do not depart from the spirit and scope of the invention.

DETAILED DESCRIPTION OF THE INVENTION

In accordance with this discovery, it is an object of the invention to provide the chemical composition of the low mammalian-toxicity insecticide.

The chemical composition is herein described.

In accordance with the invention, the chemical composition consists of a synergistic blend of alcohol, either isopropyl or ethyl alcohol with twin-chain quaternary ammonium compound-Didecyl Dimethyl Ammonium Chloride Molecular Formula($C_{22}H_{48}ClN$), non-ionic surfactant- secondary alcohol ethoxylate and essential oil-peppermint.

The alcohol used is either isopropyl or ethyl in the said chemical formula composition. Due to its hygroscopic properties in nature; it desiccates the body fluids of the insects once the epicuticle and the protective wax have been damaged. It also has a secondary function of inducing the insect into a state of stupor. Either of the said alcohols in the low mammalian-toxicity insecticide of the present invention is provided in a quantity of more than 70% by weight.

The preferred alcohol used in said chemical composition is ethyl alcohol molecular formula- C_2H_6OH due to its lower toxicity than isopropyl.

The twin-chain quaternary ammonium compound used is either Alkyl Dimethyl Benzyl Ammonium Chloride or Didecyl Dimethyl Ammonium Chloride.

The preferred twin-chain quaternary ammonium compound is Didecyl Dimethyl Ammonium Chloride molecular formula- $C_{22}H_{48}ClN$; is used in said chemical composition because of its excellent emulsification properties when blended synergistically with other said chemicals. The said twin-chain quaternary ammonium compound in the chemical composition of the low mammalian-toxicity insecticide is provided in a quantity of more than 0.5% by weight.

The said twin-chain quaternary ammonium compound is instrumental in emulsifying the protective wax components from the epicuticle of the insect and in keeping them emulsified, suspended, and dispersed so they do not settle back onto the surface of the epicuticle of the insect.

The preferred non-ionic surfactant is secondary alcohol ethoxylate of 7 moles and with a HLB 12.1 (Hydrophilic-lipophilic Balance) because of its superior wetting properties; low toxicity and biodegradability properties over Nonyl Phenol non-ionic surfactants.

The function of the said surfactant in the chemical composition is used as a wetting agent to help the said insecticide mixture spread over and penetrate the epicuticle of the insect or to penetrate through the small hairs present on the body of the insect, it lowers the interfacial wax molecules tensions on the epicuticle of insects and in this way lifts the protective wax off the epicuticle of the insect.

The said surfactant in the chemical composition of the low mammalian-toxicity insecticide is provided in a quantity of more than 0.5% by weight.

The non-ionic surfactant, emulsifier and the ethyl alcohol are instrumental in removing the protective wax, from the epicuticle of the insect and keeping them in emulsified suspended form.

The preferred peppermint essential oil in the said chemical composition is *Mentha piperita* (molecular formula $C_{62}H_{108}O_7$); because of its good stuporous effects on insects when blended with the said chemicals. It induces the insect into a state of stupor, while allowing the said insecticide to react with the wax coating on the cuticle of the insect.

The said peppermint essential oil in the chemical composition of the low mammalian toxicity insecticide is provided in a quantity of more than 1% by weight.

EXAMPLES

By way of example and not limitation, the following are illustrative of various embodiments of the foregoing invention.

Example 1

This example illustrates the typical chemical composition of a low mammalian-toxicity insecticide that kills insects through stuporous effect and desiccation of its body fluids.

A typical said chemical composition consists of 90 wt % of ethyl alcohol, 2 wt % of Didecyl Dimethyl Ammonium Chloride, 2% by weight secondary alcohol ethoxylated 7 moles with HLB of 12.1, and 6 wt % of peppermint oil-mentha piperita to complete the said chemical composition.

Example 2

This example illustrates another typical chemical composition of a low mammalian-toxicity insecticide that kills insects through stuporous effect and desiccation of its body fluids.

The said chemical composition consists of 93 wt % of ethyl alcohol, 1 wt % of Didecyl Dimethyl Ammonium Chloride, 1 wt % of secondary alcohol ethoxylated 7 moles with HLB of 12.1, and 5 wt % of peppermint oil-mentha piperita to complete the said chemical composition.

This example illustrates another typical chemical composition of a low mammalian-toxicity insecticide that kills insects through stuporous effect and desiccation of its body fluids.

The said chemical composition consists of 95 wt % of ethyl alcohol 1 wt % of Didecyl Dimethyl Ammonium Chloride, 1% by weight secondary alcohol ethoxylated 7 moles with HLB of 12.1, and 3 wt % of peppermint oil-mentha piperita to complete the said chemical composition.

The foregoing embodiments are susceptible to considerable variation in its practice.

Accordingly, the embodiments are not intended to be limited to the specific exemplifications set forth hereinabove. Rather, the foregoing embodiments are not within the spirit and scope of the appended claims, including the equivalents thereof available as matter of law.

The applicants do not intend to dedicate any disclosed embodiments to the public, and to the extent any disclosed modifications or alterations may not literally fall within the scope of the claims, they are considered to be part hereof under the doctrine of equivalents.

Claims:**What is claimed is:**

- 1) Chemical composition of a low mammalian-toxicity insecticide that kills insects through a combination of induced stuporous effect and desiccation of its body fluids, comprising all of the synergistic following chemicals: Alcohol, Twin-Chain Quaternary Ammonium Compound, Non-Ionic Surfactant and Essential Oil.
- 2) Chemical composition of a low mammalian-toxicity insecticide that kills insects through a combination of induced stuporous effect and desiccation of its body fluids, as in claim 1 wherein the Alcohol is either Isopropyl or Ethyl Alcohol.
- 3) Chemical composition of a low mammalian-toxicity insecticide that kills insects through a combination of induced stuporous effect and desiccation of its body fluids, as in claim 1 wherein the Twin-Chain Quaternary Ammonium Compound used is Didecyl Dimethyl Ammonium Chloride.
- 4) Chemical composition of a low mammalian-toxicity insecticide that kills insects through a combination of induced stuporous effect and desiccation of its body fluids as in claim 1 wherein the non-ionic surfactant is either Alcohol Ethoxylate or Nonyl-Phenol Ethoxylate.
- 5) Chemical composition of a low mammalian-toxicity insecticide that kills insects through a combination of induced stuporous effect and desiccation of its body fluids as in claim 1 wherein the Essential Oil is Peppermint.
- 6) Chemical composition of a low mammalian-toxicity insecticide that kills insects through a combination of induced stuporous effect and desiccation of its body fluids as in claim 2 wherein the preferred alcohol is ethyl alcohol.
- 7) Chemical composition of a low mammalian-toxicity insecticide that kills insects through a combination of induced stuporous effect and desiccation of its body fluids as in claim 4 wherein said surfactant is Alcohol Ethoxylated 7 moles with HLB of 12.1.
- 8) Chemical composition of a low mammalian-toxicity insecticide that kills insects through a combination of induced stuporous effect and desiccation of its body fluids as in claim 5 wherein the essential oil peppermint is *Mentha piperita* molecular formula $C_{10}H_{18}O_7$.

9) Chemical composition of a low mammalian-toxicity insecticide that kills insects through a combination of induced stuporous effect and desiccation of its body fluids as in accordance to claim 1 comprising:

75-95 wt % of ethyl alcohol

1-5 wt % of Didecyl Dimethyl Ammonium Chloride,

1-5% by weight secondary alcohol ethoxylated 7 moles with HLB of 12.1, and

1- 10 wt % of peppermint oil-mentha piperita.

10) Chemical composition of a low mammalian-toxicity insecticide that kills insects through a combination of induced stuporous effect and desiccation of its body fluids as in accordance to claim 9 comprising:

95 wt % of ethyl alcohol

1 wt % of Didecyl Dimethyl Ammonium Chloride,

1 wt % of secondary alcohol ethoxylated 7 moles with HLB of 12.1, and

4 wt % of peppermint oil-mentha piperita.