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(54) Title: A SHEET FOR PROVIDING A BARRIER

(57) Abstract: A sheet for providing a barrier against the penetration of insects, the sheet comprising at least one insecticide distributed through a plastics material wherein the insecticide is substantially retained in the plastics material.

A SHEET FOR PROVIDING A BARRIER

Field of the Invention

The present invention relates to sheets for providing a barrier against the penetration of insects and methods of protecting a building against the penetration of insects into the building.

Background to the Invention

Buildings may be subject to entry by insects. Some insects, such as termites will damage the building. In general, termites enter the building where it contacts the ground. From there, the termites may spread rapidly throughout the building, causing significant damage to any timber.

As a result, physical barriers have been employed to guard against the entry of insects, particularly termites to buildings. Typically, these barriers are in the form of plastic sheets and are placed either under a concrete slab or the entire building including the footings (ie. in full soil contact), whereby the plastic sheet also acts as a moisture barrier. The main problem with using plastic sheeting is that some termites are capable of eating through the plastic, thereby causing a breakdown of the physical barrier to their entry into the building.

To overcome this problem, a number of approaches have been proposed in which use of the plastic sheet is combined with the use of an insecticide. In one approach, the plastic sheet incorporates an insecticide either throughout the sheet or in localised areas of the plastic sheet, whereby the insecticide is controllably released or leached from the plastic into the surrounding soil. A

"buffer zone" around the plastic sheet is thus created, in which insects will be killed should they enter this zone. One of the most significant problems with this approach is that once the insecticide has substantially leached from the plastic, then the sheet becomes nothing more than the plain plastic sheet, with its associated problems, discussed above. Thus, the plastic sheet which leaches an insecticide has an effective lifetime which is limited by the leaching rate of the insecticide. Another problem with the insecticide leaching plastic sheet is that the release of such chemicals into the general environment may harm the environment and kill other organisms. Furthermore, the insecticide may be washed from the soil during heavy rain fall, which may result in pollution to run-off as well as the loss of the lethal "buffer zone". Furthermore, the insecticide leaching plastic sheet has only limited applications because, in order to work, it requires a substrate into which the termiticide can leach.

In an alternative, a liquid insecticide, typically deltamethrin is contained between two sheets of impermeable plastic. Thus, when the plastic is chewed through by termites, the liquid insecticide is released into a localised area around the penetration point where it kills any termites which are present. However, there are several problems with this arrangement as well, one of these being that once the plastic has been breached and the insecticide released, that there is no further termiticide barrier. Of further concern with this approach is that release of concentrated insecticide (ie. in liquid form) may cause harm to the local environment. Concentrated insecticides also pose a substantial health risk to humans. Thus, this type of barrier could not be used in a location where it would be likely that humans

would come in contact with the liquid insecticide, such as at or above ground level. Another problem, is that the plastic/liquid insecticide sheeting is difficult and dangerous to handle because it is bulky and also because when it is cut to shape for use, the person handling the sheeting is often exposed to the liquid insecticide.

Summary of the Invention

According to a first aspect of the present invention, there is provided a sheet for providing a barrier against the penetration of insects, the sheet comprising at least one insecticide distributed through a plastics material wherein the insecticide is substantially retained in the plastics material.

Because the insecticide is retained, the insecticide does not substantially leach from the plastics material. Thus, its activity is expressed throughout the plastics material.

In use, the plastics material provides a physical barrier against the penetration of insects and the insecticide provides a chemical barrier against the penetration of insects.

Preferably, the surfaces of the sheet are substantially identical, whereby, in use, the sheet may be laid with either surface facing up.

Preferably, the sheet is approximately 0.1 - 1 mm thick.

Preferably, the sheet is approximately 0.2 - 0.5 mm thick.

Preferably, the sheet is approximately 0.2 or 0.5 mm thick.

Preferably, the plastics material is any synthetic or semi-synthetic compound formed by organic

condensational polymerisation.

Preferably, the plastics material is any plastics material which can be moulded or extruded into objects or films or fibres.

Preferably, the plastics material is any one or a combination of polyamide (nylon), polyethylene, ethylene vinyl acetate, polystyrene, polyvinylchloride, synthetic rubber (eg. neoprene), polymethylmethacrylate (acrylic), polypropylene and polyurethane.

Preferably, the plastics material is low density polyethylene.

Preferably, the plastics material contains a UV stabiliser.

Preferably, the plastics material contains a white colouring agent.

Preferably, the sheet is substantially impact resistant according to Australian standard AS 4347.6.

Preferably, the sheet is substantially impermeable to water.

Preferably, vapour permeance through the sheet is less than 0.02 mg/Ns.

Preferably, the at least one insecticide is any compound that exhibits sufficient lethal control and/or repellent effects against insects.

Alternatively, a separate repellent compound in addition to the insecticide is distributed through the plastics material.

Preferably, the repellent compound does not significantly leach from the plastics material.

In use, the repellent compound provides a repellent barrier against the penetration of insects in addition to the chemical and physical barrier.

Preferably, the at least one insecticide is any

one or combination of pyrethrum, synthetic pyrethroids, organo-chlorines, organo-sulfurs, carbamates, organo-phosphates, formamidines, nicotinoids, spinosyns, phenylpyrazoles, pyrroles, pyrazoles, dinitrophenols, pyridazinones, quinazolines, and benzoylureas.

Typically, the insects impeded by the sheet will be termites.

Preferably, the at least one insecticide is a termiticide.

Preferably, the termiticide is a synthetic pyrethroid.

Preferably, the termiticide is any one or combination of bifenthrin, permethrin, deltamethrin, lambda-cyhalothrin, cypermethrin, alpha-cypermethrin, tetramethrin, and cyfluthrin or any other synthetic pyrethroid.

Preferably, the concentration of insecticide in the plastic is less than 5 weight %.

Preferably, the concentration of insecticide in the plastic is greater than 0.01 weight %.

Preferably, the insecticide is bifenthrin.

Where the insecticide is bifenthrin, its concentration in the plastic is preferably 0.05 to 1.0 weight %.

Preferably, the bifenthrin has a concentration of approximately 0.05 - 0.1 weight %, more preferably, approximately 0.1 weight %.

Bifenthrin provides a repellent barrier as well as a chemical barrier to the penetration of termites.

Preferably, the sheet is formed in a blown film extrusion process. Alternatively, the sheet is formed in an extrusion process. Preferably, the sheet is formed in the extrusion process if it has a thickness of

approximately 0.5 mm. If the sheet has a thickness of approximately 0.2 mm, then preferably it is formed in the blown film extrusion process.

Preferably, the sheet is formed from a master batch of plastic containing insecticides.

Preferably, the master batch has a concentration of insecticide which is stably supported in the plastic.

Preferably, at least one surface of the sheet is embossed. Alternatively, at least one surface of the sheet is smooth.

According to a second aspect of the present invention, there is provided a method of protecting a building against the penetration of insects into the building, the method comprising the step of positioning one or more sheets of a plastics material above the footings of the building, wherein the plastics material contains at least one insecticide distributed therethrough.

Preferably, the step of positioning the sheets of plastics material further involves positioning the sheets around the perimeter of the building at least extending between an outer wall of the building and an inner frame of the building.

In this arrangement, the sheets of plastics material restrict penetration by insects to the perimeter cavity between the outer wall and inner frame.

Preferably, the step of positioning the sheets of plastics material further involves positioning the sheets under all or part of a concrete slab of the building.

Preferably, the insecticide is substantially retained in the plastics material.

Preferably, the sheet acts as a moisture barrier for at least a portion of the building.

Preferably, the sheet acts as the damp proof course of the building.

Preferably, the sheets of plastics material comprise sheets according to the first aspect of the present invention.

Brief Description of the Drawings

A preferred embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic view and a magnified view of a sheet according to preferred embodiments of the present invention in a cavity barrier application;

Figure 2 is a schematic view of the sheet of Fig. 1 in an alternative cavity barrier application including a separate damp proof course sheet; and

Figure 3 is a schematic view of the sheet of Figure 1 in a complete underslab application.

Detailed Description of a Preferred Embodiment

Referring to the figures, a sheet 10 for providing a barrier against insects according to preferred embodiments of the present invention is shown. The sheet 10 comprises a plastics material having an insecticide dispersed therethrough and retained in the plastics material. As will become apparent from the description below, the sheet 10 provides a physical and chemical barrier to impede the penetration of insects by virtue of the fact that it is manufactured from a plastics material having an insecticide dispersed therethrough. The sheet 10 may also provide a repellent barrier, ie. will repel insects away from its location if the plastics material also has a repellent dispersed therethrough.

The sheet 10 has a vapour permeance of less than 0.02 mg/Ns and therefore according to the Australian Standards is substantially impermeable to water and can be used to form a moisture barrier for a building, for example.

The surfaces of the sheet 10 are substantially identical such that, when the sheet 10 is used, it may be laid with either surface facing up. The sheet 10 is approximately 0.1 - 1 mm thick, preferably 0.2 or 0.5 mm thick when purposes of sheets 10 of these different thicknesses will be dscribed further on in the specification.

The plastics material may comprise any synthetic or semi-synthetic compound formed by organic condensational polymerisation and which can be moulded or extruded into objects or films or fibres. Such compounds may include, but are not limited to, polyamide (nylon), polyethylene, ethylene vinyl acetate, polystyrene, polyvinylchloride, synthetic rubber (eg. neoprene), polymethylmethacrylate (acrylic), polypropylene and polyurethane. The plastics material may be formed from a combination of two or more of these compounds. The preferred compound used for the plastics material is low density polyethylene.

The plastics material may contain a UV stabiliser to prevent break down of the plastics material when exposed to sunlight. This is important in maintaining the longevity of the sheet 10 which may be in use for up to 50 or more years. The plastics material may also comprise a white colouring agent so that the sheet 10 is white in colour. The white sheet 10 does not heat up as much as conventionally black plastic sheeting in the sun and is therefore cooler and easier to handle during installation.

The sheet 10 is substantially impact resistant, which guards against rips or tears being formed in the sheet 10 during or after installation. The impact resistance of the sheet 10 is determined using the falling dart impact test outlined in Australian Standard AS 4347.6. This test involves firstly, dropping a load of 310 grams from a drop height of 660 mm, on the fold of the sheet 10. And secondly, dropping a load of 340 grams and a drop height of 660 mm, the load is dropped twice per metre width of sheet 10 across the full width of the sheet 10 with the sheet passing if 75% of these tests do not fail.

The insecticides which are retained in the plastics material may be any compound that exhibits control or repellent affects against insect species, particularly termites. These compounds include, but are not limited to, pyrethrum, synthetic pyrethroids, organo-chlorines, organo-sulfurs, carbamates, organo-phosphates, formamidines, nicotinoids, spinosyns, phenylpyrazoles, pyrroles, pyrazoles, dinitrophenols, pyridazinones, quinazolines, and benzoylureas. Preferably, a noted termiticide is used such as bifenthrin, permethrin, deltamethrin, lambda-cyhalothrin, cypermethrin, alpha-cypermethrin, zeta-cypermethrin, tetramethrin, and cyfluthrin. Some of the aforementioned insecticide compounds may also provide a repellent effect, thereby creating the repellent barrier referred to above.

In a preferred embodiment, the insecticide is bifenthrin. Bifenthrin has a non-alpha-cyano molecular structure which renders it a dermal non-sensitiser, ie. does not react substantially with a person's skin. Thus, a person handling the sheet 10 is unlikely to experience any reaction on their skin as a result of the bifenthrin in the plastics material.

Typically, the concentration of insecticide in the plastic is less than 5 weight % and greater than 0.01 weight %. The concentration of insecticide is dependent upon the actual compound used. If the insecticide is bifenthrin, as in the preferred embodiment discussed above, then the concentration of the insecticide (bifenthrin) in the plastics material is 0.05 to 1.0 weight %, preferably 0.05 to 0.1 weight % and more preferably approximately 0.1 weight %.

Notably, bifenthrin provides a repellent barrier as well as a chemical barrier to the penetration of insects.

Manufacture of the sheet 10 involves mixing the insecticide with polymer resin to form a "mater batch". The master batch has a higher concentration of insecticide than the end sheet 10 product. The concentration of insecticide in the master batch may be as high as is stably supported in the polymer matric (ie. does not react and/or leach from the plastic).

For the sheet 10 of the preferred embodiment where the insecticide is bifenthrin, mixing the insecticide with polymer resin to form the master batch, in one embodiment involdes melting solid bifenthrin (>99 % purity), melting the polymer resin separately (preferably low density polyethylene) and mixing the polymer resin and bifenthrin melts. Alternatively, powdered bifenthrin (mixed with talcum powder) or a solution of bifenthrin may be mixed with molten polymer resin to form the master batch. In a preferred embodiment, the concentration of bifenthrin in the master batch is approximately 2 weight %. However, the concentration of bifenthrin in the master batch may be substantially higher.

The master batch is solidified and formed into pellets, awaiting later dilution to achieve the desired concentration of insecticide for the end sheet 10 product. Dilution of the master batch occurs by mixing the solid master batch pellets with solid polymer pellets to form a homogenous solid mixture. The homogenous solid mixture is melted and then formed into the sheet 10 by any suitable means.

In one preferred embodiment, the sheet 10 is formed by blown film (or tubular film) extrusion of the molten monogenous mixture of plastic and insecticide. Blown film extrusion involdes extruding the molten plastic through an annular slit die, usually vertically, to form a thin walled tube. Air is introduced via a hole in the centre of the die to blow up the tube like a balloon. Mounted on top of the die, is a high-speed air ring which blows onto the hot film to cool it. The tube of film then continues upwards, continually cooling, until it passes through nip rolls where the tube is flattened to create what is known as a "lay-flat" tube of film. This lay-flat or collapsed tube is then taken back down the extrusion "tower" via more rollers. The lay-flat film is then either kept as such or the edges of the lay-flat are slit off to produce two flat film sheets 10 according to preferred embodiments of the present invention.

This blown film extrusion process is typically used to produce sheets 10 approximately 0.2 mm thick. However, if thicker sheets 10 are required to be produced, particularly if the sheets 10 are approximately 0.5 mm, then an extrusion process is typically used. Referring in particular to Figures 1 and 2, the sheet 10 is shown in use in a cavity barrier application. Figures 1 and 2 show a building 11 having footings 20 extending below the

ground 12 and a concrete slab 21 which forms the base of the building 11. The concrete slab 21 is integrally formed with the footings 20. The footings 20 support the entire building 11.

Extending upwardly from the concrete slab 21 is an inner frame 23, which is connected to the concrete slab 21 via a bottom plate 22. Extending upwardly from the footings 20, approximately parallel to the inner frame 23 is an outer wall 24. The outer wall 24 is spaced apart from the inner frame 23, such that a cavity 25 exists between them. As the cavity 25 extends all the way around the building 11, should any termites gain access to the cavity 25 from the ground 12, then they may be able to attack a substantial portion of the building 11.

Thus, in Figures 1 and 2 the sheet 10 extends between the outer wall 24 and the bottom plate 22 so as to block off access to the cavity 25 above the level of the concrete slab 21, creating a physical and chemical barrier against the penetration of insects. The physical barrier is provided by the plastics material and the chemical barrier is provided by the insecticide dispersed through the plastics material from which the sheet 10 is manufactured. The insecticide does not significantly leach from the plastic, but instead is retained so that the insecticide's activity is expressed through the plastics material. Because the insecticide's activity is expressed within the plastics material it does not require a substrate such as soil to leach into in order for the sheet 10 to work effectively. Thus, the sheet 10 is more versatile and can be used in more varied applications than those of the prior art. If termites were to attack the sheet 10, then any contact or ingestion of the insecticide containing plastics material will kill the termites. This

is because although the insecticide is tightly bound in the plastics material and is not dislodged by water, there is still enough insecticide available to deliver a lethal dose to an insect, which picks insecticide up upon contact with the sheet 10. Only a tiny amount of insecticide is required to kill the insect.

In Figure 2, a further piece of sheeting 13 extends between the outer wall 24 and the inner frame 23 on top of the sheet 10 and extends up the outside of the inner frame 23. This further piece of sheeting 13 is commonly referred to as "damp-proof course" and is primarily used as a moisture barrier to prevent moisture entering the cavity 25 above the sheet 10. As such, the damp-proof course 13 may simply be a plastic sheet, ie. contains no insecticide.

However, as shown in Figure 1 (particularly in the magnified view), the sheet 10 may be employed as the damp proof course because in a preferred embodiment, the sheet 10 is impermeable to water and can therefore act as a moisture barrier. There is therefore no need for the additional sheet 13 (as shown in Figure 2) which saves time and cost in the building process. When installing the sheet 10 with the secondary purpose of acting as the damp proof course, the sheet 10 should be doubled over at the inner edge of the bottom plate 22 so that a portion of the sheet 10 extends up the outside of the inner frame 23. The sheet 10 if used also as the damp proof course is approximately 0.5 mm thick. Otherwise, the sheet 10 (as shown in use in Figure 2) may be only 0.2 mm thick.

Weepholes 26 are provided periodically along the length of the outer wall 24 to allow for moisture between the sheet 10 and the damp-proof course 13 to exit the building 11. An advantage of the present invention is

that because the insecticide is retained in the plastics material, that there will be extremely little or no insecticide leaking out of the weepholes 26 which could pose a human health risk.

The surfaces of the sheet 10 may be embossed so that there is friction between the surface of the sheet 10 and any bricks laid above or below the sheet 10. This acts against any slippage occurring in the outer wall 24 and/or the sheet 10. Alternatively, the sheet 10 may have at least one smooth surface.

Figure 3 shows the sheet 10 in a complete underslab application. The sheet 10 is placed under the entire concrete slab 21, above the footings 20 and across the cavity channel 25 to the outer wall 24. The sheet 10 may also extend at least partially up any penetrations 27 through the concrete slab 21 such that it forms a tight fit with an elongate member (not shown) in the form of a conduit, pipe, cable, etc extending through the penetration 27. In this application, the sheet 10 acts as a barrier against entry by termites to the building through any part of the concrete slab 21 and the cavity 25.

The sheet 10 could be used in a variety of other applications in a building 11, such as the perimeter of the concrete slab 21, lining the inside of the penetrations 27 and any other critical joints, retaining walls and in any renovations or additions to the building 11. When the sheet 10 is used in a complete underslab application or in a retaining wall situation, the sheet 10 also acts as a moisture barrier.

Examples

The following examples further illustrate

preferred embodiments of the present invention.

Example 1: Efficacy test of a polymer sheet containing bifenthrin for subterranean termite control.

A replicated field trial conducted in the Northern Territory of Australia evaluated a plastic sheet product containing bifenthrin according to preferred embodiments of the present invention, as a barrier against field colonies of the Australian subterranean termites comprising *Mastotermes drawiniensis* and the mound building form of *Coptotermes acinaciformis*. A range of bifenthrin concentrations was used in the assessment including untreated plastic sheet, and a sheet containing 0.1 % bifenthrin. Each test was replicated ten times for each of the termite species giving a total number of replicates of twenty.

Table 1: Summary of residual protection performances of bifenthrin containing sheet as a barrier against termites after 2 years assessment.

	Mastotermes darwiniensis		*Coptotermes acinaciformis*		Combined total all species	
	0%	0.1% bifenthrin	Control	0.1% bifenthrin	Control	0.1% bifenthrin
Number of penetrations out of possible (10)	7 (10)	0 (10)	9 (10)	0 (10)	16 (20)	0 (20)
% of replicates breeched by termites	70%	0%	90%	0%	80%	0%

The results indicate that in the tropical north, under extreme pressure from the two most economically important and destructive termite species (*Mastotermes*

darwiniensis, and *Coptotermes acinaciformis*) in Australia, the sheet containing 0.1% bifenthrin is capable of providing 100% protection from concealed entry through the sheet. Whilst these two species were targeted *Heterotermes sp., Microcerotermes sp., and Schedorhinotermes sp.* also contacted the sheets.

In assessing the trial, it was noted that termites were exhibiting classical symptoms of repellence from the bifenthrin containing sheet. Symptoms included reduced faecal plastering on the bifenthrin containing sheet, and veneering of attractant wood directly in contact with the bifenthrin containing sheet. It was also noted that there were dead termites present on the sheet containing 0.1% bifenthrin.

Example 2: Potential for degradation of bifenthrin in a polymer sheet

Trials were conducted to investigate the degradation of bifenthrin in a sheet according to preferred embodiments of the present invention under a range of simulated installations including full under slab and perimeter cavity situations. Sheet material containing three concentrations of bifenthrin was assessed for degradation (0.05% and 0.1%).

Sampes of the sheeting were taken at 0, 1, 3, 6, and 12 months after application for under-slab simulated installations and at 0, 3, and 6 months after application for perimeter cavity simulated installations. The under slab simulated conditions also investigated influence of soil type by including a clay soil and a sandy soil in contact with the sheet product.

The results from these trials indicate that there has been no change (at the 95% confidence level) in the

amount of bifenthrin present in the sheet over the period of the trial. There has been no significant breakdown or migration of the active ingredient out of the sheet.

Table 2: Statistical analysis results (as determined by one-way ANOVA) of data generated for bifenthrin sheet in contact with sand and clay soils in an under-slab simulation, and in a perimeter cavity situation.

Test situation	Soil Type	Nominal concentration	Time period for comparison (months)	Statistical difference in concentration over time
Under-slab	Clay	0.05%	0-12	not significant (P>0.05)
Under-slab	Sand	0.05%	0-12	Not significant (P>0.05)
Under-slab	Clay	0.1%	0-12	Not significant (P>0.05)
Under -slab	Sand	0.1%	0-12	Not significant (P>0.05)
Perimeter cavity	NA	0.05%	0-6	Not significant (P>0.05)
Perimeter cavity	NA	0.1%	0-6	Not significant (P>0.05)

Example 3: Potential for leaching of bifenthrin from a sheet matrix

A study was conducted to evaluate the potential for bifenthrin contained in a plastic sheet according to preferred embodiments of the present invention to migrate into water.

In the trial a sample of a plastic sheet containing 0.1% bifenthrin was placed in water, and gently stirred once a week, for a period of six months. The

plastic sheet and the water were analysed to determine the amount of bifenthrin that had moved into the water at 0, 1 and 6 months.

The analysis of variance showed that there was no significant loss (P>0.05) of bifenthrin from the sheeting product and no significant increase (P>0.05) of bifenthrin in the water after six months compared to the time zero levels.

Table 3: One-way alaysis of variance of bifenthrin concentration in the Water

Water (µg/mL)			
	F-test	P value	Significance
Time 0 v 1 month	0.466	0.736	No significant difference (P>0.05)
Time 0 v 6 months	0.379	0.782	No significant difference (P>0.05)

Table 4: One-way analysis of variance of bifenthrin concentration in the Plastic

Plastic (µg/g)			
	F-test	P value	Significance
Time 0 v 1 month	20.783	0.017	No significant difference (P0.05)
Time 0 v 6 months	2.010	0.279	No significant difference (P>0.05)

In the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word "comprise" or variations such as "comprises" or "comprising" is used in an inclusive sense, ie. to specify the presence of the stated features but not to preclude the presence or

addition of further features in various embodiments of the invention.

CLAIMS:

1. A sheet for providing a barrier against the penetration of insects, the sheet comprising at least one insecticide distributed through a plastics material wherein the insecticide is substantially retained in the plastics material.

2. A sheet as claimed in claim 1, wherein the sheet is approximately 0.1 - 1 mm thick.

3. A sheet as claimed in either claim 1 or 2, wherein the plastics material is any synthetic or semi-synthetic compound formed by organic condensational polymerisation.

4. A sheet as claimed in either claim 1 or 2, wherein , the plastics material is any one or a combination of polyamide (nylon), polyethylene, polyvinylchloride, ethyl vinyl acetate, polystyrene, synthetic rubber (eg. neoprene), polymethylmethacrylate (acrylic), polypropylene and polyurethane.

5. A sheet as claimed in either claim 1 or 2, wherein, the plastics material is low density polyethylene.

6. A sheet as claimed in any of the preceding claims, wherein the plastics material contains a UV stabiliser.

7. A sheet as claimed in any one of the preceding claims, wherein the plastics material contains a white

colouring agent.

8. A sheet as claimed in any one of the preceding claims, wherein the sheet is substantially impermeable to water.

9. A sheet as claimed in any of one of the preceding claims, wherein the at least one insecticide is any compound that exhibits sufficient lethal control and/or repellent effects against insects.

10. A sheet as claimed in any one of claims 1 to 8, wherein the at least one insecticide is any one or combination of pyrethrum, synthetic pyrethroids, organo-chlorines, organo-sulfurs, carbamates, organo-phosphates, formamidines, nicotinoids, spinosyns, phenylpyrazoles, pyrroles, pyrazoles, dinitrophenols, pyridazinones, quinazolines, and benzoylureas.

11. A sheet as claimed in any one of claims 1 to 8, wherein the insecticide is bifenthrin.

12. A sheet as claimed in claim 11, wherein the concentration of bifenthrin in the plastic is 0.05 to 1.0 weight %.

13. A sheet as claimed in claim 11, wherein the concentration of bifentrin in the plastic is approximately 0.1 weight %.

14. A method of protecting a building against the penetration of insects into the building, the method comprising the step of positioning one or more sheets of

a plastics material above the footings of the building, wherein the plastics material contains at least one insecticide distributed therethrough.

15. A method as claimed in claim 14, wherein the step of positioning the sheets of plastics material further involves positioning the sheets around the perimeter of the building at least extending between an outer wall of the building and an inner frame of the building.

16. A method as claimed in either claim 14 or 15, wherein the sheets of plastics material comprise sheets as claimed in any one of claims 1 to 13.

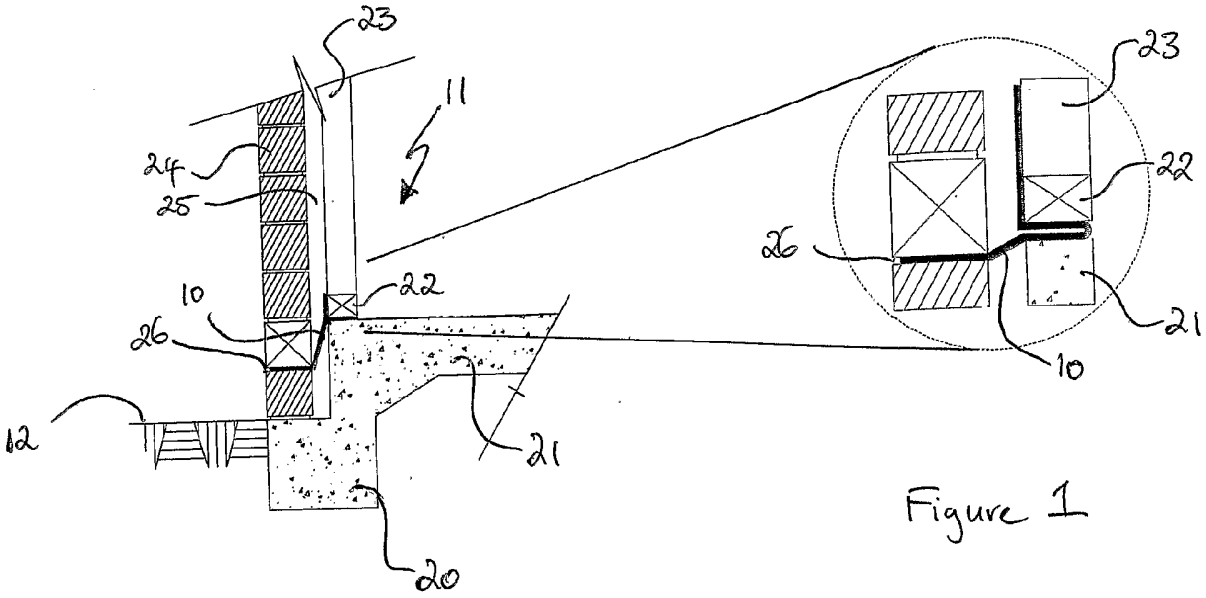

Figure 1

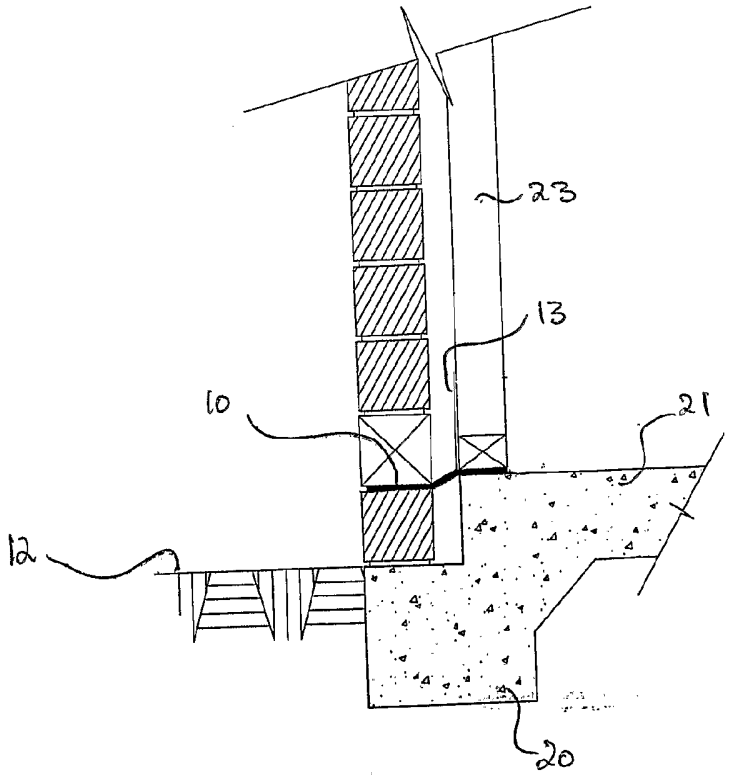

Figure 2

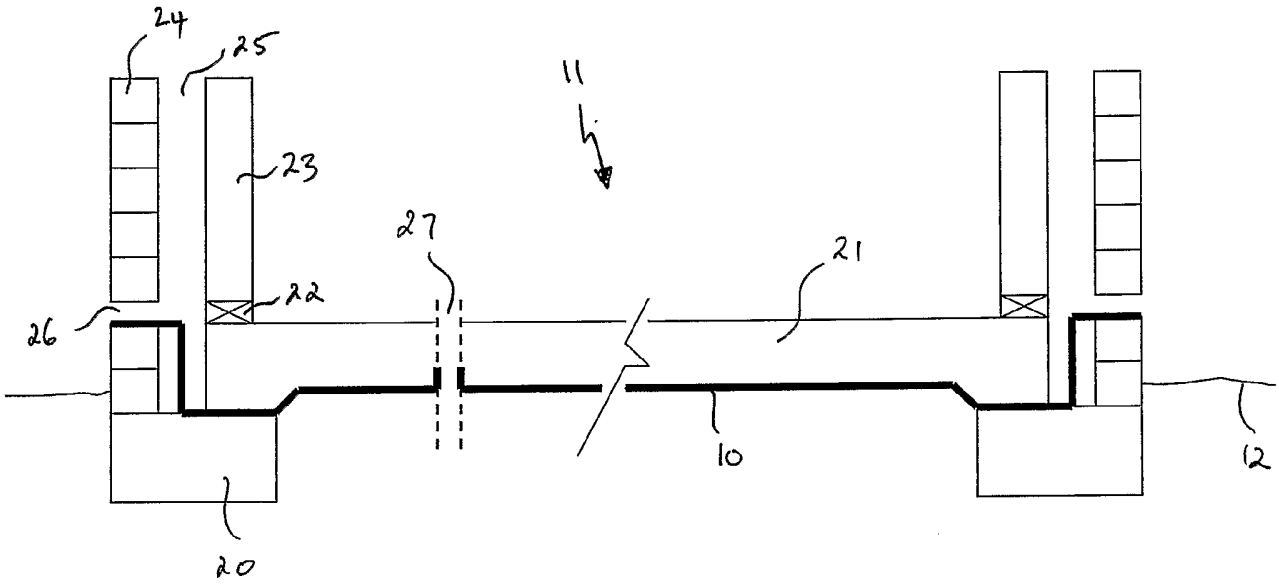

Figure 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2006/000290

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

E04B 1/72 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DWPI: IPC E04B 1/72 & keywords; sheet, membrane, barrier, insecticide, termiticide, pesticide, repellent, chemical, spino+, nicotin+, carbam+, forman+ quin+, benzo+, dini+, pyr+, biden+, organo+ and similar terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2001/0045066 A1 (NICKELL et. al.) 29 November 2001 See paragraphs [0005] and [0016]	1-13
X	Derwent Abstract Accession No. 2003-817292/77 Class C03 D22 E19, JP 2003092977-A (JUKA LIFETEK KK) 2 April 2003 See the whole abstract	1-13
X	Derwent Abstract Accession No. 2003-759367/72 Class P14, JP 2003169588-A (MARUYOSHI BIOCHEMICAL KK) 17 June 2003 See the whole abstract	1-13
A	Derwent Abstract Accession No. 2004-483346/46 Class A97 C07, JP 2004156260-A (SHINTO FINE KK) 3 June 2004 See the whole abstract	

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 March 2006	31 MAR 2006
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer **VINCE BAGUSAUSKAS** Telephone No : (02) 6283 2110

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2006/000290

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Derwent Abstract Accession No. 2004-433666/41 Class A93 C07 D22, JP 2004121206-A (TOPIX KK) 22 April 2004 See the whole abstract	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2006/000290

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	2001045066	US	6370834	US	6453637	US	6588158
		US	6729077	US	6959516	US	2002100246
		US	2002162281	US	2002194797	US	2003126829
		US	2003205007	US	2004060246	US	2005181056
JP	2003092977						
JP	2003169588						
JP	2004156260						
JP	2004121206						

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX