

DESCRIPTION

Title of the Invention

PEST CONTROL MATERIAL

5

Technical Field

The present invention relates to a pest control material for controlling pests.

10 Background Art

A pest control material having a pest control component held on a carrier such as a thermoplastic resin and the like is shown in a patent document 1. A net-shaped pest control material made with a resin composition
15 containing a pest control component is shown in a patent document 2.

Patent document 1: JP-A-H11-21206

Patent document 2: JP-A-2008-13508

20 Disclosure of Invention

(Problem to be Solved by the Invention)

The present invention has an object of providing a pest control material manifesting an excellent controlling effect on pests.

25 (Means for solving the Problem)

The present invention is a pest control material having a pyrethroid compound and an insect growth regulator held on a carrier.

That is, the present invention includes the following
5 inventions.

[1] A pest control material having a pyrethroid compound and an insect growth regulator held on a carrier.

[2] The pest control material according to [1] wherein the carrier is a resin.

10 [3] The pest control material according to [1] or [2], in the configuration of a net.

[4] The pest control material according to any one of [1] to [3], in the configuration of a mosquito net.

15 [5] The pest control material according to any one of [1] to [4], wherein the pyrethroid compound and/or the insect growth regulator is mixed in the carrier.

20 [6] The pest control material according to any one of [1] to [5], wherein the pyrethroid compound and/or the insect growth regulator is coated on the surface of the carrier.

[7] The pest control material according to any one of [1] to [6], wherein the pyrethroid compound is permethrin.

25 [8] The pest control material according to any one of [1] to [7], wherein the insect growth regulator is pyriproxyfen.

[9] The pest control material according to any one of [1] to [7], wherein the insect growth regulator is methoprene.

[10] The pest control material according to any one of [1] to [9], wherein the compounding ratio of a pyrethroid compound to an insect growth regulator is 1:20 to 20:1.

[11] The pest control material according to any one of [1] to [9], wherein the compounding ratio of a pyrethroid compound to an insect growth regulator is 1:5 to 5:1.

[12] The pest control material according to any one of [1] to [9], wherein the compounding ratio of a pyrethroid compound to an insect growth regulator is 1:2 to 2:1.

[13] The pest control material according to any one of [1] to [12], further comprising a synergist.

(Effect of the Invention)

The present invention is capable of manifesting an excellent pest controlling effect.

Brief Description of Drawings

Fig 1 is a partial view of a pest control material of the present invention having a knitted net configuration.

Fig 2 is a partial view of a pest control material of the present invention having a woven net configuration.

Description of References

1: string

3: mesh

Best Mode for Carrying Out the Invention

5 The pest control material of the present invention has a pyrethroid compound and an insect growth regulator held on a carrier.

(1) Carrier(s)

10 It is preferable to use a resin. Fibrous material such as natural fiber, glass fiber and the like may also be used. Examples of the natural fiber include pulp, cellulose, cotton, wool and the like.

15 As the resin, thermoplastic resins are preferable. Polyolefin resin, polyvinyl alcohol, polyvinyl acetate, polycarbonate, polyester, polyamide, polystyrene, polymethyl methacrylate, acrylonitrile-butadiene-styrene copolymer, polyvinyl chloride and the like can be used as the thermoplastic resin.

20 As the thermoplastic resin, polyolefin resins are preferable. As the polyolefin resin, the following compounds are preferable.

(i) Homopolymers of α -olefins: e.g., polyethylene, polypropylene and the like.

25 (ii) Ethylene- α -olefin copolymers: e.g., ethylene-propylene copolymer, ethylene-butene-1 copolymer, ethylene-

4-methyl-1-pentene copolymer, ethylene-hexene copolymer and the like.

(iii) Copolymers of ethylene with an organic carboxylic acid derivative having an ethylenically unsaturated bond: e.g., ethylene-methyl methacrylate copolymer, ethylene-vinyl acetate copolymer, ethylene-acrylic acid copolymer, ethylene-vinyl acetate-methyl methacrylate copolymer and the like.

(2) Pyrethroid compound(s) and insect growth regulator(s)

10 (2-1) Pyrethroid compound

Examples of the pyrethroid compound include acrinathrin, allethrin, d-allethrin, dd-allethrin, beta-cyfluthrin, bifenthrin, cycloprothrin, cyfluthrin, cyhalothrin, cypermethrin, dimefluthrin, empenthrin, 15 deltamethrin, terarethrin, tefluthrin, esfenvalerate, ethofenprox, fenpropathrin, fenvalerate, flucythrinate, flufenoprox, flumethrin, fluvalinate, profluthrin, halfenprox, imiprothrin, permethrin, benfluthrin, prallethrin, pyrethrins, resmethrin, d-resmethrin, sigma-cypermethrin, silafluofen, tefluthrin, tralomethrin, 20 transfluthrin, tetramethrin, d-tetramethrin, phenothrin, d-phenothrin, cyphenothrin, alpha-cypermethrin, sialpha-cypermethrin, zeta-cypermethrin, lambda-cyhalothrin, gamma-cyhalothrin, furamethrin, tau-fluvalinate, metofluthrin, 25 natural pyrethrin and the like.

As the pyrethroid compound(s), permethrin, deltamethrin or alpha-cypermethrin is preferable.

These pyrethroid compounds can be used singly or in combination of two or more. In some of the above-described compounds, optical isomers, steric isomers, geometric isomer and the like are present, and the pyrethroid compound of the present invention includes active isomers and mixtures thereof.

(2-2) Insect growth regulator

The insect growth regulator includes, specifically, juvenile hormone analogs and chitin synthesis inhibitors.

Examples of the juvenile hormone analogs include pyriproxyfen, methoprene, hydroxyprene, fenoxycarb and the like.

Examples of the chitin synthesis inhibitor include ethoxazole, chlorfluazuron, fluazuron, triazuron, novaluron, hexaflumuron, diflubenzuron, cyromazine, flufenoxuron, teflubenzuron, triflumuron, flucyclohexuron, hydroxyprene, lufenuron, noviflumuron, bistrifluron and the like.

(3) Forms

For example, the following forms are specifically mentioned.

(3-1) A pyrethroid compound and an insect growth regulator are mixed in a carrier.

(3-2) A pyrethroid compound and an insect growth

regulator are coated on the surface of a carrier.

(3-3) A pyrethroid compound is mixed in a carrier, and an insect growth regulator is coated on the surface of a carrier.

5 (3-4) A pyrethroid compound is coated on the surface of a carrier, and an insect growth regulator is mixed in a carrier.

The compounding ratio of a pyrethroid compound to an insect growth regulator is 1:10000 to 1000:1, preferably
10 1:1000 to 100:1. Further, the compounding ratios of specific components are as shown below.

permethrin to pyriproxyfen = 1:100 to 100:1

deltamethrin to pyriproxyfen = 1:1000 to 20:1

alpha-cypermethrin to pyriproxyfen = 1:1000 to 20:1

15 permethrin to methoprene = 1:100 to 100:1

deltamethrin to methoprene = 1:1000 to 20:1

alpha-cypermethrin to methoprene = 1:1000 to 20:1

More preferably, the compounding ratio of a pyrethroid compound to an insect growth regulator is 1:20 to 20:1,
20 further preferably 1:10 to 10:1, further more preferably 1:5 to 5:1, especially preferably 1:2 to 2:1.

(4) Production Method(s)

The pest control material of the present invention can be produced, for example, as described in the following
25 method (i), (ii), or (iii). In (i) to (iii), cases of

using a thermoplastic resin as a carrier are described.

(i) A thermoplastic resin, a pyrethroid compound, an insect growth regulator and any compounding agents are stirred to mix, the resultant mixture is melt-kneaded to obtain a resin composition, and a resin body of a given configuration is obtained by using this resin composition. A pest control material is thus obtained.

(ii) A thermoplastic resin, one of a pyrethroid compound and an insect growth regulator, and any compounding agents are stirred to mix, the resultant mixture is melt-kneaded to obtain a resin composition, and a resin body of a given configuration is obtained by using this resin composition. Then, the other of a pyrethroid compound and an insect growth regulator is coated on the surface of the resin body. A pest control material is thus obtained.

(iii) A thermoplastic resin and any compounding agents are stirred to mix, the resultant mixture is melt-kneaded to obtain a resin composition, and a resin body of a given configuration is obtained by using this resin composition. Then, a pyrethroid compound and an insect growth regulator are coated on the surface of the resin body. A pest control material is thus obtained.

In the above-described methods (i) to (iii), a resin body can be formed for example by melt-molding a resin

composition, however, the resin body may also be formed by other molding methods. As the molding method, methods usually used in resin molding processing can be used, and examples thereof include extrusion molding, injection molding, blow molding, compression molding, powder molding, press molding and the like.

The method of coating a pyrethroid compound and /or an insect growth regulator on the surface of a carrier includes, for example, methods in which these components are used as they are or dissolved in a solvent such as an alcohol and the like and the resultant solution is used, for an immersion treatment, spray treatment or coating treatment of the resin body.

It is also possible that at least one of a pyrethroid compound and an insect growth regulator is supported on an auxiliary carrier, then, this is melt-kneaded with a thermoplastic resin to obtain a resin composition, and a resin body of a given configuration is obtained by using this resin composition. The above-described auxiliary carrier includes silica type compounds, zeolites, clay minerals, metal oxides, micas, hydrotalcites, organic carriers and the like. The silica type compound includes amorphous silica and crystalline silica, and examples thereof include powder silicic acid, fine powder silicic acid, acid clay, diatomaceous earth, quartz, white carbon

and the like. The zeolites include A-type zeolite, mordenite and the like, the clay mineral includes montmorillonite, saponite, beidellite, bentonite, kaolinite, halloysite, nacrite, dickite, anauxite, illite, sericite
5 and the like, the metal oxide includes zinc oxide, magnesium oxide, aluminum oxide, iron oxide, copper oxide, titanium oxide and the like, the micas include mica, vermiculite and the like, the hydrotalcites include hydrotalcite, smectite and the like, and the organic
10 carrier includes coals (charcoal, peat, grass peat and the like), polymer beads (microcrystalline cellulose, polystyrene beads, acrylate beads, methacrylate beads, polyvinyl alcohol beads and the like), and cross-linked polymer beads thereof, and the like. Additionally,
15 pearlite, gypsum, ceramic, volcanic rock and the like can be used. As the above-described auxiliary carrier, amorphous inorganic carriers are preferable, amorphous silica is further preferable.

The pest control material of the present invention may
20 contain compounding agents as listed below: synergists; insecticides such as neonicotinoids, carbamates, organophosphorates, phenylpyrazoles and the like; repellents; antioxidants; fungicides; antibacterial agents; pigments; aromatic substances; deodorant agents; spreading
25 agents; ultraviolet absorbers; light stabilizers;

lubricants; antiblocking agents; antistatic agents; surfactants; fillers; flame retardants; plasticizers; antirustic agents; and the like.

In the case of use of a synergist as the above-described compounding agent, the pest control material of the present invention can be produced, for example, as described in the following method (i), (ii), or (iii). In (i) to (iii), cases of using a thermoplastic resin as a carrier are described.

(i) A thermoplastic resin, a pyrethroid compound, an insect growth regulator, a synergist, and any compounding agents are stirred to mix, the resultant mixture is melt-kneaded to obtain a resin composition, and a resin body of a given configuration is obtained by using this resin composition. A pest control material is thus obtained.

(ii) A thermoplastic resin, at least one component selected from the group consisting of a pyrethroid compound, insect growth regulator and synergist, and any compounding agents are stirred to mix, the resultant mixture is melt-kneaded to obtain a resin composition, and a resin body of a given configuration is obtained by using this resin composition. Then, the other components not selected in the above-described group are coated on the surface of the resin body. A pest control material is thus obtained.

(iii) A thermoplastic resin and any compounding agents

are stirred to mix, the resultant mixture is melt-kneaded to obtain a resin composition, and a resin body of a given configuration is obtained by using this resin composition. Then, a pyrethroid compound, an insect growth regulator and
5 a synergist are coated on the surface of the resin body. A pest control material is thus obtained.

Examples of the synergist include the following compounds.

α -[2-(2-butoxyethoxy)ethoxy]-4,5-methylenedioxy-2-
10 propyltoluene [piperonyl butoxide (PBO)]

N-(2-ethylhexyl)-1-isopropyl-4-methylbicyclo(2,2,2)oct-5-ene-2,3-dicarboxyimide [Synepirin
500]

Butyl stearate

15 Bis-(2,3,3,3-tetrachloropropyl) ether [S-421]

N-(2-ethylhexyl)bicyclo[2.2.1]hept-5-ene-2,3-dicarboxyimide [MGK264]

The compounding amounts of components in the pest control material of the present invention include,
20 preferably, 30 to 99 wt% of a thermoplastic resin, 0.01 to 50 wt% of a pyrethroid compound and 0.001 to 50 wt% of an insect growth regulator, more preferably, 50 to 99 wt% of a thermoplastic resin, 0.1 to 25 wt% of a pyrethroid compound, and 0.01 to 25 wt% of an insect growth regulator.

25 Further, when a synergist is contained, the

compounding amounts of components in the pest control material of the present invention include, preferably, 30 to 99 wt% of a thermoplastic resin, 0.01 to 50 wt% of a pyrethroid compound, 0.001 to 50 wt% of an insect growth regulator, and 0.01 to 50 wt% of a synergist, more preferably, 50 to 99 wt% of a thermoplastic resin, 0.1 to 25 wt% of a pyrethroid compound, 0.01 to 25 wt% of an insect growth regulator, and 0.1 to 25 wt% of a synergist.

(5) Configuration

The pest control material of the present invention has preferably a configuration of a net. This net can be formed by knitting or weaving a string obtained by spinning the resin composition in the above-described methods (i) to (iii), so as to form a lot of meshes. The above-described net has a knitted structure when formed by knitting, and has a woven structure when formed by weaving. Fig. 1 shows one example of a knitted structure net formed by knitting a string 1, so as to form a lot of meshes 3, and Fig. 2 shows one example of a woven structure net formed by weaving a string 1, so as to form a lot of meshes 3. It is preferable that this net has a knitted structure.

The size of the mesh 3 is appropriately set depending on the body length of a pest as a control subject, and it is preferable that the size is so adjusted that the pest gets into touch with the net in trying to pass through the

net. In general, the size of the mesh 3 (hole size) is 1 to 5 mm, preferably 2 to 4 mm.

It is preferable that the string 1 is a monofilament having a given thickness. By this, a knitting work or
5 weaving work becomes easy. In this case, "given thickness" means a thickness capable of maintaining the strength as a pest control material. In general, when the string 1 is a monofilament, it is preferable to use a monofilament of 50 to 350 deniers.

10 The string 1 may also be a multifilament having a given thickness.

In the above-described net, a coming pest gets into touch with the string 1 when trying to pass through the mesh 3. Thus, the insect is controlled without fail.

15 Examples of those having a configuration of a net include a mosquito net, net window, insect screen and the like, and particularly, the configuration of a mosquito net is preferable.

Further, the configuration of the pest control
20 material of the present invention includes distribution materials such as a film, sheet, paper, wallpaper, cloth, curtain, floor material, packing material, hose, tape, tube, pipe, bag, tent·turf, store curtain, electric wire, cable, sheath, string, synthetic fiber thread, rope, filter, shoe,
25 bag, clothes, electronic device, electric device, home

electric appliance, sport good, office equipment, vehicle equipment, transport machine, container, case, and the like; those used in house articles and components for house; pet supplies such as a dog house, mat, sheet, collar, tags and the like; etc., and these are used as an insect-proof product for human; pets such as dog, cat, bird and the like; domestic animals such as cow, pig, sheep, bird and the like; etc. Films and sheets can be further processed into a molded body of a desired shape by vacuum molding and the like.

(6) Effect(s)

With the pest control material of the present invention, pests such as, for example, harmful insects, harmful mites and the like can be controlled. Examples of such pests include, specifically, the following organisms.

Mosquitoes of genus *Anopheles*: *An. gambiae*, *An. arabiensis*, *An. funestus*, *An. melas*, *An. minimus*, *An. dirus*, *An. stephensi*, *An. sinensis*, *An. anthropophagus*, and the like.

Mosquitoes of genus *Culex*: *Cx. pipiens pipiens*, *Cx. quinquefasciatus*, *Cx. pipiens pallens*, *Cx. pipiens f. molestus*, *Cx. restuans*, *Cx. tarsalis*, *Cx. modestus*, *Cx. tritaeniorhynchus*, and the like.

Mosquitoes of genus *Aedes*: *Aedes aegypti*, *Ae. albopictus*, *Ae. japonicus*, *Ae. vexans*, and the like.

Horse-flies (Tabanidae), flies (Muscidae), black-flies (Simuliidae), sand-flies (Phlebotominae), biting midges (Ceratopogonidae), tsetse-flies (Glossinidae), chironomids (Chironomidae), fleas (Siphonaptera), sucking-lice (Anoplura), bedbugs (Cimicidae), triatomine bugs (Triatominae), ants (Formicidae), termites (Termitidae), cockroaches (Blattaria), mites, ticks and the like.

When a pest gets into touch with the pest control material of the present invention, pest controlling effects as described below are specifically manifested.

(1) Blood-sucking by a pest can be prevented.

(2) A pest can be sterilized.

(3) Egg hatching of a pest can be inhibited.

(4) Blood-sucking of second or later times by a pest can be inhibited.

(5) The longevity of a pest can be shortened.

(6) The population density of a pest can be decreases by the above-described effects.

(7) Transmission of pathogens to men and animals can be prevented by the above-described blood-sucking inhibiting effect.

(8) When a pest transmits an infectious disease, the infectious disease transmitting ability of a pest can be significantly decreased by the above-described effect.

Thus, when the pest control material of the present

invention is used in the entire area of a given region, infectious diseases in this region can be eliminated.

(9) The above-described effect is excellent also on pests having a kdr and/or metabolic pyrethroid-resistance.

5 (10) Not only human infectious diseases, but also domestic animal infectious diseases can be controlled.

(EXAMPLES)

Examples of the pest control material of the present invention will be illustrated below. The present invention is not limited to these examples.

[Example 1]

10.0 parts by weight of amorphous silica, 10.0 parts by weight of permethrin, 7.0 parts by weight of zinc stearate, and 0.4 parts by weight of BHT were stirred to mix by a super mixer to obtain a powder A1. To polyethylene melted at 150°C in a single screw extruder was added the powder A1 so that the amount of the powder A1 was 27.4 parts by weight with respect to 62 parts by weight of the polyethylene and the mixture was kneaded, and the melt-kneaded material was extruded through a die into a strand which was then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

25 Next, 20.0 parts by weight of the resultant master

batch pellets and 80.0 parts by weight of polyethylene were stirred to mix. Next, from the resultant mixture, monofilaments were spun at a processing temperature of 240°C. Then, the resultant resin strings were knitted so
5 as to form a lot of meshes, fabricating a net A1. The size of the mesh was so set that the number of holes per 6.45 cm² was 100.

Then, the net A1 was immersed in a 0.1% w/v alcohol solution of pyriproxyfen for 1 hour, taken out, and air-
10 dried for 24 hours.

[Example 2]

10.0 parts by weight of amorphous silica, 10.0 parts by weight of permethrin, 7.0 parts by weight of zinc stearate, and 0.4 parts by weight of BHT are stirred to mix
15 by a super mixer to obtain a powder A1. To polyethylene melted at 150°C in a single screw extruder is added the powder A1 so that the amount of the powder A1 is 27.4 parts by weight with respect to 62 parts by weight of the
20 polyethylene and the mixture is kneaded, further, pyriproxyfen melted by heating at 55°C is added in an amount of 5.0 parts by weight by using an infusion pump and the mixture is kneaded, and the melt-kneaded material is extruded through a die into a strand which is then cooled
25 with water, then, cut by a pelletizer, to obtain master

batch pellets in the shape of a cylinder.

Next, 20.0 parts by weight of the resultant master batch pellets and 80.0 parts by weight of polyethylene are stirred to mix. Next, from the resultant mixture, 5 monofilaments are spun at a processing temperature of 240°C. Then, the resultant resin strings are knitted so as to form a lot of meshes, fabricating a net B1. The size of the mesh is so set that the number of holes per 6.45 cm² is 100.

10 [Example 3]

From polyethylene, monofilaments are spun at a processing temperature of 240°C. Then, the resultant resin strings are knitted so as to form a lot of meshes, fabricating a net C1. The size of the mesh is so set that 15 the number of holes per 6.45 cm² is 100.

Separately, 5.0 parts by weight of permethrin, 5.0 parts by weight of pyriproxyfen, and 3.0 parts by weight of propylene glycol are dissolved in 87.0 parts by weight of an alcohol, to obtain spray liquid A1.

20 Then, the spray liquid A1 is sprayed on the net C1, and this is air-dried for 24 hours.

[Example 4]

From polyester, multifilaments are spun at a 25 processing temperature of 260°C. Then, the resultant resin

strings are knitted so as to form a lot of meshes, fabricating a net D1. The size of the mesh is so set that the number of holes per 6.45 cm^2 is 100.

Separately, 5.0 parts by weight of permethrin, 5.0 parts by weight of pyriproxyfen, and 3.0 parts by weight of propylene glycol are dissolved in 87.0 parts by weight of an alcohol, to obtain spray liquid A1.

Then, the spray liquid A1 is sprayed on the net D1, and this is air-dried for 24 hours.

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[Example 5]

10.0 parts by weight of amorphous silica, 7.0 parts by weight of zinc stearate, and 0.4 parts by weight of BHT are stirred to mix by a super mixer to obtain a powder H1. To polyethylene melted at 150°C in a single screw extruder is added the powder H1 so that the amount of the powder H1 is 17.4 parts by weight with respect to 72 parts by weight of the polyethylene and the mixture is kneaded, further, pyriproxyfen melted by heating at 55°C is added in an amount of 5.0 parts by weight by using an infusion pump and the mixture is kneaded, and the melt-kneaded material is extruded through a die into a strand which is then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

Next, 20.0 parts by weight of the resultant master

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batch pellets and 80.0 parts by weight of polyethylene are stirred to mix. Next, from the resultant mixture, monofilaments are spun at a processing temperature of 240°C. Then, the resultant resin strings are knitted so as to form a lot of meshes, fabricating a net H1. The size of the mesh is so set that the number of holes per 6.45 cm² is 100.

Then, the net H1 is immersed in a 0.1% w/v isopropanol solution of permethrin for 1 hour, taken out, and air-dried for 24 hours.

[Example 6]

10.0 parts by weight of amorphous silica, 10.0 parts by weight of a pyrethroid compound selected from the group consisting of permethrin, deltamethrin, and alpha-cypermethrin, 7.0 parts by weight of zinc stearate and 0.4 parts by weight of BHT are stirred to mix by a super mixer to obtain a powder A2. To polyethylene melted at 150°C in a single screw extruder is added the powder A2 so that the amount of the powder A2 is 27.4 parts by weight with respect to 62 parts by weight of the polyethylene and the mixture is kneaded, and the melt-kneaded material is extruded through a die into a strand which is then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

Next, 20.0 parts by weight of the resultant master

batch pellets and 80.0 parts by weight of polyethylene are stirred to mix. Next, from the resultant mixture, monofilaments are spun at a processing temperature of 240°C. Then, the resultant resin strings are knitted so as to form a lot of meshes, fabricating a net A2. The size of the mesh is so set that the number of holes per 6.45 cm² is 100.

Then, the net A2 is immersed in a 0.1% w/v alcohol solution of methoprene, taken out, and air-dried for 24 hours.

[Example 7]

10.0 parts by weight of amorphous silica, 10.0 parts by weight of a pyrethroid compound selected from the group consisting of permethrin, deltamethrin and alpha-cypermethrin, 7.0 parts by weight of zinc stearate, and 0.4 parts by weight of BHT are stirred to mix by a super mixer to obtain a powder A2. To polyethylene melted at 150°C in a single screw extruder is added the powder A2 so that the amount of the powder A2 is 27.4 parts by weight with respect to 62 parts by weight of the polyethylene and the mixture is kneaded, further, methoprene melted by heating at 55°C is added in an amount of 5.0 parts by weight by using an infusion pump and the mixture is kneaded, and the melt-kneaded material is extruded through a die into a strand which is then cooled with water, then, cut by a

pelletizer, to obtain master batch pellets in the shape of a cylinder.

Next, 20.0 parts by weight of the resultant master batch pellets and 80.0 parts by weight of polyethylene are stirred to mix. Next, from the resultant mixture, monofilaments are spun at a processing temperature of 240°C. Then, the resultant resin strings are knitted so as to form a lot of meshes, fabricating a net B2. The size of the mesh is so set that the number of holes per 6.45 cm² is 100.

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[Example 8]

From polyethylene, monofilaments are spun at a processing temperature of 240°C. Then, the resultant resin strings are knitted so as to form a lot of meshes, fabricating a net C2. The size of the mesh is so set that the number of holes per 6.45 cm² is 100.

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Separately, 5.0 parts by weight of a pyrethroid compound selected from the group consisting of permethrin, deltamethrin, and alpha-cypermethrin, 5.0 parts by weight of methoprene, and 3.0 parts by weight of propylene glycol are dissolved in 87.0 parts by weight of an alcohol, to obtain spray liquid A2.

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Then, the spray liquid A2 is sprayed on the net C2, and this is air-dried for 24 hours.

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[Example 9]

From polyester, multifilaments are spun at a processing temperature of 260°C. Then, the resultant resin strings are knitted so as to form a lot of meshes, fabricating a net D2. The size of the mesh is so set that the number of holes per 6.45 cm² is 100.

Separately, 5.0 parts by weight of a pyrethroid compound selected from the group consisting of permethrin, deltamethrin, and alpha-cypermethrin, 5.0 parts by weight of methoprene, and 3.0 parts by weight of propylene glycol are dissolved in 87.0 parts by weight of an alcohol, to obtain spray liquid A2.

Then, the spray liquid A2 is sprayed on the net D2, and this is air-dried for 24 hours.

[Example 10]

10.0 parts by weight of amorphous silica, 7, 0 parts by weight of zinc stearate, and 0.4 parts by weight of BHT are stirred to mix by a super mixer to obtain a powder H2. To polyethylene melted at 150°C in a single screw extruder is added the powder H2 so that the amount of the powder is 17.4 parts by weight with respect to 72 parts by weight of the polyethylene and the mixture is kneaded, further, pyriproxyfen melted by heating at 55°C is added in an amount of 5.0 parts by weight by using an infusion pump and

the mixture is kneaded, and the melt-kneaded material is extruded through a die into a strand which is then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

5 Next, 20.0 parts by weight of the resultant master batch pellets and 80.0 parts by weight of polyethylene are stirred to mix. Next, from the resultant mixture, monofilaments are spun at a processing temperature of 240°C. Then, the resultant resin strings are knitted so as to form
10 a lot of meshes, fabricating a net H2. The size of the mesh is so set that the number of holes per 6.45 cm² is 100.

 Then, the net H2 is immersed for 1 hour in a 0.1% w/v alcohol solution of a pyrethroid compound selected from the group consisting of permethrin, deltamethrin and alpha-
15 cypermethrin, taken out, and air-dried for 24 hours.

[Example 11]

 10.0 parts by weight of amorphous silica, 10.0 parts by weight of deltamethrin or alpha-cypermethrin, 7.0 parts
20 by weight of zinc stearate, and 0.4 parts by weight of BHT are stirred to mix by a super mixer to obtain a powder A3. To polyethylene melted at 150°C in a single screw extruder is added the powder A3 so that the amount of the powder A3 is 27.4 parts by weight with respect to 62 parts by weight
25 of the polyethylene and the mixture is kneaded, the melt-

kneaded material is extruded through a die into a strand which is then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

Next, 20.0 parts by weight of the resultant master batch pellets and 80.0 parts by weight of polyethylene are stirred to mix. Next, from the resultant mixture, monofilaments are spun at a processing temperature of 240°C. Then, the resultant resin strings are knitted so as to form a lot of meshes, fabricating a net A3. The size of the mesh is so set that the number of holes per 6.45 cm² is 100.

Then, the net A3 is immersed in a 0.1% w/v alcohol solution of pyriproxyfen for 1 hour, taken out, and air-dried for 24 hours.

[Example 12]

10.0 parts by weight of amorphous silica, 10.0 parts by weight of deltamethrin or alpha-cypermethrin, 7.0 parts by weight of zinc stearate, and 0.4 parts by weight of BHT are stirred to mix by a super mixer to obtain a powder A3. To polyethylene melted at 150°C in a single screw extruder is added the powder A3 so that the amount of the powder A3 was 27.4 parts by weight with respect to 62 parts by weight of the polyethylene and the mixture is kneaded, further, pyriproxyfen melted by heating at 55°C is added in an amount of 5.0 parts by weight by using an infusion pump and

the mixture is kneaded, and the melt-kneaded material is extruded through a die into a strand which is then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

5 Next, 20.0 parts by weight of the resultant master batch pellets and 80.0 parts by weight of polyethylene are stirred to mix. Next, from the resultant mixture, monofilaments are spun at a processing temperature of 240°C. Then, the resultant resin strings are knitted so as to form
10 a lot of meshes, fabricating a net B3. The size of the mesh is so set that the number of holes per 6.45 cm² is 100.

[Example 13]

 From polyethylene, monofilaments are spun at a
15 processing temperature of 240°C. Then, the resultant resin strings are knitted so as to form a lot of meshes, fabricating a net C3. The size of the mesh is so set that the number of holes per 6.45 cm² is 100.

 Separately, 5.0 parts by weight of deltamethrin or
20 alpha-cypermethrin, 5.0 parts by weight of pyriproxyfen, and 3.0 parts by weight of propylene glycol are dissolved in 87.0 parts by weight of an alcohol, to obtain spray liquid A3.

 Then, the spray liquid A3 is sprayed on the net C3,
25 and this is air-dried for 24 hours.

[Example 14]

From polyester, multifilaments are spun at a processing temperature of 260°C. Then, the resultant resin strings are knitted so as to form a lot of meshes, fabricating a net D3. The size of the mesh is so set that the number of holes per 6.45 cm² is 100.

Separately, 5.0 parts by weight of deltamethrin or alpha-cypermethrin, 5.0 parts by weight of pyriproxyfen and 3.0 parts by weight of propylene glycol are dissolved in 87.0 parts by weight of an alcohol, to obtain spray liquid A3.

Then, the spray liquid A3 is sprayed on the net D3, and this is air-dried for 24 hours.

[Example 15]

10.0 parts by weight of amorphous silica, 7.0 parts by weight of zinc stearate and 0.4 parts by weight of BHT are stirred to mix by a super mixer to obtain a powder H3. To polyethylene melted at 150°C in a single screw extruder is added the powder H3 so that the amount of the powder H3 is 17.4 parts by weight with respect to 72 parts by weight of the polyethylene and the mixture is kneaded, further, pyriproxyfen melted by heating at 55°C is added in an amount of 5.0 parts by weight by using an infusion pump and

the mixture is kneaded, and the melt-kneaded material is extruded through a die into a strand which is then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

5 Next, 20.0 parts by weight of the resultant master batch pellets and 80.0 parts by weight of polyethylene are stirred to mix. Next, from the resultant mixture, monofilaments are spun at a processing temperature of 240°C. Then, the resultant resin strings are knitted so as to form
10 a lot of meshes, fabricating a net H3. The size of the mesh is so set that the number of holes per 6.45 cm² is 100.

Then, the net H3 is immersed for 1 hour in a 0.1% w/v alcohol solution of deltamethrin or alpha-cypermethrin, taken out, and air-dried for 24 hours.

15

[Example 16]

7.0 parts by weight of permethrin, 5.0 parts by weight of zinc stearate, and 0.3 parts by weight of BHT are stirred to mix by a super mixer to obtain a powder A4. To
20 a mixture at 3:2 of polyethylene and ethylene-methyl methacrylate copolymer melted at 150°C in a single screw extruder is added the powder A4 so that the amount of the powder A4 is 12.3 parts by weight with respect to 87.7 parts by weight of the mixture at 3:2 of polyethylene and
25 ethylene-methyl methacrylate copolymer and the mixture is

kneaded, and the melt-kneaded material is extruded through a die into a strand which is then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

5 Next, 30.0 parts by weight of the resultant master batch pellets and 70.0 parts by weight of polyethylene are stirred to mix. Next, from the resultant mixture, monofilaments are spun at a processing temperature of 240°C. Then, the resultant resin strings are knitted so as to form
10 a lot of meshes, fabricating a net E1. The size of the mesh is so set that the number of holes per 6.45 cm² is 100.

Then, the net E1 is immersed for 1 hour in a 0.1% w/v alcohol solution of pyriproxyfen, taken out, and air-dried for 24 hours.

15

[Example 17]

7.0 parts by weight of permethrin, 5.0 parts by weight of zinc stearate, and 0.3 parts by weight of BHT were stirred to mix by a super mixer to obtain a powder A4. To
20 a mixture at 3:2 of polyethylene and ethylene-methyl methacrylate copolymer melted at 150°C in a single screw extruder was added the powder A4 so that the amount of the powder A4 was 12.3 parts by weight with respect to 84.2 parts by weight of the mixture at 3:2 of polyethylene and
25 ethylene-methyl methacrylate copolymer and the mixture was

kneaded, further, pyriproxyfen melted by heating at 55°C was added in an amount of 3.5 parts by weight by using an infusion pump and the mixture was kneaded, and the melt-kneaded material was extruded through a die into a strand
5 which was then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

Next, 30.0 parts by weight of the resultant master batch pellets and 70.0 parts by weight of polyethylene were stirred to mix. Next, from the resultant mixture,
10 monofilaments were spun at a processing temperature of 240°C. Then, the resultant resin strings were knitted so as to form a lot of meshes, fabricating a net F1. The size of the mesh was so set that the number of holes per 6.45 cm² was 100.

15

[Example 18]

5.0 parts by weight of zinc stearate and 0.3 parts by weight of BHT are stirred to mix by a super mixer to obtain a powder H4. To a mixture at 3:2 of polyethylene and
20 ethylene-methyl methacrylate copolymer melted at 150°C in a single screw extruder is added the powder H4 so that the amount of the powder H4 is 5.3 parts by weight with respect to 91.2 parts by weight of the mixture at 3:2 of polyethylene and ethylene-methyl methacrylate copolymer and
25 the mixture is kneaded, further, pyriproxyfen melted by

heating at 55°C is added in an amount of 3.5 parts by weight by using an infusion pump and the mixture is kneaded, and the melt-kneaded material is extruded through a die into a strand which is then cooled with water, then, cut by
5 a pelletizer, to obtain master batch pellets in the shape of a cylinder.

Next, 30.0 parts by weight of the resultant master batch pellets and 70.0 parts by weight of polyethylene are stirred to mix. Next, from the resultant mixture,
10 monofilaments are spun at a processing temperature of 240°C. Then, the resultant resin strings are knitted so as to form a lot of meshes, fabricating a net H4. The size of the mesh is so set that the number of holes per 6.45 cm² is 100.

Then, the net H4 is immersed in a 0.1% w/v isopropanol
15 solution of permethrin for 1 hour, taken out, and air-dried for 24 hours.

[Example 19]

5.0 parts by weight of zinc stearate and 0.3 parts by
20 weight of BHT were stirred to mix by a super mixer to obtain a powder A5. To a mixture at 3:2 of polyethylene and ethylene-methyl methacrylate copolymer melted at 150°C in a single screw extruder was added the powder A5 so that the amount of the powder A5 was 5.3 parts by weight with
25 respect to 84.2 parts by weight of the mixture at 3:2 of

polyethylene and ethylene-methyl methacrylate copolymer and the mixture was kneaded, further, a mixture at 2:1 of permethrin and pyriproxyfen melted by heating at 55°C was added in an amount of 10.5 parts by weight by using an
5 infusion pump and the mixture was kneaded, and the melt-kneaded material was extruded through a die into a strand which was then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

Next, 30.0 parts by weight of the resultant master
10 batch pellets and 70.0 parts by weight of polyethylene were stirred to mix. Next, from the resultant mixture, monofilaments were spun at a processing temperature of 240°C. Then, the resultant resin strings were knitted so as to form a lot of meshes, fabricating a net F2. The size
15 of the mesh was so set that the number of holes per 6.45 cm² was 100.

[Example 20]

5.0 parts by weight of zinc stearate and 0.3 parts by
20 weight of BHT were stirred to mix by a super mixer to obtain a powder A5. To a mixture at 3:2 of polyethylene and ethylene-methyl methacrylate copolymer melted at 150°C in a single screw extruder was added the powder A5 so that the amount of the powder A5 was 5.3 parts by weight with
25 respect to 87.7 parts by weight of the mixture at 3:2 of

polyethylene and ethylene-methyl methacrylate copolymer and the mixture was kneaded, further, a mixture at 1:1 of permethrin and pyriproxyfen melted by heating at 55°C was added in an amount of 7.0 parts by weight by using an infusion pump and the mixture was kneaded, and the melt-kneaded material was extruded through a die into a strand which was then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

Next, 30.0 parts by weight of the resultant master batch pellets and 70.0 parts by weight of polyethylene were stirred to mix. Next, from the resultant mixture, monofilaments were spun at a processing temperature of 240°C. Then, the resultant resin strings were knitted so as to form a lot of meshes, fabricating a net F3. The size of the mesh was so set that the number of holes per 6.45 cm² was 100.

[Example 21]

5.0 parts by weight of zinc stearate and 0.3 parts by weight of BHT were stirred to mix by a super mixer to obtain a powder A5. To a mixture at 3:2 of polyethylene and ethylene-methyl methacrylate copolymer melted at 150°C in a single screw extruder was added the powder A5 so that the amount of the powder A5 was 5.3 parts by weight with respect to 84.2 parts by weight of the mixture at 3:2 of

polyethylene and ethylene-methyl methacrylate copolymer and the mixture was kneaded, further, a mixture at 1:1 of permethrin and pyriproxyfen melted by heating at 55°C was added in an amount of 10.5 parts by weight by using an
5 infusion pump and the mixture was kneaded, and the melt-kneaded material was extruded through a die into a strand which was then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

Next, 30.0 parts by weight of the resultant master
10 batch pellets and 70.0 parts by weight of polyethylene were stirred to mix. Next, from the resultant mixture, monofilaments were spun at a processing temperature of 240°C. Then, the resultant resin strings were knitted so as to form a lot of meshes, fabricating a net F4. The size
15 of the mesh was so set that the number of holes per 6.45 cm² was 100.

[Example 22]

5.0 parts by weight of zinc stearate and 0.3 parts by
20 weight of BHT were stirred to mix by a super mixer to obtain a powder A5. To a mixture at 3:2 of polyethylene and ethylene-methyl methacrylate copolymer melted at 150°C in a single screw extruder was added the powder A5 so that the amount of the powder A5 was 5.3 parts by weight with
25 respect to 84.2 parts by weight of the mixture at 3:2 of

polyethylene and ethylene-methyl methacrylate copolymer and the mixture was kneaded, further, a mixture at 1:2 of permethrin and pyriproxyfen melted by heating at 55°C was added in an amount of 10.5 parts by weight by using an infusion pump and the mixture was kneaded, and the melt-kneaded material was extruded through a die into a strand which was then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

Next, 30.0 parts by weight of the resultant master batch pellets and 70.0 parts by weight of polyethylene were stirred to mix. Next, from the resultant mixture, monofilaments were spun at a processing temperature of 240°C. Then, the resultant resin strings were knitted so as to form a lot of meshes, fabricating a net F5. The size of the mesh was so set that the number of holes per 6.45 cm² was 100.

[Example 23]

5.0 parts by weight of zinc stearate and 0.3 parts by weight of BHT were stirred to mix by a super mixer to obtain a powder A5. To a mixture at 3:2 of polyethylene and ethylene-methyl methacrylate copolymer melted at 150°C in a single screw extruder was added the powder A5 so that the amount of the powder A5 was 5.3 parts by weight with respect to 87.2 parts by weight of the mixture at 3:2 of

polyethylene and ethylene-methyl methacrylate copolymer and the mixture was kneaded, further, a mixture at 2:1 of permethrin and pyriproxyfen melted by heating at 55°C was added in an amount of 7.5 parts by weight by using an infusion pump and the mixture was kneaded, and the melt-kneaded material was extruded through a die into a strand which was then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

Next, 30.0 parts by weight of the resultant master batch pellets and 70.0 parts by weight of polyethylene were stirred to mix. Next, from the resultant mixture, monofilaments were spun at a processing temperature of 240°C. Then, the resultant resin strings were knitted so as to form a lot of meshes, fabricating a net F6. The size of the mesh was so set that the number of holes per 6.45 cm² was 100.

[Comparative Example 1]

5.0 parts by weight of zinc stearate and 0.3 parts by weight of BHT were stirred to mix by a super mixer to obtain a powder A5. To a mixture at 3:2 of polyethylene and ethylene-methyl methacrylate copolymer melted at 150°C in a single screw extruder was added the powder A5 so that the amount of the powder A5 was 5.3 parts by weight with respect to 87.7 parts by weight of the mixture at 3:2 of

polyethylene and ethylene-methyl methacrylate copolymer and the mixture was kneaded, further, permethrin melted by heating at 55°C was added in an amount of 7.0 parts by weight by using an infusion pump and the mixture was
5 kneaded, and the melt-kneaded material was extruded through a die into a strand which was then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

Next, 30.0 parts by weight of the resultant master
10 batch pellets and 70.0 parts by weight of polyethylene were stirred to mix. Next, from the resultant mixture, monofilaments were spun at a processing temperature of 240°C. Then, the resultant resin strings were knitted so as to form a lot of meshes, fabricating a net G1. The size
15 of the mesh was so set that the number of holes per 6.45 cm² was 100.

[Comparative Example 2]

5.0 parts by weight of zinc stearate and 0.3 parts by
20 weight of BHT were stirred to mix by a super mixer to obtain a powder H4. To a mixture at 3:2 of polyethylene and ethylene-methyl methacrylate copolymer melted at 150°C in a single screw extruder was added the powder H4 so that the amount of the powder H4 was 5.3 parts by weight with
25 respect to 84.2 parts by weight of the mixture at 3:2 of

polyethylene and ethylene-methyl methacrylate copolymer and the mixture was kneaded, further, pyriproxyfen melted by heating at 55°C was added in an amount of 10.5 parts by weight by using an infusion pump and the mixture was
5 kneaded, and the melt-kneaded material was extruded through a die into a strand which was then cooled with water, then, cut by a pelletizer, to obtain master batch pellets in the shape of a cylinder.

Next, 30.0 parts by weight of the resultant master
10 batch pellets and 70.0 parts by weight of polyethylene were stirred to mix. Next, from the resultant mixture, monofilaments were spun at a processing temperature of 240°C. Then, the resultant resin strings were knitted so as to form a lot of meshes, fabricating a net G2. The size
15 of the mesh was so set that the number of holes per 6.45 cm² was 100.

[Test Example 1]

From the pest control materials having a configuration
20 of a net in Examples 19, 21, and 22 and Comparative Examples 1 and 2, pieces of 25 cm × 25 cm were cut as test samples. Each of pieces was put in a glass bottle of 900 ml and active ingredients on the surface of which was washed away with 500 ml of acetone. And then, each of
25 pieces was kept at 30°C for one day and exposed to females

of *Anopheles albimanus* for three minutes according to the standard WHO cone method disclosed in the following reference literature. After exposure, *Anopheles albimanus* were put in an observation plastic-cup of 200 ml and the knock down individual number after sixty minutes was measured. Mosquitoes which were unable to stand up were judged as "knocked down". The results are as shown in Table 1.

(Reference Literature)

WHOPES (2005), Guidelines for laboratory and field testing of long-lasting insecticidal mosquito nets, WHO/CDS/WHOPES/GCDPP/2005.11 Geneva, WHO.

(Table 1)

	Number of females tested	(%) Knockdown
Example 19	39	100
Example 21	39	77
Example 22	40	95
Comparative Example 1	38	26
Comparative Example 2	39	0

As described above, the pest control material of the present invention showed an excellent pest controlling effect.

Industrial Applicability

The pest control material of the present invention has an excellent controlling effect on pests, thus, it has a significant industrial utility value.

CLAIMS

1. A pest control material having a pyrethroid compound and an insect growth regulator held on a carrier.

5

2. The pest control material according to Claim 1 wherein the carrier is a resin.

10

3. The pest control material according to Claim 1 or 2, in the configuration of a net.

4. The pest control material according to any one of Claims 1 to 3, in the configuration of a mosquito net.

15

5. The pest control material according to any one of Claims 1 to 4, wherein the pyrethroid compound and/or the insect growth regulator is mixed in the carrier.

20

6. The pest control material according to any one of Claims 1 to 5, wherein the pyrethroid compound and/or the insect growth regulator is coated on the surface of the carrier.

25

7. The pest control material according to any one of Claims 1 to 6, wherein the pyrethroid compound is

permethrin.

8. The pest control material according to any one of
Claims 1 to 7, wherein the insect growth regulator is
5 pyriproxyfen.

9. The pest control material according to any one of
Claims 1 to 7, wherein the insect growth regulator is
methoprene.
10

10. The pest control material according to any one of
Claims 1 to 9, wherein the compounding ratio of a
pyrethroid compound to an insect growth regulator is 1:20
to 20:1.

11. The pest control material according to any one of
Claims 1 to 9, wherein the compounding ratio of a
pyrethroid compound to an insect growth regulator is 1:5 to
5:1.
15

12. The pest control material according to any one of
Claims 1 to 9, wherein the compounding ratio of a
pyrethroid compound to an insect growth regulator is 1:2 to
2:1.
20

25

13. The pest control material according to any one of Claims 1 to 12, further comprising a synergist.