

## **Cartridge, Termite Control Device, and Termite Control Method**

[Cross-Reference to Related Applications]

[0001] This patent application claims priority to Japan Patent Application No. 2022-115037, filed on July 19, 2022, all disclosed contents of which are hereby incorporated by reference as part of this application.

[Technical Field]

[0002] The present disclosure relates to a cartridge, a termite control device, and a termite control method. More particularly, the present disclosure relates to a cartridge, termite control device, and a termite control method for inhibiting or eradicating the activity of termite populations.

[Background Art]

[0003] One aspect of a conventional method of termite control is to spray an insecticide having insecticidal action against termites on the soil under a building floor or on a concrete foundation surface to prevent termites from entering the building for a certain number of years and to kill them when they do enter.

[0004] Another aspect of a method of termite control is to embed a termite attracting device in outdoor soil, and after confirming the capture of termites, replacing a substrate that termites can forage on (such as a cellulose substrate) with insecticide-impregnated poison bait to eradicate the colony through termite nutrient replacement (see, for example, Patent Document 1).

[Prior Art Documents]

[Patent Documents]

[0005] [Patent Document 1] JP 3024651

[Summary of the Invention]

[0006] One aspect of termite control method raises concerns about exposure of workers, occupants, and employees to chemicals due to the spraying of biologically active chemicals under floors and other indoor areas. The diversity of building structures in recent years has also made it impossible to perform chemical spraying in some cases.

[0007] Other aspects of a termite control method can alleviate problems associated with the one aspect of a termite control method. However, frequent checks on the device (for example, to confirm termite infestation or change poison bait) are required. Therefore, there are challenges in terms of widespread adoption, primarily because of the labor costs incurred, which impose a large cost burden associated with providing a service.

[0008] As a result of extensive research, the present disclosers discovered that by using a termite control device equipped with a cartridge containing an unavoidable, slow-acting insecticide active ingredient and a container capable of housing the cartridge, need for frequent device checks could be eliminated, reducing the cost burden associated with providing a service. The present disclosure is based on this discovery.

[0009] According to one aspect of the present disclosure, a cartridge is provided having a structure including a member composed of a material that is resistant to decay or corrosion in soil and that is resistant to feeding damage by termites, thereby reducing feeding damage by termites, the structure having a passage through which the termites can move, and the structure containing an unavoidable, slow-acting insecticide active ingredient.

[0010] According to another aspect of the present disclosure, a termite control device is provided equipped with: a cartridge; and a container capable of housing the cartridge that is composed of a resin, a metal, a ceramic, or a composite of these materials, wherein the container has a lid that can be opened and closed on the top surface thereof, and that has a plurality of through-holes or slits in a side surface thereof through which termites can enter.

[0011] According to still another aspect of the present disclosure, a termite control method is provided for protecting a building from termite damage using the termite control device, the method further including a step of burying the termite control device in soil surrounding the building so that at least some of the through-holes or slits provided in a side surface of the container through which termites can enter are in the soil.

[0012] According to one embodiment of the cartridge of the present disclosure, a structure includes a member composed of a material that is resistant to decay or corrosion in soil and that is

resistant to feeding damage by termites, thereby reducing feeding damage by termites, the structure containing an unavoidable, slow-acting insecticide active ingredient. Because the structure includes a member composed of a material that is resistant to feeding damage by termites and reduces feeding damage by termites, loss due to termite feeding can be reduced. Furthermore, because the insecticide active ingredient is unavoidable and slow-acting, termites moving through the cartridge are exposed to the insecticide active ingredient for a certain period of time but are not immediately killed, and the interior of the cartridge does not become quickly filled with dead termites. Moreover, because the structure contains an insecticide active ingredient, termite paths are less likely to be formed in a termite passage inside the cartridges, and preferably no termite paths are formed at all. As a result, the cartridge does not need to be replaced frequently and can be used until the expiration date of the insecticide active ingredient.

[0013] Another embodiment of the present disclosure is a termite control device equipped with a cartridge and a container, wherein the container has a lid that can be opened and closed on the top surface thereof, and that has a plurality of through-holes or slits in a side surface thereof through which termites can enter. As mentioned above, the cartridge does not need to be replaced frequently and can be used until the expiration date of the insecticide active ingredient. As a result, there is no need to check the device frequently, which can reduce the cost burden associated with providing a service. Furthermore, because the container has a lid that can be opened and closed on the top surface, the cartridge is easy to replace after the expiration date.

Moreover, in another embodiment of the termite control device of the present disclosure, the bottom surface of the container has an opening. In another embodiment of the termite control device of the present disclosure, even when water or fine particles of soil enter the container due to rainfall, they readily flow out of the container. Therefore, this embodiment of the termite control device of the present disclosure is suitable for outdoor use.

[0014] In one embodiment of a termite control method of the present disclosure, the termite control device is buried in soil surrounding a building so that at least some of the through-holes or slits provided in a side surface of the container through which termites can enter are in the soil.

Termites enter through a through-hole or slit in the container in the soil through random probing behavior and are exposed to the insecticide active ingredient for a period of time as they move through a passage in the cartridge. Because the insecticide active ingredient is unavoidable and slow-acting, termites that enter the cartridge are exposed to the insecticide active ingredient for a certain period of time but are not immediately killed, and they return to the colony to transmit the insecticide active ingredient to other termites. As a result, a certain percentage of the colony population is killed, and the termites, being social insects, are unable to maintain the colony. In this way, the activity of termites can be inhibited or eradicated.

In another embodiment of the termite control method of the present disclosure, a plurality of termite control devices are buried in soil surrounding a building, and a guide member is arranged to connect at least some of the plurality of termite control devices to each other. The guide member has a recessed portion formed along its longitudinal direction and is preferably positioned so that the recessed portion faces downward vertically. This aspect of the present disclosure takes advantage of the habit of termites of moving along objects and around corners, and termites that have risen from the ground between termite control devices can be encouraged to move along the recessed portion of the guide member to a termite control device. In this way, the activity of termites can be further inhibited or eradicated.

[Brief Description of the Drawings]

[0015] [Fig. 1A] Fig. 1A is a schematic plan view of a cartridge.

[Fig. 1B] Fig. 1B is a schematic view of a cut end surface of the cartridge cut at the position indicated by dotted line 1B-1B in Fig. 1A.

[Fig. 2A] Fig. 2A is a schematic plan view of a cartridge.

[Fig. 2B] Fig. 2B is a schematic view of a cut end surface of the cartridge cut at the position indicated by dotted line 2B-2B in Fig. 2A.

[Fig. 3A] Fig. 3A is a schematic plan view of a cartridge.

[Fig. 3B] Fig. 3B is a schematic view of a cut end surface of the cartridge cut at the position indicated by dotted line 3B-3B in Fig. 3A.

[Fig. 4] Fig. 4 is a perspective view of one embodiment of a container constituting a termite control device.

[Fig. 5] Fig. 5 is a perspective view of a container constituting a termite control device in another embodiment.

[Fig. 6] Fig. 6 is a schematic diagram showing another embodiment of the termite control method.

[Fig. 7A] Fig. 7A is a photograph of a cartridge used in an example.

[Fig. 7B] Fig. 7B is a photograph of a container used in an example.

[Detailed Description of the Invention]

[0016] The following is a description of embodiments of the present disclosure with reference to the drawings. Each figure is illustrated schematically with respect to shape, size, and arrangement of constituent elements so that the present invention can be understood. The present disclosure is not limited by the following embodiments, and each constituent element can be changed when appropriate without departing from the scope and spirit of the disclosure.

In each figure used in the following explanation, similar components are denoted by the same reference numbers and duplicate descriptions may be omitted.

[0017] [Cartridges]

(1) Common Configuration

The common configuration of all cartridges will now be described.

A cartridge is a structure that contains a member composed of a material that is resistant to decay or corrosion in soil and resistant to feeding damage, thereby reducing feeding damage by termites (the "material" below), and that has a passage through which termites can move. The structure is not easily lost by being eaten by termites because it includes a member composed of a feeding resistant material that reduces feeding damage caused by termites. The structure also contains an unavoidable and slow-acting insecticide active ingredient. Therefore, termites moving through the cartridge are exposed to the insecticide active ingredient for a certain period of time but are not immediately killed, and the interior of the cartridge does not become quickly filled with

dead termites. Additionally, termite paths are less likely to be formed in a termite passage inside the cartridge, and preferably no termite paths are formed at all. As a result, the cartridge does not need to be replaced frequently and can be used until the expiration date of the insecticide active ingredient.

[0018] Examples of the material include, specifically, a resin material, a metal material, a ceramic material, or a composite of these materials. Specific examples of resin materials include an acrylonitrile-butadiene-styrene resin, a polylactic acid resin, an acrylate-styrene-acrylonitrile resin, a polypropylene resin, a polyethylene terephthalate resin, an epoxy resin, an acrylic resin, a polycarbonate resin, a nylon resin, a thermoplastic polyurethane resin, a polymethyl methacrylate resin, a polyvinylidene fluoride resin, or a polyethylene resin. Specific examples of metal materials include stainless steel materials, aluminum materials, and titanium materials. Specific examples of ceramic materials include barium titanate materials, lead zirconate titanate materials, silicon carbide materials, and aluminum nitride materials.

[0019] Examples of insecticide active ingredients include, specifically, phenylpyrazole insecticide active ingredients such as fipronil, ethiprole, and pyriprole; neonicotinoid insecticide active ingredients such as imidacloprid, thiacloprid, thiamethoxam, clothianidin, dinotefuran, and acetamiprid; diamide insecticide active ingredients such as flubendiamide, tetraniliprole, chlorantraniliprole, cyclaniliprole, and cyantraniliprole; metadiazide insecticide active ingredients such as broflanilide; phenylurea insecticide active ingredients such as novaluron, teflubenzuron, bistrifluron, diflubenzuron, hexaflumuron, nobiflumuron, chlorfluazuron, and triflumuron; sulfoxyimine insecticide active ingredients such as sulfoxaflor; butanolide insecticide active ingredients such as flupyradifurone; mesoionic insecticide active ingredients such as dichloromezothiaz and triflumezopyrim; pyridylidene insecticide active ingredients such as flupirimine; and isoxazoline insecticide active ingredients such as fluxametamide and isocycloseram.

[0020] The amount of insecticide active ingredient is preferably 1% by weight or less of the cartridge material, but from 0.05% to 0.5% by weight is more preferred. When the amount of

insecticide active ingredient is 0.05% by weight or more, termites can be sufficiently exposed to the insecticide active ingredient. Termites that have been sufficiently exposed to the insecticide active ingredient will transmit the agent to other termites by grooming. As a result, a certain percentage of the colony population will die, and the termites, being social insects, will not be able to maintain the colony, thus inhibiting or eradicating termite activity. When the amount of insecticide active ingredient is 1% by weight or less, an excessive amount of insecticide active ingredient is not used and so this is more economical.

[0021] The cartridge is not limited to a particular size, as long as it may be housed in the container used by the termite control device. For example, the cartridge can be 20 to 30 cm deep by 5 to 30 cm wide by 20 to 30 cm high.

[0022] The cartridge may contain a termite-attracting ingredient if needed. Termite-attracting ingredients include, for example, pheromones, sugar-containing aqueous solutions (for example, Pocari Sweat<sup>®</sup>), and wood materials containing cellulose.

[0023] (2) One Embodiment

One embodiment of a cartridge will now be described with reference to Fig. 1a and Fig. 1b.

In this embodiment, a cartridge 1 has a cell structure with cells 3 that are formed compartmentally by a member 2. In this embodiment, the cells 3 form passages through which termites can travel.

In Fig. 1a and Fig. 1b, the member 2 that forms the cells 3 forms the cell structure by a combination of octagons and squares. However, the cell structure in cartridges is not limited to this form, and may be formed, for example, simply of squares, or combinations of hexagons and squares, etc.

[0024] In this embodiment, the cell diameter of the cell structure is preferably from 2 to 5 mm, and more preferably from 2 to 3 mm. The cell diameter of a cell structure is a value calculated by inscribing an elliptical form around the cells (void), and taking the average of the long axis LH and the short axis WH of the inscribed ellipse.

[0025] In this embodiment, the insecticide active ingredient adheres to the surface of the member and/or is kneaded into the member. One method of adhering the insecticide active ingredient to the surface of the member is, for example, to immerse the member in an aqueous solution of the insecticide active ingredient or a solvent in which the insecticide active ingredient has been dissolved. One method of kneading the insecticide active ingredient into the member is, for example, to create cell structures using a melted material composed by melting a resin material listed above and adding an insecticide active ingredient.

### [0026] (3) Another Embodiment

Another embodiment of a cartridge will now be described with reference to Fig. 2a and Fig. 2b.

In this embodiment, a cartridge 11 is a panel-shaped structure with a plurality of through-holes 13 in a panel-shaped member 12 made of the material. In this embodiment, the plurality of through-holes 13 form passages through which termites can move.

In Fig. 2, the plurality of through-holes 13 are round, but the through-holes 13 in the cartridge 11 are not limited to this shape and may be oval, rectangular, slit-shaped, etc.

[0027] In this embodiment, a hole diameter of the through-hole is preferably from 2 to 5 mm, and more preferably from 2 to 3 mm. When the through-hole is round, oval-shaped, rectangular, etc., the hole diameter refers, respectively, to the diameter, long axis diameter, or length of the long side. If the through-hole is slit-shaped, the hole diameter is generally a value represented by the slit width.

[0028] The cartridge 11 may be a single-layer structure or, as illustrated in Fig. 2b, a layered structure in which a plurality of panel-shaped structures are layered. When the cartridge 11 is a layered structure, the number of layers, while not limited, may be from two to ten layers. The through-holes may also be formed at overlapping positions in the stacking direction of the plurality of panel-shaped members, or they may be formed alternately at non-overlapping positions. Fig. 2b illustrates through-holes formed in non-overlapping positions in the stacking direction of the plurality of panel-shaped members. In Fig. 2b, a space is illustrated between the plurality of panel-

shaped members, but this is a schematic representation of the boundaries between panel-shaped members, which are actually gaps.

[0029] In this embodiment, the insecticide active ingredient adheres to the surface of the member and/or is kneaded into the member. One method of adhering the insecticide active ingredient to the surface of the member is, for example, to immerse the member in an aqueous solution of the insecticide active ingredient or a solvent in which the insecticide active ingredient has been dissolved. One method of kneading the insecticide active ingredient into the member is, for example, to create the panel-shaped structure using a melted material composed by melting a resin material listed above and adding an insecticide active ingredient.

#### [0030] (4) A Further Embodiment

A further embodiment of a cartridge will now be described with reference to Fig. 3a and Fig. 3b.

In this embodiment, a cartridge 21 is a mesh-like structure composed of the material and including a support member 22 with an opening 24 and a mesh member 22' provided on the support member 22. In this embodiment, the opening 24 in the support member 22 and an opening 23 in the mesh member 22' form passages through which termites can move.

In Fig. 3a, the opening 24 is square, but the opening 24 in the cartridge 21 are not limited to this shape and may be round, oval-shaped, slit-shaped, etc.

[0031] In this embodiment, an opening diameter of the mesh member is preferably from 2 to 5 mm, and more preferably from 2 to 3 mm. The opening diameter of the mesh member is generally a value represented by the mesh gap. The opening diameter of the support member is not limited, and may be any size large enough to allow the mesh-like member to be installed on the support member.

[0032] The cartridge 21 may have a single-layer structure or, as illustrated in Fig. 3b, may have a layered structure in which a plurality of mesh-like structures are layered. When the cartridge 21 has a layered structure, the number of layers, while not limited, may be from two to ten.

[0033] In this embodiment, the insecticide active ingredient adheres to the surface of the mesh

member and/or is kneaded into the mesh member. However, in this embodiment, the insecticide active ingredient may adhere to the surface of the support member and/or be kneaded into the support member.

One method of adhering the insecticide active ingredient to the surface of the mesh member is, for example, to immerse the mesh member in an aqueous solution of the insecticide active ingredient or a solvent in which the insecticide active ingredient has been dissolved. One method of kneading the insecticide active ingredient into the mesh member is, for example, to create the mesh member using a melted material composed by melting a resin material listed above and adding an insecticide active ingredient.

The material of the support member and the material of the mesh member may be the same or different, but are preferably the same.

#### [0034] (5) A Further Embodiment

A further embodiment of a cartridge not illustrated in any of the drawings will now be described.

In this embodiment, the cartridge has a mesh-like structure consisting of a mesh member made of the material. In this embodiment, the openings in the mesh member form passages through which termites can move.

[0035] In this embodiment, an opening diameter of the mesh member is preferably from 2 to 5 mm, and more preferably from 2 to 3 mm. The opening diameter of the mesh member is generally a value represented by the mesh gap.

[0036] The cartridge may be a structure consisting of a single mesh-like structure or a latticework structure in which a plurality of mesh-like structures are layered. When the cartridge is a structure in which a plurality of mesh-like structures are layered, the number of mesh structures, while not limited, may be from 2 to 10.

[0037] In this embodiment, the insecticide active ingredient is adhered to the surface of the mesh member and/or kneaded into the mesh member.

One method of adhering the insecticide active ingredient to the surface of the mesh-like

member is, for example, to immerse the mesh member in an aqueous solution of the insecticide active ingredient or a solvent in which the insecticide active ingredient has been dissolved. One method of kneading the insecticide active ingredient into the mesh member is, for example, to create the mesh member using a melted material composed by melting a resin material listed above and adding an insecticide active ingredient.

In this embodiment, the mesh-like structure is preferably flexible.

[0038] [Termite Control Device]

The termite control device is provided with a cartridge and a container capable of housing the cartridge that is made of a resin, a metal, a ceramic, or a composite of these materials. As mentioned above, the cartridge does not need to be replaced frequently and can be used until the expiration date of the insecticide active ingredient. Thus, the termite control device provided with the cartridge does not have to be checked frequently, which reduces the cost burden associated with providing a service.

[0039] The container has a lid that can be opened and closed on the top surface thereof. This makes it easy to replace the cartridge after its expiration date. Furthermore, a side surface of the container has a plurality of through-holes or slits through which termites can enter. Also, the bottom surface of the container preferably has an opening. When the bottom surface of the container has an opening, when water or fine particles of soil enter the container due to rainfall, they readily flow out of the container. Therefore, the termite control device in another embodiment of the present disclosure is suitable for outdoor use. The opening in the bottom surface of the container is not particularly limited, and may be a single large opening, a plurality of through-holes, or a slit.

[0040] The interior space of the container may be provided with a partition member that forms a partition in the longitudinal direction as long as it can house the cartridge. Providing the partition member prevents damage or deformation of the container when pressure is applied to the container due to rainfall or some other factor. The position and number of partition members may be adjusted depending on the size of the container, but from the perspective of housing a cartridge, a single

partition in the center in the longitudinal direction is preferred. When a partition member is provided in the interior space of the container, the cartridge is preferably housed in all of the space partitioned by the partition member.

[0041] One embodiment of a container 31 will now be described with reference to Fig. 4.

In Fig. 4, a lid 35 is connected to the container, but is not limited to this, and the container and the lid may be separate. Furthermore, a side surface of the container has a plurality of round through-holes 34, but the shape of the side surface through-holes is not limited to this example and may be oval-shaped, rectangular, diamond-shaped, etc. Slits may also be formed instead of through-holes, and when slits are formed, they are preferably sloped downward to prevent soil and water from entering from the ground. The bottom surface of the container has a large opening 36, but the shape of the opening in the bottom is not limited to this. For example, a plurality of small through-holes may be provided, similar to the through-holes on the side surface, or a slit may be provided.

[0042] Another embodiment of a container 41 will now be described with reference to Fig. 5.

In Fig. 5, a lid 45 is separate from the container, but is not limited to this shape, and the container and the lid may be connected. A plurality of slits 44 are formed on a side surface of the container parallel to the bottom surface, but the slits may be sloped downward to prevent soil and water from entering from the ground. Through-holes may be formed on the side surface instead of slits. The through-holes may be any shape, such as round, oval-shaped, rectangular, diamond-shaped, etc. Although not illustrated in a drawing, the bottom surface of the container may have an opening, and there are no particular restrictions on the size of the opening.

[0043] Although not illustrated, the lid preferably has a child proof mechanism. A child proof mechanism is a mechanism that prevents accidents due to tampering by children, for example, a mechanism that cannot be easily opened or closed without using a key. The key may be a dedicated key or master key, or it may be a card key, electronic key, or biometric authentication such as fingerprint authentication.

[0044] The material of the container may be a resin, a metal, a ceramic, or a composite of these

materials. More specifically, resins such as polypropylene or polyvinyl chloride resin, a metal such as stainless steel, titanium, or aluminum, or a ceramic such as silicon carbide material or aluminum nitride material may be used.

[0045] The size of the container is not limited, as long as it can house the cartridge. One example is 30 to 40 cm deep by 5 to 40 cm wide by 30 to 40 cm high.

[0046] [Termite Control Method]

A termite control method protects a building from termite damage using a termite control device, and the method includes a step of burying the termite control device in soil surrounding the building so that at least some of the through-holes or slits in a side surface of the container through which termites can enter are in the soil. As mentioned above, the termite control device is buried in soil surrounding the building so that at least some of the through-holes or slits provided in a side surface of the container through which termites can enter are in the soil. Termites enter through a through-hole or slit in the container in the soil through random probing behavior and are exposed to the insecticide active ingredient for a period of time as they move through a passage in the cartridge. Because the insecticide active ingredient is unavoidable and slow-acting, termites that enter the cartridge are exposed to the insecticide active ingredient for a certain period of time but are not immediately killed, and they return to the colony to transmit the insecticide active ingredient to other termites. As a result, a certain percentage of the colony population is killed, and the termites, being social insects, are unable to maintain the colony. In this way, the activity of termites can be inhibited or eradicated.

[0047] In the termite control method, the termite control device may be buried in the soil surrounding the building so that at least some the through-holes or slits provided in the side surface of the container through which termites pass are in the soil, or the entire termite control device may be buried in the soil surrounding the building. In a preferred embodiment from the standpoint of replacing the cartridge, the termite control device is buried in the soil surrounding the building so that the lid on the top surface of the container can be opened and closed. In another preferred embodiment, the entire termite control device is buried at a soil depth where termites are expected

to be present. In this embodiment, a removable depth- adjusting member may be provided on the lid on top surface of the container. The depth-adjusting member may be connected to a guide member described below near the surface of the ground.

[0048] The termite control method preferably also includes a step of replacing the cartridge at the expiration date of the insecticide active ingredient. This replacement step allows for low-cost, permanent inhibition or eradication of termite activity.

[0049] In the termite control method, a single termite control device may be buried, or a plurality of termite control devices may be buried. When a single termite control device is buried, it is preferably placed directly at a location with termite damage. A location with termite damage is a location where evidence of termite paths or damage (such as on the surfaces of wooden components, etc.) can be observed. When burying a plurality of termite control devices, the termite control devices are preferably be buried at intervals of 0.2 to 6 meters, more preferably at intervals of 0.5 to 5 meters, and even more preferably at intervals of 0.5 to 3 meters.

[0050] The termite control method preferably involves burying a plurality of termite control devices in the soil surrounding a building and arranging a guide member that connects at least some of the plurality of termite control devices to each other. As illustrated in Fig. 6, a plurality of termite control devices are preferably buried in soil 51 adjacent to a foundation portion 50 of the building, and a guide member 52 connecting the termite control devices to each other is preferably arranged adjacent to the foundation portion 50. The guide member 52 has a recessed portion formed along the longitudinal direction thereof, and the guide member is preferably arranged so that the recessed portion faces downward in the vertical direction. The guide member 52 arranged in this way can take advantage of a habit of termites of moving along objects and around corners, and termites that have risen from the ground between termite control devices can be encouraged to move along the recessed portion of the guide member to a termite control device. In this way, the activity of termites can be further inhibited or eradicated.

In Fig. 6, the dotted line indicates portions in soil.

[0051] In Fig. 6, the guide member 52 connects two termite control devices at the ground level.

Although not illustrated in the figure, the guide member may also be buried in the soil to connect the two termite control devices. When the guide member is buried in the soil, it is preferably arranged closer to the ground surface than to the holes or slits provided in the side surface of the termite control device from the standpoint of guiding termites that move between termite control devices through a guide member toward a termite control device.

[0052] Furthermore, according to one aspect of the present disclosure, the following [1] to [28] are provided.

[1] A cartridge having a structure including a member composed of a material that is resistant to decay or corrosion in soil and that is resistant to feeding damage by termites, thereby reducing feeding damage by termites, the structure having a passage through which the termites can move, and the structure containing an unavoidable, slow-acting insecticide active ingredient.

[2] The cartridge according to [1], wherein the structure is a cell structure with cells that are partitioned and formed by the member.

[3] The cartridge according to [1], wherein the structure is a panel-shaped structure with a plurality of through-holes in a panel-shaped member made of the material.

[4] The cartridge according to any of [1] to [3], wherein the insecticide active ingredient adheres to a surface of the member and/or is kneaded into the member.

[5] The cartridge according to [1], wherein the structure is a mesh-like structure consisting of a mesh member made of the material.

[6] The cartridge according to [1], wherein the structure is a mesh-like structure composed of the material and including a support member having an opening and a mesh member provided on the support member.

[7] The cartridge according to [5] or [6], wherein the insecticide active ingredient adheres to the surface of the mesh member and/or is kneaded into the mesh member.

[8] The cartridge according to any of [1] to [7], wherein the insecticide active ingredient is at least one type selected from the group consisting of a phenylpyrazole insecticide active ingredient, a neonicotinoid insecticide active ingredient, a diamide insecticide active ingredient, a

metadiamide insecticide active ingredient, a phenylurea insecticide active ingredient, a sulfoxyimine insecticide active ingredient, a butenolide insecticide active ingredient, a meso-ionic insecticide active ingredient, a pyridylidene insecticide active ingredient, and an isoxazoline insecticide active ingredient.

[9] The cartridge according to [8], wherein the phenylpyrazole insecticide active ingredient is at least one type selected from the group consisting of fipronil, ethiprole, and pyriprole.

[10] The cartridge according to [8], wherein the neonicotinoid insecticide active ingredient is at least one type selected from the group consisting of imidacloprid, thiacloprid, thiamethoxam, clothianidin, dinotefuran, and acetamiprid.

[11] The cartridge according to [8], wherein the diamide insecticide active ingredient is at least one type selected from the group consisting of flubendiamide, tetraniliprole, chlorantraniliprole, cyclaniliprole, and cyantraniliprole.

[12] The cartridge according to [8], wherein the metadiamide insecticide active ingredient is broflanilide.

[13] The cartridge according to [8], wherein the phenylurea insecticide active ingredient is at least one type selected from the group consisting of novaluron, teflubenzuron, bistrifluron, diflubenzuron, hexaflumuron, noviflumuron, chlorfluazuron, and triflumuron.

[14] The cartridge according to [8], wherein the sulfoxyimine insecticide active ingredient is sulfoxaflor.

[15] The cartridge according to [8], wherein the butenolide insecticide active ingredient is flupyradifurone.

[16] The cartridge according to [8], wherein the mesoionic insecticide active ingredient is at least one of dichloromezothiaz and triflumezopyrim.

[17] The cartridge according to [8], wherein the pyridylidene insecticide active ingredient is flupyrimin.

[18] The cartridge according to [8], wherein the isoxazoline insecticide active ingredient is at least one of fluxamethamide and isocycloseram.

[19] The cartridge according to any of [1] to [18], wherein the material is composed of a resin material, a metal material, a ceramic material, or a composite of these materials.

[20] The cartridge according to [19], wherein the resin material is an acrylonitrile-butadiene-styrene resin, a polylactic acid resin, an acrylate-styrene-acrylonitrile resin, a polypropylene resin, a polyethylene terephthalate resin, an epoxy resin, an acrylic resin, a polycarbonate resin, a nylon resin, a thermoplastic polyurethane resin, a polymethyl methacrylate resin, a polyvinylidene fluoride resin, or a polyethylene resin.

[21] A termite control device provided with: the cartridge according to any of [1] to [20]; and a container that is able to house the cartridge and that is composed of a resin, a metal, a ceramic, or a composite of these materials, wherein the container has a lid that can be opened and closed on the top surface thereof, and that has a plurality of through-holes or slits in a side surface thereof through which termites can enter.

[22] The termite control device according to [21], wherein the bottom surface thereof has an opening.

[23] The termite control device according to [21] or [22], wherein the lid has a child proof mechanism.

[24] A termite control method for protecting a building from termite damage using the termite control device according to any of [21] to [23], the method including a step of burying the termite control device in soil surrounding the building so that at least some of the through-holes or slits provided in a side surface of the container through which termites can enter are in the soil.

[25] The termite control method according to [24], further including a step of replacing the cartridge according to any of [1] to [20] at the expiration date of the insecticide active ingredient.

[26] The termite control method according to [24] or [25], further including a step of burying a plurality of the termite control device in soil surrounding the building and arranging a guide member to connect at least some of the plurality of the termite control device.

[27] The termite control method according to [26], wherein a plurality of the termite

control device and the guide member are arranged adjacent to the foundation portion of the building.

[28] The termite control method according to [26], wherein the guide member has a recessed portion formed along the longitudinal direction thereof, and the guide member is arranged so that the recessed portion faces downward in the vertical direction.

[Examples]

[0053] The present disclosure will be described in greater detail using examples, but the present disclosure is not limited to these examples. Unless otherwise stated, all percentages used in the present disclosure are mass based. Also, unless otherwise stated, all units and measurement methods used herein are in accordance with Japanese Industrial Standards (JIS).

[0054] The materials and species of termite used in the examples and comparative example are listed below.

Termites: *Coptotermes formosanus*

Cartridge: 4-mm polyethylene mesh treated with 0.2 g of Agenda<sup>®</sup> MC (0.7% by mass fipronil equivalent) (Fig. 7A)

Container: 52-mm high, 31-mm diameter plastic bottle provided with a 40 mm long x 3 mm wide slit in the side surface (Fig. 7B)

Case: 270 mm (L) x 360 mm (W) x 180 mm (H) case

Bricks: 60 mm (L) x 210 mm (W) x 100 mm (H) bricks

Piece of Wood: 20 mm (L) x 20 mm (W) x 40 mm (H).

Soil: Soil with 25% moisture content

[0055] [Termite Activity Index]:The termites were rated on a 10-point relative scale on the basis of the subjectivity of the same experimenter, with 10 points being the point at which termites were introduced to the test device and 0 points being the point at which no termites exhibiting activity were present.

[0056] (Example 1)

Termite control devices were prepared by housing a cartridge in a container. Two bricks were arranged in the center of a case filled with soil to a height of 25 mm, and a piece of wood was arranged on the top surface of the bricks. Six of the prepared termite control devices were arranged around the base of the bricks. The termite control device was buried so that the slit was in the soil. The case was then filled with 2,200 termites. All termites were dead after 15 days. No formation of termite paths was observed. The weight loss of the piece of wood was 3% by mass. Table 1 lists the termite activity indices and the presence or absence of termite path formation.

[0057] (Example 2)

After Example 1, 2,200 termites were re-introduced without any change to the termite control devices. All termites were dead after 11 days. No formation of termite paths was observed. The weight loss of the piece of wood was 1% by mass. Table 1 lists the termite activity indices and the presence or absence of termite path formation.

[0058] (Comparative Example)

Termites were observed under the same conditions as in Example 1, except that the termite control devices were not arranged. All termites were still active after 15 days. Formation of termite paths was also observed after 11 days. The weight loss of the piece of wood was 12% by mass. Table 1 lists the termite activity indices and the presence or absence of termite path formation.

[0059] [Table 1]

|             | Ex. 1    |           | Ex. 2    |           | C. Ex.   |           |
|-------------|----------|-----------|----------|-----------|----------|-----------|
|             | Activity | Path      | Activity | Path      | Activity | Path      |
|             | Index    | Formation | Index    | Formation | Index    | Formation |
| After Day 1 | 10       | No        | 10       | No        | 10       | No        |
| After Day 2 | 10       | No        | 9        | No        | 10       | No        |
| After Day 3 | 8        | No        | 8        | No        | 10       | No        |
| After Day 4 | 5        | No        | 6        | No        | 10       | No        |
| After Day 5 | 5        | No        | 4        | No        | 10       | No        |

|              |   |    |   |    |    |     |
|--------------|---|----|---|----|----|-----|
| After Day 6  | 4 | No | 3 | No | 10 | No  |
| After Day 7  | 4 | No | 2 | No | 10 | No  |
| After Day 8  | 4 | No | 1 | No | 10 | No  |
| After Day 9  | 3 | No | 1 | No | 10 | No  |
| After Day 10 | 3 | No | 1 | No | 10 | No  |
| After Day 11 | 2 | No | 0 | No | 10 | Yes |
| After Day 12 | 2 | No | - | No | 10 | Yes |
| After Day 13 | 1 | No | - | No | 10 | Yes |
| After Day 14 | 1 | No | - | No | 10 | Yes |
| After Day 15 | 1 | No | - | No | 10 | Yes |
| After Day 16 | 0 | No | - | No | 10 | Yes |

[0060] It is clear from Table 1 that when a termite control device housing a cartridge according to the present disclosure is used, the formation of termite paths is not observed and the device can be used over and over again. The results from Example 2 in particular show that infestations and activity by termites can be inhibited or eradicated a plurality of times, even when the cartridge has not been replaced after a certain amount of time. Therefore, the cartridge does not need to be replaced frequently and can be used until the expiration date of the insecticide active ingredient. Thus, the device does not have to be checked frequently, which can reduce the cost burden associated with providing a service. The termite control method can also inhibit or eradicate the activity of termites, as all termites were killed when the termite control device was used.

[Key to the Drawings]

[0061] 1, 11, 21: Cartridge

2: Member

12: Panel-shaped member

22: Support member

22': Mesh member

3: Cell

13: Through-hole

23, 24: Opening

31, 41: Container

34: Through-hole

35, 45: Lid

36: Opening

44: Slit

50: Foundation portion

51: Soil

52: Guide member

## CLAIMS

1. A cartridge comprising a structure comprising a member composed of a material that is resistant to decay or corrosion in soil and that is resistant to feeding damage by termites, thereby reducing feeding damage by termites,

the structure comprising a passage through which the termites can move, and

the structure comprising an unavoidable, slow-acting insecticide active ingredient.

2. The cartridge according to claim 1, wherein the structure is a cell structure comprising cells that are partitioned and formed by the member.

3. The cartridge according to claim 1, wherein the structure is a panel-shaped structure comprising a plurality of through-holes in a panel-shaped member made of the material.

4. The cartridge according to claim 2 or 3, wherein the insecticide active ingredient adheres to a surface of the member and/or is kneaded into the member.

5. The cartridge according to claim 1, wherein the structure is a mesh-like structure comprising a mesh member made of the material.

6. The cartridge according to claim 1, wherein the structure is a mesh-like structure composed of the material and comprising a support member comprising an opening and a mesh member provided on the support member.

7. The cartridge according to claim 5 or 6, wherein the insecticide active ingredient adheres to the surface of the mesh member and/or is kneaded into the mesh member.

8. The cartridge according to claim 1, wherein the insecticide active ingredient is at least one type selected from the group consisting of a phenylpyrazole insecticide active ingredient, a neonicotinoid insecticide active ingredient, a diamide insecticide active ingredient, a metadiamide insecticide active ingredient, a phenylurea insecticide active ingredient, a sulfoxyimine insecticide active ingredient, a butenolide insecticide active ingredient, a meso- ionic insecticide active ingredient, a pyridylidene insecticide active ingredient, and an isoxazoline insecticide active ingredient.

9. The cartridge according to claim 8, wherein the phenylpyrazole insecticide active ingredient

is at least one type selected from the group consisting of fipronil, ethiprole, and pyriprole.

10. The cartridge according to claim 8, wherein the neonicotinoid insecticide active ingredient is at least one type selected from the group consisting of imidacloprid, thiacloprid, thiamethoxam, clothianidin, dinotefuran, and acetamiprid.

11. The cartridge according to claim 8, wherein the diamide insecticide active ingredient is at least one type selected from the group consisting of flubendiamide, tetraniliprole, chlorantraniliprole, cyclaniliprole, and cyantraniliprole.

12. The cartridge according to claim 8, wherein the metadiamide insecticide active ingredient is broflanilide.

13. The cartridge according to claim 8, wherein the phenylurea insecticide active ingredient is at least one type selected from the group consisting of novaluron, teflubenzuron, bistrifluron, diflubenzuron, hexaflumuron, noviflumuron, chlorfluazuron, and triflumuron.

14. The cartridge according to claim 8, wherein the sulfoxyimine insecticide active ingredient is sulfoxaflor.

15. The cartridge according to claim 8, wherein the butenolide insecticide active ingredient is flupyradifurone.

16. The cartridge according to claim 8, wherein the mesoionic insecticide active ingredient is at least one of dichloromezothiaz and triflumezopyrim.

17. The cartridge according to claim 8, wherein the pyridylidene insecticide active ingredient is flupyrimin.

18. The cartridge according to claim 8, wherein the isoxazoline insecticide active ingredient is at least one of fluxamethamide and isocycloseram.

19. The cartridge according to claim 1, wherein the material is composed of a resin material, a metal material, a ceramic material, or a composite of these materials.

20. The cartridge according to claim 19, wherein the resin material is an acrylonitrile-butadiene-styrene resin, a polylactic acid resin, an acrylate-styrene-acrylonitrile resin, a polypropylene resin, a polyethylene terephthalate resin, an epoxy resin, an acrylic resin, a

polycarbonate resin, a nylon resin, a thermoplastic polyurethane resin, a polymethyl methacrylate resin, a polyvinylidene fluoride resin, or a polyethylene resin.

21. A termite control device comprising:

the cartridge according to claim 1; and

a container that is able to house the cartridge and that is composed of a resin, a metal, a ceramic, or a composite of these materials,

wherein the container comprises a lid that can be opened and closed on the top surface thereof,

and has a plurality of through-holes or slits in a side surface thereof through which termites can enter.

22. The termite control device according to claim 21, wherein the bottom surface thereof comprises an opening.

23. The termite control device according to claim 21 or 22, wherein the lid comprises a child proof mechanism.

24. A termite control method for protecting a building from termite damage using the termite control device according to claim 21, the method comprising a step of burying the termite control device in soil surrounding the building so that at least some of the through-holes or slits provided in a side surface of the container through which termites can enter are in the soil.

25. The termite control method according to claim 24, further comprising a step of replacing the cartridge according to claim 1 at the expiration date of the insecticide active ingredient.

26. The termite control method according to claim 24 or 25, further comprising a step of burying a plurality of the termite control device in soil surrounding the building and arranging a guide member to connect at least some of the plurality of the termite control device.

27. The termite control method according to claim 26, wherein a plurality of the termite control device and the guide member are arranged adjacent to a foundation portion of the building.

28. The termite control method according to claim 26, wherein the guide member has a recessed portion formed along the longitudinal direction thereof, and

the guide member is arranged so that the recessed portion faces downward in the vertical

direction.