



(51) International Patent Classification:

C09D 5/14 (2006.01)

C09D 125/14 (2006.01)

Declarations under Rule 4.17:

- as to the identity of the inventor (Rule 4.17(i))
- of inventorship (Rule 4.17(iv))

(21) International Application Number:

PCT/IB2017/056310

Published:

- with international search report (Art. 21(3))

(22) International Filing Date:

12 October 2017 (12.10.2017)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

201721027842

04 August 2017 (04.08.2017)

IN

(71) Applicant: KANSAI NEROLAC PAINTS LIMITED

[IN/IN]; Nerolac House Ganpatrao Kadam Marg, Lower Parel, Mumbai-, Maharashtra 400013 (IN).

(72) Inventors: MEHROTRA, Mahesh; Nerolac House Gan-

patrao Kadam Marg, Lower Parel, Mumbai-, Maharashtra 400013 (IN). MARATHE, Mukul; Nerolac House Ganpatrao Kadam Marg, Lower Parel, Mumbai-, Maharashtra 400013 (IN).

(74) Agent: DEWAN, Mohan; R. K. Dewan & Co. Podar

Chambers, S. A. Brelvi Road, Fort, Mumbai-, Maharashtra 400001 (IN).

(81) Designated States (unless otherwise indicated, for every

kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every

kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: AN ANTI MOSQUITO PAINT COMPOSITION AND A PROCESS FOR PREPARATION THEREOF

(57) Abstract: The present disclosure relates to an anti mosquito paint composition and a process for preparation thereof. The anti mosquito paint composition comprises a polymeric emulsion, an insecticide that depolarizes axonal sodium channels of mosquitoes, a biocide, a pigment, a dispersing agent, a filler, and water. The insecticide is in an amount in the range of 0.9 to 1.1 mass% of the total mass of the anti mosquito paint composition, which acts on the central nervous system (CNS) of the mosquitoes by affecting the sodium channels in the axonal membranes, thereby paralyzing the mosquito and further leading to its death. The anti mosquito paint composition of the present disclosure is non-toxic to humans.



AN ANTI MOSQUITO PAINT COMPOSITION AND A PROCESS FOR PREPARATION THEREOF

FIELD

The present disclosure relates to the field of paints and a process for manufacturing paints.

5 BACKGROUND

Mosquitoes are considered dangerous creatures on the planet because of their ability to spread deadly diseases including malaria, dengue, zika, West Nile virus and yellow fever. They are carriers, or vectors, for some of humanity's most deadly illnesses. Infected mosquitoes carry these organisms from person to person without exhibiting symptoms themselves. Moreover, with tourists and visitors visiting different countries, they potentially carry such diseases with them and aid in spreading disease. According to the World Health Organization, mosquitoes infect over 300 million people a year with Malaria and Dengue. Mosquito-borne diseases cause millions of deaths worldwide every year with a disproportionate effect on children and the elderly in developing countries.

15 In recent years the rate of infection has risen dramatically, and a growing number of scientists are now concerned that global warming will translate into an explosive growth of mosquito-borne diseases worldwide. Further, mosquitoes require very little amount of water for breeding, thus controlling their population is problematic.

For protection against mosquitoes, generally people use repellents which are formulated for use on bare skin (skin creams), as aerosols which are to be sprayed, solid sticks to be burnt or liquids (Roll-on Liquids and Liquid vaporizers).

All these repellents have to be applied/used on a frequent basis and they need direct exposure to humans (via skin or by breathing) and the environment. These options are short lived. Further, health authorities who administer vector control programs have tight budgetary constraints and methods like fogging can at times be costly and ineffective.

Such vectors (mosquitoes) often rest and crawl on walls and surfaces of houses/buildings.

Hence, there exists a need to develop a paint composition for controlling mosquitoes and other flying insects that is non-toxic to humans.

OBJECTS

Some of the objects of the present disclosure, which at least one embodiment herein satisfies, are as follows:

5 It is an object of the present disclosure to ameliorate one or more problems of the prior art or to at least provide a useful alternative.

An object of the present disclosure is to provide a paint composition.

Another object of the present disclosure is to provide an anti mosquito paint composition that controls the breeding and growth of mosquitoes.

10 Still another object of the present disclosure is to provide an anti mosquito paint composition that is non-toxic to humans.

Yet another object of the present disclosure is to provide a process for preparing an anti mosquito paint composition.

Other objects and advantages of the present disclosure will be more apparent from the following description, which is not intended to limit the scope of the present disclosure.

15 SUMMARY

The present disclosure relates to an anti mosquito paint composition and a process for preparation thereof.

In one aspect, the present disclosure provides an anti mosquito paint composition. The anti mosquito paint composition comprises:

- 20 a) a polymeric emulsion in an amount in the range of 10 to 25 mass% of the total mass of the anti mosquito paint composition;
- b) an insecticide that depolarizes axonal sodium channels of mosquitoes, the amount of the insecticide being in the range of 0.9 to 1.1 mass% of the total mass of the anti mosquito paint composition;
- 25 c) a biocide in an amount in the range of 0.21 to 1.1 mass% of the total mass of the anti mosquito paint composition;

- d) a pigment in an amount in the range of 8 to 13 mass% of the total mass of the anti mosquito paint composition;
- e) a dispersing agent in an amount in the range of 0.5 to 1.5 mass% of the total mass of the anti mosquito paint composition;
- 5 f) a filler in an amount in the range of 18 to 35 mass% of the total mass of the anti mosquito paint composition; and
- g) water in an amount in the range of 35 to 45 mass% of the total mass of the anti mosquito paint composition.

10 In accordance with the embodiments of the present disclosure, the polymeric emulsion is at least one selected from the group consisting of styrene acrylic polymeric emulsion and acrylic polymeric emulsion.

The polymeric emulsion may comprise polymer in the range of 42 to 55 mass% of the total mass of the polymeric emulsion, and water in the range of 45 to 58 mass% of the polymeric emulsion. Preferably, the polymeric emulsion can comprise 50% polymer and 50% water.

15 The insecticide can be 3-phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (cis :trans :: 40:60) (CAS No. 52645-53-1).

The biocide can be at least one selected from the group consisting of 2-octyl-4-isothiazolin-3-one, chloro-2-methyl-4-isothiazolin-3-one and methyl-4-isothiazolin-3-one.

The pigment can be titanium dioxide.

20 The dispersing agent can be sodium polyacrylate.

The filler can be at least one selected from the group consisting of calcium carbonate and calcined kaolin (aluminum silicate).

Water is selected from the group consisting of water treated with ultra-violet (UV) radiations, demineralized water, and water obtained by reverse osmosis treatment.

25 In accordance with one exemplary embodiment of the present disclosure, the anti mosquito paint composition comprises:

- i. styrene acrylic polymeric emulsion, which contains 50 mass% of styrene acrylic polymer. The styrene acrylic polymeric emulsion is used in an amount of 14 mass% of the total mass of the anti mosquito paint composition;
- 5 ii. 3-phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (cis :trans :: 40:60) as an insecticide that depolarizes axonal sodium channels of mosquitoes, the insecticide is used in an amount of 1 mass% of the total mass of the anti mosquito paint composition;
- 10 iii. a biocide being a mixture of 2-octyl-4-isothiazolin-3-one, chloro-2-methyl-4-isothiazolin-3-one and methyl-4-isothiazolin-3-one, the total amount of the biocide being 0.35 mass% of the total mass of the anti mosquito paint composition;
- iv. titanium dioxide as a pigment in an amount of 11 mass% of the total mass of the anti mosquito paint composition;
- v. sodium polyacrylate as a dispersing agent in an amount of 1 mass% of the total mass of the anti mosquito paint composition;
- 15 vi. calcium carbonate and calcined kaolin (aluminum silicate) as fillers in an amount of 31 mass% of the total mass of the anti mosquito paint composition; and
- vii. water treated with UV radiations, in an amount of 41.75 mass% of the total mass of the anti mosquito paint composition.

20 The anti mosquito paint composition can further comprise a sequestering agent in an amount in the range of 0.01 to 0.1 mass% of the total mass of the anti mosquito paint composition.

Preferably, the amount of the sequestering agent is 0.05 mass%.

The sequestering agent can be selected from the group consisting of sodium hexametaphosphate (SHMP), tetra potassium pyrophosphate (TPPP), and potassium tri poly phosphate (KTPP).

25 The anti mosquito paint composition may further comprise a preservative in an amount in the range of 0.01 to 0.20 mass% of the total mass of the anti mosquito paint composition.

Preferably, the amount of the preservative is 0.15 mass%.

The preservative can be 1,2-benzisothiazolin-3-one.

The anti mosquito paint composition may further comprise a thickening agent in an amount in the range of 0.7 to 2.5 mass% of the total mass of the anti mosquito paint composition.

Preferably, the amount of the thickening agent is 1.55 mass%.

The thickening agent can be at least one selected from the group consisting of acrylic acid, methyl ester of acrylic acid, ethyl ester of acrylic acid, polymerised acrylic acid, methyl ester of polymerised acrylic acid, ethyl ester of polymerised acrylic acid, 2-hydroxyethyl cellulose, hydrophobically modified hydroxyethyl cellulose (HMHEC), alkali swellable emulsions, hydrophobically modified alkali swellable emulsions, hydrophobically modified ethoxylate urethanes, and clay based rheology modifiers.

10 The anti mosquito paint composition may further comprise a plasticizer in an amount in the range of 0.60 to 3.00 mass% of the total mass of the anti mosquito paint composition.

Preferably, the amount of the plasticizer is 1.6 mass%.

The plasticizer can be at least one selected from the group consisting of triethylene glycol, 2,2,4 trimethyl 1,3 pentanediol monoisobutyrate, and 2,2,4-trimethyl-1,3-pentanediol diisobutyrate.

The anti mosquito paint composition may further comprise an emulsifier in an amount in the range of 0.10 to 0.50 mass% of the total mass of the anti mosquito paint composition.

Preferably, the amount of the emulsifier is 0.2 mass%.

The emulsifier can be poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(nonylphenoxy)-, branched, ammonium salt (CAS No. 68649-55-8).

The anti mosquito paint composition may further comprise additives in an amount in the range of 0.05 to 0.20 mass% of the total mass of the anti mosquito paint composition.

Preferably, the amount of the additive is 0.15 mass%.

The additive can be selected from the group consisting of ethanolamine and 2-amino-2-methyl-1-propanol.

The anti mosquito paint composition may further comprise a fungicidal agent in an amount in the range of 0.1 to 0.5 mass% of the total mass of the anti mosquito paint composition.

Preferably, the amount of the fungicidal agent is 0.30 mass%.

The fungicidal agent can be selected from the group consisting of zinc salt of 1-hydroxypyridine-2-thione, iodopropynyl butyl carbamate, and methyl *1H*-benzimidazol-2-yl carbamate.

- 5 The anti mosquito paint composition may further comprise kaolin clay in an amount ranging from 0 to 30 mass% of the total mass of the anti mosquito paint composition.

In second aspect, the present disclosure discloses a process for preparing an anti mosquito paint composition. The process comprises the following steps:

- 10 Predetermined amounts of water, a pigment, a dispersing agent, a filler, a biocide, and a polymeric emulsion are mixed to obtain a first mixture. The first mixture is filtered to obtain a filtered mixture. Predetermined amount of an insecticide is added to the filtered mixture under stirring to obtain a second mixture. The second mixture is filtered to obtain the anti mosquito paint composition.

- 15 In accordance with the present disclosure, the step of mixing to obtain a first mixture in the process for preparing the anti mosquito paint composition further involves addition of predetermined amounts of at least one excipient selected from the group consisting of a sequestering agent, a preservative, a thickening agent, a plasticizer, an additive, an emulsifier, a fungicidal agent, and water.

- 20 In accordance with the present disclosure, the step of adding to obtain a second mixture in the process for preparing the anti mosquito paint composition further involves addition of predetermined amount of a thickening agent.

DETAILED DESCRIPTION

- 25 Mosquitoes are carriers, or vectors, for some of humanity's most deadly illnesses like malaria, dengue, zika, West Nile virus and yellow fever which cause several million deaths each year. Curbing the spread of these life threatening diseases is costly and cumbersome.

Often mosquitoes rest and crawl on walls and surfaces of houses/buildings. Thus, coating the interior and external walls and surfaces with an anti mosquito paint composition can be a cost effective way in eliminating the mosquitoes. The present disclosure envisages an anti mosquito paint composition by combining the aesthetics and sustainability with functionality.

The present disclosure envisages an anti mosquito paint composition and a process for preparation thereof.

In one aspect, the present disclosure provides an anti mosquito paint composition. The anti mosquito paint composition comprises:

- 5 a) a polymeric emulsion in an amount in the range of 10 to 25 mass% of the total mass of the anti mosquito paint composition;
 - b) an insecticide that depolarizes axonal sodium channels of mosquitoes, the amount of the insecticide being in the range of 0.9 to 1.1 mass% of the total mass of the anti mosquito paint composition;
 - 10 c) a biocide in an amount in the range of 0.21 to 1.1 mass% of the total mass of the anti mosquito paint composition;
 - d) a pigment in an amount in the range of 8 to 13 mass% of the total mass of the anti mosquito paint composition;
 - e) a dispersing agent in an amount in the range of 0.5 to 1.5 mass% of the total mass of the
15 anti mosquito paint composition;
 - f) a filler in an amount in the range of 18 to 35 mass% of the total mass of the anti mosquito paint composition; and
 - g) water in an amount in the range of 35 to 45 mass% of the total mass of the anti mosquito paint composition.
- 20 The total water content in the anti mosquito paint composition of the present disclosure is in the range of 35 to 57.5 mass% of the total mass of the anti mosquito paint composition upon including the water present in the polymeric emulsion.

In accordance with the embodiments of the present disclosure, the polymeric emulsion is at least one selected from the group consisting of styrene acrylic polymeric emulsion and
25 acrylic polymeric emulsion.

In accordance with the embodiments of the present disclosure, the polymeric emulsion may comprise polymer and water. The polymer can be in the range of 42 to 55 mass% of the total

mass of the polymeric emulsion, and water can be in the range of 45 to 58 mass% of the total mass of the polymeric emulsion.

In one embodiment the polymeric emulsion may comprise 50% polymer and 50% water.

5 The insecticide can be 3-phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (cis :trans :: 40:60) (CAS No. 52645-53-1).

The biocide can be at least one selected from the group consisting of 2-octyl-4-isothiazolin-3-one, chloro-2-methyl-4-isothiazolin-3-one and methyl-4-isothiazolin-3-one.

Typically, in the present anti mosquito paint composition the pigment used is titanium dioxide. Titanium dioxide can be of Rutile or Anatase type. Other pigments may also be used.

10 A pigment provides colour, opacity and gloss to a paint composition. Further, on application of a paint composition, the pigment protects the surface underneath from corrosion and weathering.

Typically, in the present anti mosquito paint composition the dispersing agent can be sodium polyacrylate. Other dispersing agents may also be used. A dispersing agent facilitates in
15 improving the separation of particles and prevents settling or clumping of particles.

Typically, in the present anti mosquito paint composition the filler can be at least one selected from the group consisting of calcium carbonate and calcined kaolin (aluminum silicate). A filler thickens a paint composition, supports its structure on the applied surface and increases the volume of a paint.

20 Water is selected from the group consisting of water treated with ultra-violet (UV) radiations, demineralized water, and water obtained by reverse osmosis treatment.

In an embodiment of the present disclosure the water is water treated with ultra-violet (UV) radiations.

In accordance with one exemplary embodiment of the present disclosure, an anti mosquito
25 paint composition comprises

- i. styrene acrylic polymeric emulsion containing 50 mass% of styrene acrylic polymer, in an amount of 14 mass% of the total mass of the anti mosquito paint composition;
- ii. 3-phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (cis :trans :: 40:60) as an insecticide that

- depolarizes axonal sodium channels of the mosquitoes, in an amount of 1 mass% of the total mass of the anti mosquito paint composition;
- iii. a biocide comprising 2-octyl-4-isothiazolin-3-one, chloro-2-methyl-4-isothiazolin-3-one and methyl-4-isothiazolin-3-one, total amount of the biocide is 0.35 mass% of the total mass of the anti mosquito paint composition;
- 5 iv. titanium dioxide as a pigment in an amount of 11 mass% of the total mass of the anti mosquito paint composition;
- v. sodium polyacrylate as a dispersing agent in an amount of 1 mass% of the total mass of the anti mosquito paint composition;
- 10 vi. calcium carbonate and calcined kaolin as fillers in an amount of 31 mass% of the total mass of the anti mosquito paint composition; and
- vii. water treated with UV radiations, in an amount of 41.75 mass% of the total mass of the anti mosquito paint composition.

The anti mosquito paint composition can further comprise a sequestering agent in an amount in the range of 0.01 to 0.1 mass% of the total mass of the anti mosquito paint composition. A sequestering agent is added to a paint composition to prevent metallic ions from precipitating in an alkaline solution.

15

Preferably, the amount of the sequestering agent is 0.05 mass%.

In accordance with the embodiments of the present disclosure, the sequestering agent can be selected from the group consisting of sodium hexametaphosphate (SHMP), tetra potassium pyrophosphate (TPPP), and potassium tri poly phosphate (KTPP).

20

In accordance with one embodiment of the present disclosure, the sequestering agent can be sodium hexametaphosphate (SHMP).

The anti mosquito paint composition may further comprise a preservative in an amount in the range of 0.01 to 0.20 mass% of the total mass of the anti mosquito paint composition. A preservative prevents decomposition and disfiguration of a paint composition due to microbial attack and its growth on painted surfaces.

25

Preferably, the amount of the preservative is 0.15 mass%.

In accordance with one embodiment of the present disclosure, the preservative can be 1,2-benzisothiazolin-3-one.

30

The anti mosquito paint composition may further comprise a thickening agent in an amount in the range of 0.7 to 2.5 mass% of the total mass of the anti mosquito paint composition. A thickening agent is added to a paint composition to increase the viscosity of the paint composition without substantially changing its other properties.

- 5 Preferably, the amount of the thickening agent is 1.55 mass%.

In accordance with one embodiment of the present disclosure, the thickening agent can be at least one selected from the group consisting of acrylic acid, methyl ester of acrylic acid, ethyl ester of acrylic acid, polymerised acrylic acid, methyl ester of polymerised acrylic acid, ethyl ester of polymerised acrylic acid, 2-hydroxyethyl cellulose, hydrophobically modified
10 hydroxyethyl cellulose (HMHEC), alkali swellable emulsions, hydrophobically modified alkali swellable emulsions, hydrophobically modified ethoxylate urethanes, and clay based rheology modifiers.

The anti mosquito paint composition may further comprise a plasticizer in an amount in the range of 0.60 to 3.00 mass% of the total mass of the anti mosquito paint composition. A
15 plasticizer is added to a paint composition to increase the plasticity of the paint composition.

Preferably, the amount of the plasticizer is 1.6 mass%.

In accordance with the embodiments of the present disclosure, the plasticizer can be at least one selected from the group consisting of triethylene glycol, 2,2,4 trimethyl 1,3 pentanediol monoisobutyrate, and 2,2,4-trimethyl-1,3-pentanediol diisobutyrate.

- 20 The anti mosquito paint composition may further comprise an emulsifier in an amount in the range of 0.10 to 0.50 mass% of the total mass of the paint composition. An emulsifier is added to a paint composition to form an emulsion of the paint composition and keep the emulsion well-dispersed.

Preferably, the amount of the emulsifier is 0.2 mass%.

- 25 In accordance with one embodiment of the present disclosure, the emulsifier can be poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(nonylphenoxy)-, branched, ammonium salt (CAS No. 68649-55-8).

The anti mosquito paint composition may further comprise additives in an amount in the range of 0.05 to 0.20 mass% of the total mass of the anti mosquito paint composition.

Preferably, the amount of the additive is 0.15 mass%.

In accordance with the embodiments of the present disclosure, the additive can be selected from the group consisting of ethanolamine and 2-amino-2-methyl-1-propanol.

5 In accordance with one embodiment of the present disclosure, the additive can be ethanolamine.

The anti mosquito paint composition may further comprise a fungicidal agent in an amount in the range of 0.1 to 0.5 mass% of the total mass of the anti mosquito paint composition.

Preferably, the amount of the fungicidal agent is 0.30 mass%.

10 In accordance with the embodiments of the present disclosure, the fungicidal agent can be selected from the group consisting of zinc salt of 1-hydroxypyridine-2-thione, Iodopropynyl butyl carbamate, and Methyl *1H*-benzimidazol-2-yl carbamate.

In accordance with one embodiment of the present disclosure, the fungicidal agent can be a zinc salt of 1-hydroxypyridine-2-thione.

15 In accordance with one embodiment of the present disclosure, the anti mosquito paint composition may further comprise Kaolin clay as a gloss modifying agent. Kaolin clay is used in an amount ranging from 0 to 30 mass% of the total mass of the anti mosquito paint composition. A gloss modifying agent is added to a paint composition to enhance gloss of the paint composition applied on a surface by helping the paint composition to level out after application and by increasing pigment dispersion on the surface.

20 In accordance with another aspect of the present disclosure, a process for preparing an anti mosquito paint composition is provided. The process involves following steps:

Predetermined amounts of water, a pigment, a dispersing agent, a filler, a biocide, and a polymeric emulsion, are mixed to obtain a first mixture. The first mixture is filtered to obtain a filtered mixture. Predetermined amount of an insecticide is added to the filtered mixture and
25 stirred to obtain a second mixture. The second mixture is filtered to obtain the anti mosquito paint composition.

In accordance with the present disclosure, the step of mixing further involves addition of predetermined amounts of at least one excipient selected from the group consisting of a

sequestering agent, a preservative, a thickening agent, a plasticizer, an additive, an emulsifier, a fungicidal agent, and water.

In accordance with the present disclosure, the step of adding an insecticide to the filtered mixture, further involves addition of predetermined amount of a thickening agent.

- 5 In accordance with one embodiment of the present disclosure, the anti mosquito paint composition of the present disclosure has smooth finish.

In accordance with another embodiment of the present disclosure, the anti mosquito paint composition of the present disclosure has matte finish.

- 10 The process for the preparation of the anti mosquito paint composition of the present disclosure, is easy and simple.

The anti mosquito paint composition of the present disclosure does not contain ammonia. Further, the anti mosquito paint composition of the present disclosure does not contain added lead or heavy metals.

- 15 The Pigment Volume Concentration (PVC) of the anti mosquito paint composition of the present disclosure is in the range of 50 to 75.

Preferably, the PVC of the anti mosquito paint composition of the present disclosure is in the range of 60 to 65.

- 20 The insecticide in the anti mosquito paint composition acts on the central nervous system (CNS) of the mosquito by affecting the sodium channels in the axonal membranes; thereby paralyzing the mosquito and further leading to death.

The biocide/insecticide can be axonic excitotoxins.

The anti mosquito paint composition of the present disclosure is stable and is in a ready-to use form.

- 25 The anti mosquito paint composition of the present disclosure can be diluted with water for ease of application.

It is observed that the anti mosquito paint composition of the present disclosure is effective against the mosquito species of *aedes aegypti*, *culex quinquefasciatus*, and *anopheles stephensi*.

It is observed that the insecticide in the anti mosquito paint composition of the present disclosure does not vaporize, and it remains in the paint film formed after application of the anti mosquito paint composition on a surface.

5 It is observed that the anti mosquito paint composition of the present disclosure is not an eye irritant or a skin irritant.

The anti mosquito paint composition of the present disclosure is non-toxic to humans and pets. It is safe for use as paint.

10 The anti mosquito paint composition of the present disclosure is found to be safe for use, when evaluated for the acute oral toxicity studies and the acute dermal toxicity studies performed according to globally harmonized system (GHS) of hazard category.

It is observed that the anti mosquito paint composition of the present disclosure is safe for earthworms, Japanese quail (flying bird), mallard duck (crawling bird), and honey bees.

The anti mosquito paint composition of the present disclosure is easy to apply without spattering.

15 The anti mosquito paint composition of the present disclosure is available in various shades. Desired shade can be obtained by selection of a suitable pigment.

The anti mosquito paint composition of the present disclosure has excellent covering capacity and is washable.

The anti mosquito paint composition of the present disclosure has excellent opacity.

20 The anti mosquito paint composition of the present disclosure that comprises a fungicidal additive, does not allow fungal growth on a surface coated with the anti mosquito paint composition.

25 The present disclosure is further described in light of the following examples and experiments which are set forth for illustration purpose only and not to be construed for limiting the scope of the disclosure. The following examples and experiments can be scaled up to industrial/commercial scale and the results obtained can be extrapolated to industrial scale.

Example No. 1: Process for preparing the anti mosquito paint composition:

In a mixing vessel, UV treated water (32.55 g) and sodium hexametaphosphate (0.05 g) were added while stirring, and 1,2-benzisothiazol-3(2H)-one (0.15 g), sodium polyacrylate (1.00 g), tri ethylene glycol (0.8 g), ethoxylated alcohol (0.3 g), poly(oxy-1,2-ethanediyl)-alpha-sulfo-omega-(nonylphenoxy)-branched, ammonium salt (0.2 g) and 2-aminoethanol (0.15 g) were added to the vessel and stirred for 10 to 15 minutes. Further, titanium dioxide (11 g), a mixture of 2-hydroxyethyl cellulose (0.55 g), 2, 2, 4-trimethyl-1, 3-pentanediol diisobutyrate (0.8 g), calcined kaolin (aluminum silicate) (11 g), and calcium carbonate (20 g) were added to the vessel under stirring. UV treated water (2.00 g) was added to the vessel and stirring was continued for 30 to 60 minutes. 2-Octyl-4-isothiazolin-3-one (0.05 g), chloro-2-methyl-4-isothiazolin-3-one-methyl-4-isothiazolin-3-one (0.3 g), a mixture comprising polymerised acrylic acid, ethyl ester of polymerised acrylic acid and methyl ester of polymerised acrylic acid (0.90 g), and UV treated distilled water (1.00 g), styrene acrylic polymeric emulsion/pure acrylic polymeric emulsion (14 g) were added and stirred to obtain a first mixture. The first mixture was filtered to obtain a filtered mixture. To the filtered mixture, ($\pm$)-3-phenoxybenzyl 3-(2, 2-dichlorovinyl)-2, 2-dimethylcyclopropanecarboxylate (1 g), a mixture comprising polymerised acrylic acid, ethyl ester of polymerised acrylic acid, and methyl ester of polymerised acrylic acid (0.10 g), in UV treated distilled water (0.10 g), and UV treated distilled water (2.00 g) were added to obtain a second mixture. The second mixture was filtered to obtain the anti mosquito paint composition.

Experiment No. 1: Bio efficacy

The anti mosquito paint composition prepared in Example no. 1 was tested for bio efficacy. The paint was found to be effective against following mosquito species:

- *Aedes aegypti*;
- *Culex quinquefasciatus*; and
- *Anopheles stephensi*.

Experiment No. 2: Toxicity

a) Oral and Dermal Toxicity

Oral and Dermal toxicity of the anti mosquito paint composition of Example no. 1 was performed as per globally harmonized system (GHS) of hazard category. The results are summarized in Table 1.

Table 1. Results of the toxicity studies performed for the anti mosquito paint composition of Example no. 1

Name of Study	Results
Acute Oral Toxicity	GHS category 5, Unclassified
Acute Dermal Toxicity	GHS category 5, Unclassified
Acute Inhalation Toxicity	GHS category 4

*GHS Category: 1 = Harmful, GHS Category: 4 = (Acute inhalation median lethal dose of 50 % the paint composition of the present disclosure (V/V) diluted with a vehicle (distilled water) was greater than 2.86 mg/L, GHS Category: 5 = Safe

It was observed that the anti mosquito paint composition of the present disclosure was found to be safe for use, when evaluated for the acute oral toxicity studies and the acute dermal toxicity studies performed according to the globally harmonized system (GHS) of hazard category.

b) Eye irritation and Dermal irritation

Eye irritation and Dermal irritation of the anti mosquito paint composition of Example no. 1 was performed as per the globally harmonized system (GHS) of hazard category. The results are summarized in Table 2.

Table 2. Results of the eye irritation and dermal irritation studies performed for the anti mosquito paint composition of Example no. 1

Acute Eye Irritation	GHS Category - Not classified as an Eye Irritant
Acute Dermal Irritation	GHS Category - Not classified as Skin Irritant.

It was observed that the anti mosquito paint composition of the present disclosure was found to be non-irritant for eyes and skin, when evaluated for the eye irritation studies and dermal irritation studies performed according to the globally harmonized system (GHS) of hazard category.

5 c) Skin sensitization

Skin sensitization studies of the anti mosquito paint composition of Example no. 1 was performed as per the globally harmonized system (GHS) of hazard category. The results are summarized in Table 3.

Table 3. Results of the skin sensitization studies performed for the anti mosquito paint composition of Example no. 1

Skin Sensitization	GHS Category 1 B (Moderate Skin Sensitizer), Below mentioned Caution statement added on Label
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It was observed that the anti mosquito paint composition of the present disclosure was found to be Moderate Skin Sensitizer, when evaluated for the skin sensitization studies performed according to the globally harmonized system (GHS) of hazard category.

15 **Experiment No. 3: Eco toxicity**

Eco toxicity of the anti mosquito paint composition of Example no. 1 was evaluated. The results are summarized in Table 4.

Table 4. Results of the eco toxicity studies performed for the anti mosquito paint composition of Example no. 1

Sr. No.	Name Of Study	Results	Remarks
1	acute toxicity study of the anti mosquito paint composition of the present disclosure on earthworm, <i>Eisenia fetida</i>	LC50 (14 th day) value was greater than 2000 mg for anti mosquito paint composition of the present disclosure /kg (dry weight of artificial soil).	No effect of the anti mosquito paint composition of the present disclosure on the growth of earthworms. Thus, the paint is safe for earthworms.
2	acute oral toxicity study of anti mosquito paint composition of the present disclosure on Japanese quail, <i>Coturnix japonica</i>	LD50 value of anti mosquito paint composition of the present disclosure on Japanese quail, <i>Coturnix japonica</i> was greater than 2000 mg/kg body weight.	No effect of the anti mosquito paint composition of the present disclosure on the Japanese quail (flying bird). Thus, the paint is safe for birds.
3	acute oral toxicity study of anti mosquito paint composition of the present disclosure on mallard duck, <i>Anas platyrhynchos</i>	Lethal dose (LD50) value of the anti mosquito paint composition of the present disclosure on mallard duck (<i>Anas platyrhynchos</i>) was greater than 2000 mg/kg body weight.	No effect of the anti mosquito paint composition of the present disclosure on mallard duck (crawling bird). Thus, the paint is safe for birds.
4	acute contact toxicity of anti mosquito paint composition of the present disclosure on honeybee, <i>Apis mellifera</i> .	LD50 (24 h) value was 44.8 µg of anti mosquito paint composition of the present disclosure/bee. LD50 (48h) value was 44.8 µg of the anti mosquito paint composition of the present disclosure/bee.	The anti mosquito paint composition of the present disclosure in wet condition was harmful to the honey bees. But this product is meant for use inside of the house and chances of honey bees entering inside the house are very less.
5	acute oral toxicity of anti mosquito paint composition of the present disclosure to honeybee, <i>Apis mellifera</i>	LD50 (24 h) value was 52.0 µg of anti mosquito paint composition of the present disclosure/bee LD50 (48 h) value was 52.0	The testing was carried out on dry paint/painted

		µg of anti mosquito paint composition of the present disclosure/bee		surface (after overnight drying). The results showed that the paint composition of the present disclosure was safe for honey bees as no mortality was observed.
6	bio efficacy of dried anti mosquito paint composition of the present disclosure panel on honey bee	No Mortality till 96 Hrs. after exposure.		
7	acute immobilization study of anti mosquito paint composition of the present disclosure to <i>Daphnia magna</i>	EC50 (48 h) value was 5.8 mg for the anti mosquito paint composition of the present disclosure/L NOEC (No Observed Effect Concentration) : 1.0 mg anti mosquito paint composition of the present disclosure/L LOEC (Lowest-Observed Effect Concentration) : 2.1 mg anti mosquito paint composition of the present disclosure /L		The anti mosquito paint composition of the present disclosure was found to be harmful to aquatic microorganisms and fish.
8	acute toxicity study of anti mosquito paint composition of the present disclosure to zebra fish, danio rerio	48 h LC ₅₀	: 8.3 mg of anti mosquito paint composition of the present disclosure /L	
		72 h LC ₅₀	: 5.4 mg of anti mosquito paint composition of the present disclosure /L	
		96 h LC ₅₀	: 3.2 mg of anti mosquito paint composition of the present disclosure /L	
		NOEC	: 0.5 mg of anti mosquito paint composition of the present disclosure /L	
		LOEC	: 1.1 mg of anti mosquito paint	

		composition of the present disclosure /L
9	Alga (<i>Pseudokirchneriella subcapitata</i>), growth inhibition test with anti mosquito paint composition of the present disclosure.	EbC10 for biomass inhibition (0 - 72 h) : 7.41 mg/L ErC10 for growth rate inhibition (0 - 72 h) : 16.61 mg/L EyC10 for yield inhibition (0 - 72 h) : 7.86 mg/L EbC20 for biomass inhibition (0 - 72 h) : 11.26 mg/L ErC20 for growth rate inhibition (0 - 72 h) : 24.47 mg/L EyC20 for yield inhibition (0 - 72 h) : 10.74 mg/L EbC50 for biomass inhibition (0 - 72 h) : 25.03 mg/L ErC50 for growth rate inhibition (0 - 72 h) : 51.38 mg/L EyC50 for yield inhibition (0 - 72 h) : 19.51 mg/L NOEC for biomass, growth rate and yield : 5.3 mg/L LOEC for biomass, growth rate and yield : 9.5 mg/L

It was observed that the anti mosquito paint composition of the present disclosure is safe for earthworms, Japanese quail (flying bird), mallard duck (crawling bird), and honey bees.

Experiment No. 4: Air concentration study

- 5 Determination of air concentration of the insecticide in a room applied with the paint composition of Example no. 1 by the following methodology;
 1. Room of Size 9ft × 9 ft. × 10 ft. was painted with the anti mosquito paint composition of Example no. 1.

2. Presence of the insecticide in the air in the form of vapors was checked for 6 months continuously.
3. The insecticide in the air in the form of vapors was below detectable limits.

This indicates that the insecticide did not vaporize.

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Example No. 2: Process for preparing the anti mosquito paint composition (with fungicidal additive):

In a mixing vessel, UV treated water (32.25 g) and sodium hexametaphosphate (0.05 g) were added while stirring, and 1,2-benzisothiazol-3(2H)-one (0.15 g), Sodium polyacrylate (1.00 g), tri ethylene glycol (0.8 g), ethoxylated alcohol (0.3 g), poly(oxy-1,2-ethanediyl)-alpha-sulfo-omega-(nonylphenoxy)-branched, ammonium salt (0.2 g) and 2-aminoethanol (0.15 g) were added to the vessel and stirred for 10 to 15 minutes. Further, titanium dioxide (11 g), a mixture of 2-hydroxyethyl cellulose (0.55 g), 2, 2, 4-trimethyl-1, 3-pentanediol diisobutyrate (0.8 g), calcined kaolin (aluminum silicate) (11 g), and calcium carbonate (20 g) were added to the vessel under stirring. UV treated water (2.00 g) was added to the vessel and stirring was continued for 30 to 60 minutes. 2-Octyl-4-isothiazolin-3-one (0.05 g), 1-hydroxypyridine-2-thione zinc salt (0.3 g), chloro-2-methyl-4-isothiazolin-3-one-methyl-4-isothiazolin-3-one (0.3 g), a mixture comprising polymerised acrylic acid, ethyl ester of polymerised acrylic acid and methyl ester of polymerised acrylic acid (0.90 g), and UV treated distilled water (1.00 g), styrene acrylic polymeric emulsion/pure acrylic polymeric emulsion (14 g) were added and stirred to obtain a first mixture. The first mixture was filtered to obtain a filtered mixture. To the filtered mixture, ($\pm$)-3-phenoxybenzyl 3-(2, 2-dichlorovinyl)-2, 2-dimethylcyclopropanecarboxylate (1 g), a mixture comprising polymerised acrylic acid, ethyl ester of polymerised acrylic acid, and methyl ester of polymerised acrylic acid (0.10 g), in UV treated distilled water (0.10 g), and UV treated distilled water (2.00 g) were added to obtain a second mixture. The second mixture was filtered to obtain the anti mosquito paint composition.

Experiment No. 5: Anti Fungal performance of the Anti Mosquito Paint (with fungicidal additive).

The anti mosquito paint composition prepared in Example no. 2 was tested for anti fungal performance of the anti mosquito paint.

- 5 Anti mosquito paint was tested against fungal species (spp) as per ASTM D 5590. ASTM D 5590 is a standard test method for determining the resistance of paint films and related coatings to fungal defacement by accelerated four-week agar plate assay. The fungal species used for the experiment were *Aspergillus niger*, and *Penicillium* spp.

- 10 The anti mosquito paint samples were applied on Whatman filter paper no. 40 and those panels were artificially weathered. The weathered panels were placed on the surface of fungal culture medium PDA (potato dextrose agar), inoculated with a mixed fungal spore suspension, and incubated at 28 °C with relative humidity of 90%.

Observation and evaluation:

Resistance to fungal growth was assessed by visual examination of the incubated agar panels.

- 15 The incubated agar panels were observed for the zone of inhibition of fungal growth (halo) around the test panel on day 3, day 7 and day 14.

The fungal growth on the coated surface, on day 3, day 7 and day 14 was rated using the following scale:

0: no growth

- 20 1: traces of growth (<10 %)

2: Light growth (10-30%)

3: Moderate growth (30.0-60.0 %)

4: Heavy growth (60% to complete coverage)

- 25 The zone (halo) surrounding the test panel was measured and recorded in terms of a code comprising n_1Zn_2 , wherein n_1 is the rating number mentioned herein above, Z represents zone, and n_2 is the average width in millimeters (mm) of the zone around the sample.

For example, **3Z5** would indicate 30-60% growth on the coated surface, within a zone of 5 mm around the sample.

0Z6 would indicate no growth on the coated surface with a clear halo of 6 mm.

Results: According to the anti fungal performance results of the anti mosquito paint of the present disclosure, rating the present anti mosquito paint is: **0Z7**

i.e. No growth on coated surface with clear halo of 7 mm.

TECHNICAL ADVANCEMENTS

The present disclosure described herein above has several technical advantages including, but not limited to, the realization of:

- 10 – an anti mosquito paint composition which is useful in controlling mosquitoes;
- an anti mosquito paint composition that is free of ammonia, and have no added lead and heavy metals;
- an anti mosquito paint composition which is non-toxic to humans;
- 15 – an anti mosquito paint composition that has smooth as well as matte finish, which is easy to apply without spattering, available in various shades, is washable, and has excellent opacity and covering capacity;
- an easy and simple process for the preparation of the anti mosquito paint composition; and
- 20 – cost effective way in eliminating the mosquitoes by coating the interior and external walls and/or surfaces.

Throughout this specification the word “comprise”, or variations such as “comprises” or “comprising”, will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps.

- 25 The use of the expression “at least” or “at least one” suggests the use of one or more elements or ingredients or quantities, as the use may be in the embodiment of the disclosure to achieve one or more of the desired objects or results.

Any discussion of documents, acts, materials, devices, articles or the like that has been included in this specification is solely for the purpose of providing a context for the disclosure. It is not to be taken as an admission that any or all of these matters form a part of the prior art base or were common general knowledge in the field relevant to the disclosure as
5 it existed anywhere before the priority date of this application.

The numerical values mentioned for the various physical parameters, dimensions or quantities are only approximations and it is envisaged that the values higher/lower than the numerical values assigned to the parameters, dimensions or quantities fall within the scope of the disclosure, unless there is a statement in the specification specific to the contrary.

10 While considerable emphasis has been placed herein on the components and component parts of the preferred embodiments, it will be appreciated that many embodiments can be made and that many changes can be made in the preferred embodiments without departing from the principles of the disclosure. These and other changes in the preferred embodiment as well as other embodiments of the disclosure will be apparent to those skilled in the art from the
15 disclosure herein, whereby it is to be distinctly understood that the foregoing descriptive matter is to be interpreted merely as illustrative of the disclosure and not as a limitation.

CLAIMS:

1. An anti mosquito paint composition comprising:
 - a) a polymeric emulsion in an amount in the range of 10 to 25 mass% of the total mass of the anti mosquito paint composition;
 - b) an insecticide that depolarizes axonal sodium channels of mosquitoes, wherein the amount of the insecticide is in the range of 0.9 to 1.1 mass% of the total mass of the anti mosquito paint composition;
 - c) a biocide in an amount in the range of 0.21 to 1.1 mass% of the total mass of the anti mosquito paint composition;
 - d) a pigment in an amount in the range of 8 to 13 mass% of the total mass of the anti mosquito paint composition;
 - e) a dispersing agent in an amount in the range of 0.5 to 1.5 mass% of the total mass of the anti mosquito paint composition;
 - f) a filler in an amount in the range of 18 to 35 mass% of the total mass of the anti mosquito paint composition; and
 - g) water in an amount in the range of 35 to 45 mass% of the total mass of the anti mosquito paint composition.
2. The anti mosquito paint composition of claim 1, wherein said polymeric emulsion is at least one selected from the group consisting of styrene acrylic polymeric emulsion and acrylic polymeric emulsion.
3. The anti mosquito paint composition of claim 1, wherein said polymeric emulsion comprises polymer in the range of 42 to 55 mass% of the total mass of the polymeric emulsion, and water in the range of 45 to 58 mass% of the polymeric emulsion, preferably, said polymeric emulsion comprises 50% polymer and 50% water.
4. The anti mosquito paint composition of claim 1, wherein said insecticide is 3-phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (cis :trans :: 40:60) (CAS No. 52645-53-1).

5. The anti mosquito paint composition of claim 1, wherein said biocide is at least one selected from the group consisting of 2-octyl-4-isothiazolin-3-one, chloro-2-methyl-4-isothiazolin-3-one and methyl-4-isothiazolin-3-one.
6. The anti mosquito paint composition of claim 1, wherein said pigment is titanium dioxide.
7. The anti mosquito paint composition of claim 1, wherein said dispersing agent is sodium polyacrylate.
8. The anti mosquito paint composition of claim 1, wherein said filler is at least one selected from the group consisting of calcium carbonate and calcined kaolin (aluminum silicate).
9. The anti mosquito paint composition of claim 1, wherein said water is at least one selected from the group consisting of water treated with ultra-violet (UV) radiations, demineralized water, and water obtained by reverse osmosis treatment.
10. An anti mosquito paint composition comprising:
 - i) styrene acrylic polymeric emulsion in an amount of 14 mass% of the total mass of the anti mosquito paint composition; wherein the styrene acrylic polymeric emulsion contains 50 mass% of styrene acrylic polymer;
 - ii) 3-phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (cis :trans :: 40:60) as an insecticide that depolarizes axonal sodium channels of the mosquitoes, in an amount of 1 mass% of the total mass of the anti mosquito paint composition;
 - iii) a biocide comprising 2-octyl-4-isothiazolin-3-one, chloro-2-methyl-4-isothiazolin-3-one and methyl-4-isothiazolin-3-one; wherein total amount of the biocide is 0.35 mass% of the total mass of the anti mosquito paint composition;
 - iv) titanium dioxide as a pigment in an amount of 11 mass% of the total mass of the anti mosquito paint composition;
 - v) sodium polyacrylate as a dispersing agent in an amount of 1 mass% of the total mass of the anti mosquito paint composition;

vi) calcium carbonate and calcined kaolin (aluminum silicate) as fillers in an amount of 31 mass% of the total mass of the anti mosquito paint composition; and

vii) water treated with UV radiations, in an amount of 41.75 mass% of the total mass of the anti mosquito paint composition.

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11. The anti mosquito paint composition of any one of the claims 1 and 10, further comprising a sequestering agent in an amount in the range of 0.01 to 0.1 mass% of the total mass of the anti mosquito paint composition, preferably 0.05 mass%; wherein said sequestering agent is selected from the group consisting of sodium hexametaphosphate (SHMP), tetra potassium pyrophosphate (TPPP), and potassium tri poly phosphate (KTPP).

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12. The anti mosquito paint composition of any one of the claims 1 and 10, further comprising a preservative in an amount in the range of 0.01 to 0.20 mass% of the total mass of the anti mosquito paint composition, preferably 0.15 mass%; wherein said preservative is 1,2-benzisothiazolin-3-one.

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13. The anti mosquito paint composition of any one of the claims 1 and 10, further comprising a thickening agent in an amount in the range of 0.7 to 2.5 mass% of the total mass of the anti mosquito paint composition, preferably 1.55 mass%; wherein said thickening agent is at least one selected from the group consisting of acrylic acid, methyl ester of acrylic acid, ethyl ester of acrylic acid, polymerised acrylic acid, methyl ester of polymerised acrylic acid, ethyl ester of polymerised acrylic acid, 2-hydroxyethyl cellulose, hydrophobically modified hydroxyethyl cellulose (HMHEC), alkali swellable emulsions, hydrophobically modified alkali swellable emulsions, hydrophobically modified ethoxylate urethanes, and clay based rheology modifiers.

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14. The anti mosquito paint composition of any one of the claims 1 and 10, further comprising a plasticizer in an amount in the range of 0.60 to 3.00 mass% of the total mass of the anti mosquito paint composition, preferably 1.6 mass%; wherein said plasticizer is at least one selected from the group consisting of triethylene glycol, 2,2,4 trimethyl 1,3 pentanediol monoisobutyrate, and 2,2,4-trimethyl-1,3-pentanediol diisobutyrate.

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15. The anti mosquito paint composition of any one of the claims 1 and 10, further comprising an emulsifier in an amount in the range of 0.10 to 0.50 mass% of the total mass of the anti mosquito paint composition, preferably 0.2 mass%; wherein said emulsifier is poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(nonylphenoxy)-, branched, ammonium salt (CAS No. 68649-55-8).
16. The anti mosquito paint composition of any one of the claims 1 and 10, further comprising an additive in an amount in the range of 0.05 to 0.20 mass% of the total mass of the anti mosquito paint composition, preferably 0.15 mass%; wherein said additive is selected from the group consisting of ethanolamine and 2-Amino-2-methyl-1-propanol.
17. The anti mosquito paint composition of any one of the claims 1 and 10, further comprising a fungicidal agent in an amount in the range of 0.1 to 0.5 mass% of the total mass of the anti mosquito paint composition, preferably 0.30 mass%; wherein said fungicidal agent is selected from the group consisting of zinc salt of 1-hydroxypyridine-2-thione, iodopropynyl butyl carbamate, and methyl *1H*-benzimidazol-2-yl carbamate.
18. The anti mosquito paint composition of any one of the claims 1 and 10, further comprising kaolin clay in an amount ranging from 0 to 30 mass% of the total mass of the anti mosquito paint composition.
19. A process for preparing an anti mosquito paint composition, said process comprising the following steps:
- I. mixing predetermined amounts of water, a pigment, a dispersing agent, a filler, a biocide, and a polymeric emulsion, to obtain a first mixture;
 - II. filtering said first mixture to obtain a filtered mixture;
 - III. adding predetermined amount of an insecticide to said filtered mixture and stirring to obtain a second mixture; and
 - IV. filtering said second mixture to obtain the anti mosquito paint composition.
20. The process of claim 19, wherein step (I) further involves addition of predetermined amounts of at least one excipient selected from the group consisting of a sequestering

agent, a preservative, a thickening agent, a plasticizer, an additive, an emulsifier, a fungicidal agent, and water.

21. The process as claimed in claim 19, wherein step (III) further involves addition of predetermined amount of a thickening agent.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2017/056310

A. CLASSIFICATION OF SUBJECT MATTER
C09D5/14, C09D125/14 Version=2018.01

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)

C09D

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

C07D, A01N

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Patseer, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 106189454 A (XIE CAIHONG) Published on 07/12/2016 (abstract, claim, para [0011]-[0030])	1-21
A	CN 104046143 A (CHUZHOU NINGYANG RUBBER INDUSTRY CO LTD) published on 17/09/2014 (abstract, claim 1-2, para [0004])	1-21
A	CN 101613547 A (XIANLAN YUAN) Published on 30/12/2009 (abstract, claim 1, example 1)	1-21



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"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)

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Date of the actual completion of the international search

10-04-2018

Date of mailing of the international search report

10-04-2018

Name and mailing address of the ISA/

Indian Patent Office
Plot No.32, Sector 14, Dwarka, New Delhi-110075
Facsimile No.

Authorized officer

Sathish Moorthy

Telephone No. +91-1125300200