Abstract:
The present invention relates to a polymer composition comprising a polymer, a plasticizer, and an insecticide and/or an insect repellent. Further, it relates to a process for the preparation of a molding comprising heat-molding the polymer composition. The invention also relates to a plasticizer composition comprising an insecticide and/or an insect repellent, and a plasticizer. Additionally, it relates to a molding comprising the polymer composition, and to a use of the molding for the control of insects.
Insecticidal polymer composition

The present invention relates to a polymer composition comprising a polymer, a plasticizer, an insecticide and/or an insect repellent. Further, it relates to a process for the preparation of a molding comprising heat-molding the polymer composition. The invention also relates to a plasticizer composition comprising an insecticide and/or an insect repellent, and a plasticizer. Additionally, it relates to a molding comprising the polymer composition, and to a use of the molding for the control of insects.

Polymer compositions comprising polymer, especially polyvinyl chloride (PVC), plasticizer and insecticide are known:

EP 0 763 325 A1 discloses a resin composition comprising a resin, an active compound and a vaporizable plasticizer. The active compound may be a pyrethroid insecticide.

GB 2 170 211 A discloses a hot molding for insecticidal use comprising high molecular weight material, insecticide, and a heat-stabilizing component, which might be a di-lauryl phthalate.

US 4,193,984 discloses a dispenser for controlling flies comprising a first sheeting containing resmethrin insecticide, and a second sheeting containing vanillin. A plastisol to obtain the dispenser comprised PVC and di(2-ethylhexyl) phthalate.

US 2003/0069135 A1 discloses an agrochemical formulation comprising a cyclohexane polycarboxalic ester, water, adjuvant and active ingredient.

WO 02/21913 discloses a formulation for controlled release of an active ingredient comprising an active ingredient dispersed in a matrix polymer and a plasticizer.

There are several problems associated with the polymer compositions comprising polymer, plasticizer and insecticide known in the art: When vaporizable plasticizers are used, such plasticizers evaporate into the environment in higher degree than plasticizers with a lower vapor pressure. Some plasticizers are considered harmful or toxic to the environment, such as Di(2-ethylhexyl)phthalate. Several plasticizers are not suitable for application in polymer mouldings which are exposed to low temperatures, because the plastifying effect occurs only at higher temperatures. Another problem was that the incorporation of pesticide to polymer compositions leads to decreased transparency or increased scattering or loss of surface gloss of the resulting mouldings.

Object of the present invention was to overcome the above mentioned problems of the state of the art. The object was achieved with a polymer composition comprising a
polymer, a plasticizer, and an insecticide and/or an insect repellent, wherein the plasticizer is a di(Cg-C'i3 alkyl) phthalate or a di(Cg-C'i3 alkyl) cyclohexane dicarboxylate.

The term „polymer“ refers to one or more polymers. Usually, the polymer is selected from homo- and copolymers based on vinyl chloride, ethylene, propylene, butadiene, vinyl acetate, glycidyl (meth)acrylate, (meth)acrylates of linear or branched C1 to C10 alcohols, styrene or acrylnitrile. More specifically, polyvinyl chloride, polyacrylates of C4 to C8 alcohols, polymethyl methacrylate, methacrylate-butylacrylate copolymers, methacrylate-butylmethacrylate copolymers, ethylvinylacetate-copolymers, chlorinated polyethylene, nitrile rubber, acrylnitrile-butadien-styrene-copolymers, ethylene-propylene-copolymers, ethylene-propylene-dien-copolymers, styrene-acrylnitrile-copolymers, acrylnitrile-butadiene-rubber, styrene-butadien-elastomers and methylmethacrylate-styrene-butadien-copolymers. Especially preferred polymer is polyvinyl chloride (PVC) and mixtures of PVC with at least one further polymer, preferably a polymer as listed above. Most preferred polymer is PVC.

Polyvinyl chloride may be produced via homopolymerization of vinyl chloride. PVC can be prepared industrially in various ways, examples being suspension polymerization, microsuspension polymerization, emulsion polymerization, and bulk polymerization. The K value, which characterizes the molar mass of the PVC and is determined to DIN 53726, can be in the range from 57 to 90, preferably in the range from 61 to 85, and particularly preferably in the range from 64 to 75. Kirk-Othmer, Encyclopedia of Chemical Technology, 4th Ed., Vol. 24, pp. 1017-1047, gives an overview of the properties, preparation, and use of PVC, and also describes the relationship between K value, number-average molecular weight, weight-average molecular weight, and the inherent and relative viscosity of the PVC measured to ASTM L1234.

The PVC contents of the polymer compositions may generally be from 20 to 99% by weight, preferably from 30 to 90% by weight, particularly preferably from 35 to 80% by weight, and in particular from 40 to 75% by weight, based in each case on the total weight of the polymer composition, i.e. including all of the constituents of the POLYMER composition.

The polymer composition according to the invention comprises an plasticizer, which is a di(Cg-C'i3 alkyl) phthalate or a di(Cg-C'i3 alkyl) cyclohexane dicarboxylate. The term “C9-C'i3 alkyl” refers to linear, branched or cyclic or mixtures of linear, branched and/or cyclic alkyl groups, which have a backbone of exactly 9 to 13 carbon atoms or which have a mixture of backbones in the range from 9 to 13 carbon atoms. The term “Cg alkyl” refers to linear or branched or mixtures of linear and branched alkyl groups, which have a backbone of 9 carbon atoms. The term "cyclohexane dicarboxylate" refers to 1,2-, 1,3- or 1,4-substituted cyclohexane dicarboxylate, preferably 1,2-substitution.
Suitable examples of a di(C9-C13 alkyl) phthalate plasticizer are well known in the art and commercially available: Diisononyl phthalate DINP (Palatinol® N from BASF SE), Diisodecyl phthalate DIDP, Di-2-propyloctyl phthalate DPHP (Palatinol 10-P from BASF SE), Dinonylundecyl phthalate NUP (Palatinol 911-P from BASF SE), Diundecyl phthalate DUP (Palatinol 1111-P from BASF SE), Disoundecyl phthalate DIUP, Ditridecyl phthalate DTDP (Jayflex® DTDP from Exxon Mobile), Disotridecyl phthalate DTDP (JayflexDTDP-Z from Exxon Mobile).

Suitable example of a di(Cg-Ci3 alkyl) cyclohexane dicarboxylate is diisononyl 1,2-cyclohexane dicarboxylic acid ester (Hexamoll® DINCH from BASF SE).

In a embodiment, the plasticizer is preferably a di(Cg-Ci3 alkyl) phthalate, more preferably a di(Cg alkyl) phthalate, and most preferred a diisononyl phthalate.

In another embodiment, the plasticizer is a di(Cg-Ci3 alkyl) phthalate or a di(Cg-Ci3 alkyl) cyclohexane dicarboxylate, which has a vapor pressure of up to 5.0 \times 10^{-6} hPa, preferably up to 2.0 \times 10^{-6} hPa, at 50 °C. Suitable examples are (vapor pressure at 50 °C in brackets) diisononyl 1,2-cyclohexane dicarboxylic acid ester (1.3 \times 10^{-4} hPa), Diisononyl phthalate DINP (4.0 \times 10^{-3} hPa), Di-2-propyloctyl phthalate DPHP (5.7 \times 10^{-3} hPa), Dinonylundecyl phthalate NUP (1.6 \times 10^{-3} hPa), Diundecyl phthalate DUP (1.8 \times 10^{-3} hPa), Disotridecyl phthalate DTDP (1.8 \times 10^{-3} hPa). Typically, the plasticizer has a molecular weight of less than 2000 g/mol, preferably less than 1000 g/mol.

The polymer composition comprises a plasticizer in an amount from 1 to 100 phr. The conventional formulation unit "phr" for polymer compositions is the abbreviation for "parts per hundred resin" and means that the amounts of additive weighed-out, measured and stated are not percentage content in the entire composition, but parts by weight for every one hundred parts by weight of polymer. By way of example, if the polymer to plasticizer ratio by weight is 80:20, the plasticizer content is 25 phr, because 20 parts represent 25 wt% of 80 parts. The content of the plasticizer in the inventive polymer composition may generally be from 1 to 100 phr, preferably from 10 to 90 phr, and particularly preferably from 30 to 80 phr.

The polymer composition according to the invention comprises an insecticide and/or an insect repellent, which means that one or more insecticides and/or one or more insect repellents are comprised. In an embodiment, the polymer composition comprises an insecticide. In another embodiment, the polymer composition comprises an insect repellent.

In another embodiment, the polymer composition is free of pesticides, which are no insecticides, such as herbicides, fungicides or plant growth regulators. In a preferred
embodiment,, the polymer composition is free of fungicides, such as fludioxonil or difenoconazole.

The skilled artisan is familiar with insecticides, which can be, for example, found in the Pesticide Manual, 14th Ed. (2006), The British Crop Protection Council, London. Suitable insecticides are

- organo(thio)phosphates: acephate, azamethiphos, azinphos-methyl, chlorpyrifos, chlorpyrifos-methyl, chlorfenvinphos, diazinon, dichlorvos, dicrotophos, dimethoate, disulfoton, ethion, fenitrothion, fenthion, isoxathion, malathion, methamidophos, methidathion, methyl-parathion, mevinphos, monocrotophos, oxydemeton-methyl, paraoxon, parathion, phenthoate, phosalone, phosmet, phosphamidon, phorate, phoxim, pirimiphos-methyl, profenofos, prothiofos, sulprofos, tetrachlorvinphos, terbufos, triazophos, trichlorfon;
- carbamates: alanycarb, aldicarb, bendiocarb, benfuracarb, carbaryl, carbofuran, carbosulfan, fenoxycarb, furathiocarb, methiocarb, methomyl, oxamyl, pirimicarb, propoxur, thiodicarb, triazamate;
- pyrethroids: allethrin, bifenthrin, cyfluthrin, cyhalothrin, cypermethrin, alphacypermethrin, beta-cypermethrin, zeta-cypermethrin, deltamethrin, esfenvalerate, etofenprox, fenpropathrin, fenvalerate, imiprothrin, lambda-cyhalothrin, permethrin, prallethrin, pyrethrin I and II, resmethrin, silafluofen, tau-fluvalinate, tetrafluthrin, tetratemethrin, tralomethrin, transfluthrin, profluthrin, dimefluthrin;
- insect growth regulators: a) chitin synthesis inhibitors: chlorfluazuron, cyramazin, diflubenzuron, flucyloxuron, flufenoxuron, hexaflumuron, lufenuron, novaluron, teflubenzuron, triflumuron; buprofezin, diofenolan, hexythiazox, etoxazole, clofentazine; b) ecdysone antagonists: halofenozide, methoxyfenozide, tebufenozide, azadirachtin; c) juvenoids: pyriproxyfen, methoprene, fenoxycarb; d) lipid biosynthesis inhibitors: spirodiclofen, spiromesifen, spirotetramat;
- nicotinic receptor agonists/antagonists compounds: clothianidin, dinotefuran, imidacloprid, thiamethoxam, nitenpyram, acetamiprid, thiacloprid, 1-(2-chloro-thiazol-5-ylmethyl)-2-nitrimino-3,5-dimethyl-[1,3,5]triazinane;
- GABA antagonist compounds: endosulfan, ethiprole, fipronil, vaniliprole, pyrafluprole, pyriprole, 5-amino-1-(2,6-dichloro-4-methyl-phenyl)-4-sulfamoyl-1H-pyrazole-3-carbothioic acid amide;
- macrocyclic lactone insecticides: abamectin, emamectin, milbemectin, lepimectin, spinosad, spinetoram;
- mitochondrial electron transport inhibitor (METI) I acaricides: fenazaquin, pyridaben, tebufenpyrad, tolfenpyrad, flufenerim; METI II and III compounds: acequinocyl, fluacyprim, hydramethylnon;
- Uncouplers: chlorfenapyr;
- oxidative phosphorylation inhibitors: cyhexatin, diafenthiuron, fenbutatin oxide, propargite;
- moulting disruptor compounds: cryomazine;
- mixed function oxidase inhibitors: piperonyl butoxide;
- sodium channel blockers: indoxacarb, metaflumizone;
- others: benclothiaz, bifenazate, cartap, flonicamid, pyridalyl, thiocyclam, flubendiamide, chlorantraniliprole, cyazypyr (HGW86), cypermethrin, alphacypermethrin, pyrifluquinazon.

In an embodiment, the insecticide comprises a pyrethroid, preferably alphacypermethrin. In another embodiment, the insecticide comprises a mixture of a pyrethroid, preferably alphacypermethrin with a pyrazol insecticide, preferably chlorfenapyr. The term "pyrazol insecticide" refers to chlorantraniliprole, cyantraniliprole, dimetilan, tebufenpyrad, tolfenpyrad, acetoprole, ethiprole, fipronil, pyraclofos, pyrafluprole, pyriproxyfen, or crude plant extracts from plants like Eucalyptus maculata, Vitex rotundifolia, Cymbopogan martinii, Cymbopogan

In another embodiment, the insecticide and the insect repellent are soluble in the plasticizer. An insecticide and an insect repellent are considered soluble, when at least 0.05 wt%, preferably at least 0.1 wt%, more preferably at least 0.5 wt% insecticide and insect repellent can be dissolved at 25 °C in the used plasticizer, preferably in diisononyl phthalate DINP.

In another embodiment, the insecticide and the insect repellent are stable towards temperatures of up to 100 °C, preferably up to 130 °C, more preferably up to 160 °C for 30 min when dissolved in the used plasticizer and mixed with the polymer matrix at a concentration of up to 10 wt%. The term stable means, that less than 10 wt% of degradation products of the insecticide occur.

In another embodiment, the insecticide and the insect repellent have a vapor pressure (v.p.) of up to 1·10⁻⁸ hPa, preferably up to 5·10⁻² hPa, at 20°C. Examples are alphacypermethrin (v.p. 2.3·10⁻² mPa (20 °C) or chlorfenapyr (v.p. 1.2·10⁻² mPa (20 °C)). Further suitable insecticides and their vapor pressure may be found in the Pesticide Manual, 14th Ed. (2006), The British Crop Protection Council, London.

An insect repellent is usually a chemical compound, which discourages insects from approaching or touching a composition comprising the insect repellent. The insect repellent may be selected from N, N-diethyl-meta-toluamide (DEET), N, N-diethyl-phenylacetamide (DEPA), 1- (3-cyclohexan-1-yl-carbonyl)-2-methylpiperine, (2-hydroxymethylcyclohexyl) acetic acid lactone, 2-ethyl-1,3-hexandiol, ethylbutylacetyl-amino propionate (EBAAD), p-menthane-3,8-diol (PMD), IR3535 (ethyl butylacetyl-tlyaminopropionate), icaridin (1-piperidinecarboxylic acid 2-(2-hydroxyethyl)-1-methyl-propylester), indalone, methyl neodecanamide (MNDA), a pyrethroid not used for insect control such as \{(+/-)-3-allyl-2-methyl-4-oxocyclopent-2- (+-)-enyl- (+)-trans-chrysantemate (Ebiothrin), a repellent derived from or identical with plant extracts like limonen, eugenol, (+)-Eucamalol, (-)-i-epi-eucamalol or crude plant extracts from plants like Eucalyptus maculata, Vitex rotundifolia, Cymbopogan martini, Cymbopogan
citrus (lemon grass), Cymopogon nartdus (citronella). Preferred insect repellents are DEET, icaridin, EBAAD, PMD.

In an embodiment, the polymer composition comprises an insecticide and an insect repellent. Such mixtures are advantages to prevent the evolution of resistance in insects or to control insects which have already build up resistance to a insecticide. Suitable insecticides and insect repellents are listed above. Preferred insecticides are pyrethroids such as alphacypermethrin, cyfluthrin, deltamethrin, etofenprox and permethrinbifenthrine, or non-pyrethroids such as carbosulphane. Especially preferred are alphacypermethrin and chlorfenapyr. Preferred mixtures comprise pyrethroids and PBO.

Usually, one or more additives may be present in the inventive polymer compositions. Their function of their intended use is in order to improve their mechanical, chemical, and processing properties. Merely by way of example, mention may be made in this context of stabilizers, lubricants, fillers, pigments, flame retardants, light stabilizers, blowing agents, polymeric processing aids, impact modifiers, optical brighteners, anti-static agents, and biostabilizers. Merely for the purposes of illustration of the inventive polymer compositions, some of these additives and their function are described by way of example below, but these descriptions do not restrict the inventive polymer compositions.

Stabilizers neutralize, by way of example, the hydrochloric acid eliminated from polymer during and/or after processing. Stabilizers which may be used are any of the conventional stabilizers in solid or liquid form, examples being conventional Ca/Zn, Ba/Zn, Pb, or Sn stabilizers, and also acid-binding phyllosilicates, such as hydrotalcite. Preference is given to Ba/Zn stabilizers, tribasic lead sulfate (3 PbO·PbSO 4·H 2O), and lead phosphite. Particularly preferred are Ba/Zn stabilizers. The content of stabilizers in the inventive polymer compositions may be from 0.05 to 7 phr, preferably from 0.1 to 5 phr, particularly preferably from 0.2 to 4 phr, and in particular from 0.3 to 2 phr.

Lubricants are intended to act between polymer particles and to counteract frictional forces during mixing, plastification, and forming. Lubricants which may be present in the inventive polymer compositions are any of the conventional lubricants for polymer processing. Examples of those which may be used are hydrocarbons, such as oils, paraffins, and polyethylene waxes, fatty alcohols having from 6 to 20 carbon atoms, ketones, carboxylic acids, such as fatty acids and montanic acid, oxidized polyethylene wax, metal carboxylates, carboxamides, and also carboxylic esters, such as those with the following alcohols: ethanol, fatty alcohols, glycerol, ethanediol, and pentaerythritol, and with long-chain carboxylic acids as acid component. It is preferable to use lead stearate. The content of lubricant in the inventive polymer compositions may be from
0.01 to 10 phr, preferably from 0.05 to 5 phr, particularly preferably from 0.1 to 3 phr, and in particular from 0.2 to 2 phr.

Fillers primarily affect resistance to pressure, to tension, and to flexure, and also affect the hardness and the heat resistance of plasticized polyvinyl chloride, the effect being favorable. The inventive polymer compositions may receive admixtures of fillers, such as carbon black and other inorganic fillers, e.g. naturally occurring calcium carbonates, such as chalk, limestone, and marble, synthetic calcium carbonates, dolomite, silicates, silica, sand, diatomaceous earth, and aluminum silicates, such as kaolin, mica, and feldspar. The fillers used preferably comprise calcium carbonates, chalk, dolomite, kaolin, silicates, talc, or carbon black, chalk being particularly preferred. The content of fillers in the inventive mixtures may be from 0.01 to 80 phr, preferably from 1 to 60 phr, particularly preferably from 5 to 50 phr, and in particular from 15 to 40 phr.

The inventive polymer compositions may also comprise pigments in order to adapt the resultant product to various possible uses. Either inorganic pigments or else organic pigments may be used for this purpose. Examples of inorganic pigments which may be used are cadmium pigments, such as CdS, cobalt pigments, such as COO/Al2O3, and chromium pigments, such as Cr2U3. Examples of organic pigments which may be used are monoazo pigments, condensed azo pigments, azomethine pigments, anthraquinone pigments, quinacridones, phthalocyanine pigments, dioxazine pigments, such as C.I. Pigment Violet 23 and Aniline Black (C.I. Pigment Black 1). The content of pigments in the inventive polymer compositions may be from 0.01 to 10 phr, preferably from 0.05 to 5 phr, particularly preferably from 0.1 to 3 phr, and in particular from 0.5 to 2 phr.

In order to reduce flammability and smoke generation during combustion, flame retardants may also be added to the inventive polymer compositions. Examples of flame retardants which may be used are antimony trioxide, phosphoric esters, chloroparaffin, aluminum hydroxide, boron compounds, molybdenum trioxide, ferrocene, calcium carbonate, or magnesium carbonate. It is preferable to use antimony trioxide or phosphoric esters, particular preference being given to phosphoric esters, in particular bisphenyl cresyl phosphate, diphenyl octyl phosphate or tricresyl phosphate. The content of flame retardants in the inventive polymer compositions may be from 0.01 to 10 phr, preferably from 0.1 to 8 phr, particularly preferably from 0.2 to 5 phr, and in particular from 0.5 to 3 phr.

In order to protect items produced from the inventive polymer compositions, from superficial damage by light, light stabilizers may also be added to these polymer compositions. Examples of those which may be used for this purpose are hydroxybenzophenones, hydroxyphenylbenzotriazoles, or cyanophenylacrylates. Preference is given to cyanophenylacrylates, particularly preferably 2-ethylhexyl 2-cyano-3,3-diphenyl-
acrylate. The amount of light stabilizers which may be present in the inventive polymer compositions is from 0.01 to 7 phr, preferably from 0.1 to 5 phr, particularly preferably from 0.2 to 4 phr, and in particular from 0.5 to 3 phr.

The present invention further relates to a process for the preparation of a molding comprising heat-molding the polymer compositions according to the invention. Preferably, the polymer composition is prepared by mixing polymer and a plasticizer composition, which contains the insecticide and/or the insect repellent dissolved in the plasticizer.

The usual method of heat molding of the inventive polymer compositions is mixing of the individual components at elevated temperatures, for example with stirring. L. Meier in R. Gachter, H. Muller (Ed.); Plastics Additives Handbook, 3rd Ed., Chapters 5.4.3, 5.4.4, Hanser Publishers, Munich 1990 gives, by way of example, a general description of the preparation of mixtures composed of polyvinyl chlorides, esters, and other additives. Further examples of heat molding are thermoforming, calendering, extrusion, coating, casting, dip-coating, rotor molding, or injection molding. D. H. Morton-Jones, Polymer Processing, Chapman and Hall, London 1989, describes by way of example details of these processing methods. The inventive polymer compositions are particularly suitable for the heat molding of pastes (plastisols, organosols, or plastigels) which are processed by dip-coating, spreading, casting, rotation molding, centrifugal casting, or injection molding, or else by rotary screen printing, to give end products.

The plasticizer composition according to the invention comprises an insecticide and/or an insect repellent, and a plasticizer, wherein the plasticizer is di(Cg-Ci3 alkyl) phthalate or di(Cg-Ci3 alkyl) cyclohexane dicarboxylate. Suitable insecticides are the same as listed above. Preferably, the insecticide and/or the insect repellent are dissolved in the plasticizer. Suitable plasticizers are the same as listed above. The plasticizer composition is especially suitable for the process for the preparation of a molding according to the invention.

The present invention further relates to a molding comprising the polymer composition according to the invention. The moldings are obtainable by the process according to the invention. Preferably, the molding is transparent. A molding is usually considered transparent, when the transmittance is at least 50 %, preferably at least 65 %, more preferably at least 80 %, especially at least 90 %. The transmittance may be determined according to ASTM D 1003 on planar plates with a thickness of 2 mm. In another embodiment, the transmittance may be determined according to ASTM D 1003 on foils with a thickness of 0.5 mm.

In another embodiment, the molding may be considered transparent, when the haze is up to 60 %, preferably up to 45 %, more preferably up to 30 %, especially up to 15 %,
more especially up to 10 % as determined according to ASTM D 1003 on planar plates with a thickness of 2 mm.

In another embodiment, the molding remains transparent to the same degree as the same molding without insecticide and/or insect repellent. Preferably, the transmittance or the haze of the molding is not modified within a range of plus or minus 10%. More preferably, the transmittance is reduced less than an absolute value of 15 % transmittance, preferably less than 10 % and more preferably less than 5 %. This reduction may be determined at 200 to 750 nm, preferably at 350 and 650 nm.

Preferred examples of moldings or end products comprising moldings are:
- foils, such as self-adhesive foils, automotive foils, furniture foils, stationery foils, agricultural foils, food foils (cling film), roof sheeting, oil tank liner foils, reservoir liner foils, swimming pool liner foils, construction foils, raincoats, swing doors, shower curtains, inflatable boats, flotation belts;
- strips and sheets for strip and swing doors;
- cables, for example of wiring cables, power cables, communications cables, coiled cord, computer cables, and automotive cables;
- coatings, for example for synthetic leather (applications in automobiles and in bag manufacture), truck tarpaulins, tenting, table cloths, protective clothing, vinyl wall coverings, and conveyor belts;
- floor coverings, for example of foamed floor coverings (cushion vinyl), heterogeneous compact coverings, homogeneous compact coverings, and for coatings on carpeting, and for laminates;
- profiles, e.g. industrial hoses, garden hoses, seals (e.g. for refrigerators), staircase handrails, and window profiles;
- shoes (boots, sandals), soles, toys, gloves (industrial, medical), closure caps, and erasers;
- balls, dolls, traffic cones, truck tarpaulin materials, flat tarpaulins, tenting, bag-manufacture products, ventilation ducts, synthetic leather, floor- and wall coverings, wallpapers (including those foamed by mechanical or chemical means), cladding, protective gloves, protective clothing, and protective coverings on metallic substrates, other examples being folding bellows, underbody protection for motor vehicles, and seals for twist-off closures, crown caps, and screw closures.

In a preferred embodiment, the molding is a strip or a sheet for a strip and/or swing doors. Preferably, the strip or sheet is transparent.

The invention further relates to a use of the molding according to the invention for the control of insects. Preferably, the insects are flying insects. The term "control of insects" relates to killing insects which came into contact with the molding or to repel insects from the molding. For example, if the moldings are stripes or sheets in swing
doors, the control refers to repel insects from entering the door or to killing the insects when they come into contact with the molding when trying to fly through the door.

The term “insects” refers to the animal class of insecta and to arachnida. An expert will select the insecticide and/or an insect repellent according to the insects, which are to be controlled. The term “flying insects” refers to insects, which are capable of staying in the air for at least 60 seconds. Suitable examples are flies, bees, gliding ants, parachuting spiders, preferably flies and bees.

There are several advantages of the present invention: Plasticizers with a low vapor pressure may be used resulting very low degree of evaporation into the environment. Plasticizers which are less harmful to the environment may be used. The polymer moldings are suitable for use in low temperatures, because the plasticizers provide a good plastifying properties at low temperatures. The polymer moldings may be transparent. The polymer moldings have still a glossy surface. The polymer moldings are stable and active for controlling insects for a long time, e.g. several months. Although pyrethroids are known to be susceptible for degradation by daylight, the polymer compositions allowed a long storage and application time, even in transparent moldings.

The inventive examples below give further illustration of the invention, which is not, however, restricted to these examples.

**Examples**

**Example 1** - Preparation of a PVC foil

100 g PVC powder, 67 g (45 phr) plasticizer, 30 g (20 phr) of a 5 wt% solution of alphacypermethrin in the plasticizer, 3 g (2 phr) Ba/Zn-stabilisator were mixed with a
planetary mixer at 80 °C. Afterwards, the mixture was plasizided in a steam-heated laboratory mixing mill at a temperature of 170 °C and processed by rollers in a roller-plant into a sheet. This sheet was cooled down to room temperature and subsequently pressed to a foil at a temperature of 180 °C and a pressure of 220 bar. The resulting PVC foil had a thickness of 0.5 mm and was consisted of 60,0 wt% PVC, 38,2 wt% plasticizer, 0,6 wt% alphacypermethrin and 1,2 wt% Ba/Zn-stabilisator.

Example 2 - Test on Insect control

Testing methods
The purpose of testing methods A and B was to determine the contact efficacy of alphacypermethrin-treated PVC film against two flying insect pests, house flies (Musca domestica) and yellow fever mosquitoes (Aedes aegypti) and one crawling species, Argentine ants (Linepithema humile). Each mean of a testing method is based on approximately 40-60 insects (4 replications of approximately 10-15 adults). Treated film was prepared as described in Example x and contained 0.6% alphacypermethrin. The film was stored for nine month at 20 °C. The tests were made as described with a sample after two month and another sample after nine months. The results are summarized in Table 1A and 1A, respectively.

Testing Method A for house flies and yellow fever mosquitoes
The direct contact assays were conducted in 6-oz disposable clear plastic cups (9.5 cm in diameter and 5.5 cm in height). Each cup was placed upside down on either 0.6% alphacypermethrin-treated or untreated film. A 10% sucrose soaked dental wick was inserted through the bottom of the container (punctured with a size 7 cork borer for introduction of insects) as a food source. Approximately 10-15 house flies or yellow fever mosquitoes were introduced into each cup with four replicates per species. The tests were assessed for knockdown at 2, 6, and 24 hours after treatment (HAT).

Testing Method B for Argentine ants
The direct contact assay was conducted in 60 X 15 mm plastic Petri dishes turned upside down on either 0.6% alphacypermethrin-treated or untreated film. The Petri dishes were first infested with 10 worker Argentine ants. A 10% sucrose soaked dental pellet was placed on a plastic disk and subsequently on the PVC film as a food source. There were four replicates. The test was assessed for mortality including morbidity at 2, 4, 6 and 24 HAT.
Table 1A. Mortality or knockdown \(^1\) [%] at various hours after treatment (HAT) with a sample that was stored for two months.

<table>
<thead>
<tr>
<th>HAT [h]</th>
<th>House flies</th>
<th>Yellow fever mosquitoes</th>
<th>Argentine ants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>PVC from example 1</td>
<td>93</td>
<td>98</td>
<td>100</td>
</tr>
<tr>
<td>Untreated film</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

1) Knockdown readings taken for flies and mosquitoes, mortality readings taken for Argentine ants.

Table 1B. Mortality or knockdown \(^1\) [%] at various hours after treatment (HAT) with a sample that was stored for nine months.

<table>
<thead>
<tr>
<th>HAT [h]</th>
<th>House flies</th>
<th>Yellow fever mosquitoes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>PVC from example 1</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Untreated film</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

1) Knockdown readings taken for flies and mosquitoes, mortality readings taken for Argentine ants.

Example 3 - Analysis of gloss and transmission of PVC foil

A sample of the PVC foil prepared in Example 1 ("Foil with alphacypermethrin") was compared with the same foil without insecticide. The control foil ("Foil without insecticide") was prepared according to Example 1, just without adding alphacypermethrin. The gloss was determined according to DIN 67530 (German industry norm) with a glossmeter (BYK Gardner Micro-Tri-Gloss) at a given angle (see Table 2). The glossmeter value (in Gloss Units GU) is related to a black polished glass standard with a refractive index of 1.567. As can be seen from Table 2, there was no notable difference in the gloss of the PVC foils with or without the insecticide.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Gloss at angle of 60°</th>
<th>Gloss at angle of 85°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foil without insecticide</td>
<td>143.5 GU</td>
<td>108.9 GU</td>
</tr>
<tr>
<td>Foil with alphacypermethrin</td>
<td>145.0 GU</td>
<td>110.9 GU</td>
</tr>
</tbody>
</table>

Additionally, the transmittance of the Foil without insecticide and the Foil with alphacypermethrin was analyzed between 200 and 750 nm. The resulting diagram is given in Figure 1, wherein line A refers to the Foil without insecticide and line B refers to the Foil
with alphacypermethrin. There was no notable difference in the transmission between these two samples. Thus, the addition of the insecticide had no detrimental effect on the transmission. This means, that the foil is still transparent although insecticide was added.
Claims

1. A polymer composition comprising a polymer, a plasticizer, and an insecticide and/or an insect repellent, wherein the plasticizer is a di(Cg-Ci3 alkyl) phthalate or a di(Cg-Ci3 alkyl) cyclohexane dicarboxylate.

2. The composition according to claim 1, wherein the insecticide and the insect repellent are soluble in the plasticizer.

3. The composition according to claims 1 or 2, wherein the insecticide comprises a pyrethroid.

4. The composition according to claims 1 to 3, wherein the plasticizer is a di(Cg-Ci3 alkyl) phthalate.

5. The composition according to claims 1 to 4, wherein the plasticizer is a di(Cg alkyl) phthalate.

6. The composition according to claims 1 to 5, wherein the polymer is polyvinyl chloride (PVC).

7. A process for the preparation of a molding comprising heat-molding the composition according to claims 1 to 6.

8. The process according to claim 7, wherein the composition is prepared by mixing a polymer and a plasticizer composition, which contains the insecticide dissolved in the plasticizer.

9. A plasticizer composition comprising an insecticide and/or an insect repellent, and a plasticizer, wherein the plasticizer is di(Cg-Ci3 alkyl) phthalate or di(Cg-Ci3 alkyl) cyclohexane dicarboxylate.

10. The plasticizer composition according to claim 9, wherein the insecticide and/or insect repellent is dissolved in the plasticizer.

11. A molding comprising the composition according to claims 1 to 6.

12. The molding according to claim 11, which is transparent.

13. A use of the molding according to claims 11 to 12 for the control of insects.

14. The use according to claim 13, wherein the insects are flying insects.