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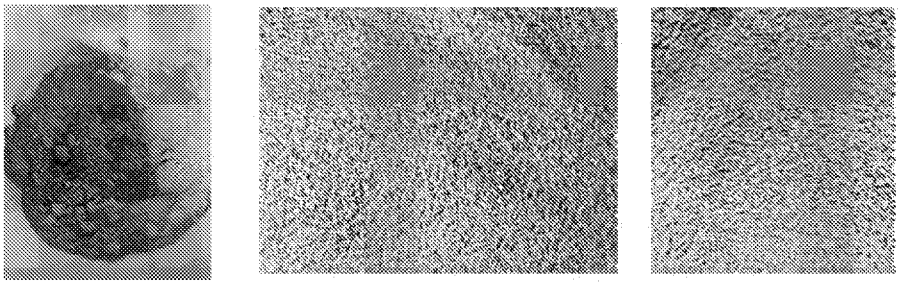

1(A)

(57) **Abstract:** The present disclosure relates to insecticidal compositions comprising a neonicotinoid insecticide, a disaccharide, an inorganic salt, and at least one salt comprising C_{8-20} alkyl alcohol derivative. The present disclosure also relates to a process for preparation, a method of application and use of the insecticidal composition thereof.

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TITLE: AN INSECTICIDAL COMPOSITION

FIELD OF THE DISCLOSURE:

The present disclosure relates to insecticidal compositions comprising neonicotinoid insecticides, a process of preparing the insecticidal compositions, a method of controlling insects using the insecticidal composition and use of the insecticidal composition for controlling insects.

BACKGROUND OF THE DISCLOSURE:

Neonicotinoid pesticides have their unique mechanism of action. Unlike pesticides that evaporate or dissociate shortly after application, neonicotinoids are systemic pesticides. They have reduced toxicity as compared to organophosphate pesticides and carbamate pesticides that provide similar broad-spectrum control against numerous crop-damaging insects. Neonicotinoids paralyze insects by blocking a pathway that transmits nerve impulses in the insect's central nervous system. Neonicotinoids are used to control a wide variety of insects. The commonly used neonicotinoids are imidacloprid, acetamiprid, clothianidin, dinotefuran, nitenpyram, thiacloprid, thiamethoxam, and combinations thereof.

Acetamiprid is a neonicotinoid pesticide/insecticide widely used in foliar as well as seed treatment applications. Its formulations such as wettable powder (WP), wettable powder in soluble packets (WSP), soluble granules (SG) or dry flowable (DF) products are known to suffer from stability problems.

Therefore, there is a need to develop solid agrochemical compositions of neonicotinoid insecticides including acetamiprid alone or in combination with other active ingredients, that retain the basic characteristics of neonicotinoid insecticides of faster dissolution and greater attrition resistance.

OBJECTIVES OF THE DISCLOSURE:

A primary objective of the present disclosure is to provide an insecticidal composition comprising a neonicotinoid insecticide.

Another objective of the present disclosure is to provide a stable insecticidal composition comprising a neonicotinoid insecticide.

Yet another objective of the present disclosure is to provide a stable insecticidal composition comprising a neonicotinoid insecticide alone or in combination with at least one additional insecticide.

Yet another objective of the present disclosure is to provide a stable solid insecticidal composition comprising a neonicotinoid insecticide.

Yet another objective of the present disclosure is to provide a stable solid insecticidal composition comprising a neonicotinoid insecticide, with greater attrition resistance.

Yet another objective of the present disclosure is to provide a stable solid insecticidal composition comprising a neonicotinoid insecticide, with better dissolution profile.

Yet another objective of the present disclosure is to provide a process for preparation of an insecticidal composition comprising a neonicotinoid insecticide.

Yet another objective of the present disclosure is to provide a method of treating pests/insects using an insecticidal composition comprising a neonicotinoid insecticide.

Yet another objective of the present disclosure is to provide use of an insecticidal composition comprising a neonicotinoid insecticide for controlling pests/insects.

SUMMARY OF THE DISCLOSURE:

In an aspect of the present disclosure, an insecticidal composition comprises:

a) a neonicotinoid insecticide;

b) a diluent mixture comprising a disaccharide and an inorganic salt; and

c) at least one salt comprising C_{8-20} alkyl alcohol derivative.

In another aspect of the present disclosure, an insecticidal composition comprises:

a) a neonicotinoid insecticide;

b) a diluent mixture comprising a disaccharide and an inorganic salt in a weight ratio from about 1:2 to about 2:1; and

c) at least one salt comprising C_{8-20} alkyl alcohol derivative.

In another aspect of the present disclosure, a process of preparing an insecticidal composition comprises:

(a) mixing a neonicotinoid insecticide, a diluent mixture comprising a disaccharide and an inorganic salt and at least one salt comprising C_{8-20} alkyl alcohol derivative to obtain a mixture,

(b) adding water to the mixture and extruding the mixture to form granules; and

(c) drying the granules to obtain the insecticidal composition.

In another aspect of the present disclosure, provided is a method of controlling pests/insects, said method comprising applying to the plant, or a locus at which the plant is growing or intended to be grown, or a plant propagation material, or a habitat area thereof, an insecticidal composition comprising:

a) a neonicotinoid insecticide;

b) a diluent mixture comprising a disaccharide and an inorganic salt; and

c) at least one salt comprising C_{8-20} alkyl alcohol derivative.

In another aspect of the present disclosure, provided is use of an insecticidal composition comprising:

a) a neonicotinoid insecticide;

b) a diluent mixture comprising a disaccharide and an inorganic salt; and

c) at least one salt comprising C_{8-20} alkyl alcohol derivative;

for controlling pests/insects.

In another aspect, the present disclosure provides a kit. The kit comprises a plurality of components, each of which may include at least one, or more, of the ingredients of the insecticidal composition of the present disclosure.

Additional features and advantages of the present disclosure will be apparent from the detailed description that follows, which illustrates by way of example, the most preferred features of the present disclosure which are not to be construed as limiting the scope of the disclosure described herein.

BRIEF DESCRIPTION OF DRAWINGS:

Figure 1(A): Discloses granule formation stages from dough to finished granules for the composition of Example 1.

Figure 1(B): Discloses granule formation stages from dough to finished granules for the compositions of Example 2.

Figure 2(A): Discloses granule formation stages from dough to finished granules for the composition of Example 3.

Figure 2(B): Discloses granule formation stages from dough to finished granules for the compositions of Example 4.

Figure 3(A): Discloses granule formation stages from dough to finished granules for the composition of Example 5.

Figure 3(B): Disclosed granule formation stages from dough to finished granules for the composition of Example 6.

DETAILED DESCRIPTION OF THE DISCLOSURE:

The present disclosure now will be described hereinafter with reference to the accompanying examples, in which embodiments of the disclosure are shown. This

description is not intended to be a detailed catalogue of all the different ways in which the disclosure may be implemented, or all the features that may be added to the instant disclosure. For example, features illustrated with respect to one embodiment may be incorporated into other embodiments, and features illustrated with respect to a particular embodiment may be deleted from that embodiment. Thus, the disclosure contemplates that in some embodiments of the disclosure, any feature or combination of features set forth herein can be excluded or omitted. In addition, numerous variations and additions to the various embodiments suggested herein will be apparent to those skilled in the art in light of the instant disclosure, which do not depart from the instant disclosure. Hence, the following descriptions are intended to illustrate some particular embodiments of the disclosure, and not to exhaustively specify all permutations, combinations and variations thereof.

Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure belongs. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of the disclosure, suitable methods and materials are described herein.

It must be noted that, as used in this specification, the singular forms “a”, “an”, and “the” include plural referents unless the content clearly dictates otherwise. The terms “preferred” and “preferably” refer to embodiments of the disclosure that may afford certain benefits, under certain circumstances.

As used herein, the terms “comprising”, “including”, “having”, “containing”, “involving” and the like are to be understood to be open-ended i.e., to mean including but not limited to.

As used herein, the terms “about” or “approximately” are inclusive of the stated value and means within an acceptable range of deviation for the particular value as determined by one of ordinary skill in the art, considering the measurement in

question and the error associated with measurement of the particular quantity (i.e., the limitations of the measurement system). For example, "about" can mean within one or more standard deviations, or within ±10% or ±5% of the stated value.

Recitation of ranges of values are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. The endpoints of all ranges are included within the range and independently combinable. As used herein, all numerical values or numerical ranges include integers within such ranges and fractions of the values or the integers within ranges unless the context clearly indicates otherwise. Thus, for example, reference to a range of 90-100%, includes 91%, 92%, 93%, 94%, 95%, 95%, 97%, etc., as well as 91.1%, 91.2%, 91.3%, 91.4%, 91.5%, etc., 92.1%, 92.2%, 92.3%, 92.4%, 92.5%, etc., and so forth. All methods described herein can be performed in a suitable order unless otherwise indicated herein or otherwise clearly contradicted by context.

The use of any and all examples, or exemplary language (e.g., "such as"), is intended merely to better illustrate the disclosure and does not pose a limitation on the scope of the disclosure unless otherwise claimed. No language in the specification should be construed as indicating any non-claimed element as essential to the practice of the disclosure as used herein.

While the disclosure has been described with reference to an exemplary embodiment, it will be understood by those skilled in the art that various changes may be made, and equivalents may be substituted for elements thereof without departing from the scope of the disclosure. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the disclosure without departing from the essential scope thereof. Therefore, it is intended that the disclosure is not limited to the particular embodiment disclosed as the best mode

contemplated for carrying out this disclosure, but that the disclosure will include all embodiments falling within the scope of the appended claims.

The expression of various quantities in terms of "%" or "% w/v" or "% w/w" means the percentage by weight of the total solution or composition unless otherwise specified.

As used herein, the term "agrochemical" is understood to denote an agricultural chemical such as pesticides, fungicides, insecticides, acaricides, herbicides, nematicides, plant growth regulators and can be used interchangeably.

As used herein, the term "insecticide" refers to the ability of a substance to decrease or inhibit growth of insects/pests.

As used herein, the term "insecticidal" refers to the ability of a substance to control or modify the growth of insects/pests.

The term "insecticidally effective amount" means the amount of the composition needed to achieve an observable adverse effect on growth, including the effects of necrosis, death, retardation, prevention, and removal, destruction, insect pest mortality, insect pest weight loss, insect pest reduced plant defoliation, and other behavioural and physical changes of an insect pest after feeding and exposure for an appropriate length of time.

The term "insects" includes all organisms in the class "Insecta". Insecticidal refers to the ability of a substance to increase mortality of insects, and/or inhibit the growth rate of insects.

The term "control" or "controlling" insects refers to inhibition of insects, through a toxic effect, the ability of insect pests to survive, grow, feed, and/or reproduce, or to limit insect-related damage or loss in crop plants. To "control" insects may or

may not mean killing the insects, although it preferably means reducing insect population by killing the insects.

The term "plant" refers to all physical parts of a plant, including seeds, seedlings, saplings, roots, tubers, stems, stalks, foliage and fruits. The term plant includes transgenic and non-transgenic plants.

The term "locus" of a plant as used herein is intended to embrace the place on which the plants are growing, where the plant propagation materials of the plants are sown or where the plant propagation materials of the plants will be placed into the soil.

The term "plant propagation material" is understood to denote generative parts of a plant, such as seeds, vegetative material such as cuttings or tubers, roots, fruits, tubers, bulbs, rhizomes and parts of plants, germinated plants and young plants which are to be transplanted after germination or after emergence from the soil.

The term "seed" as used herein means any resting stage of a plant that is physically detached from the vegetative stage of a plant.

The term "stable" referred to herein refers to chemical and/or physical stabilization of the composition in terms of achieving chemical stability of the active ingredient and desired suspensibility and dispersibility of the composition by maintaining homogeneity of the components that imparts better shelf life.

The inventors of the present disclosure found that the insecticidal composition of neonicotinoid insecticides, with better dissolution and greater attrition resistance, may be obtained by adding a diluent mixture comprising a disaccharide and an inorganic salt in the presence of at least one salt comprising C_{8-20} alkyl alcohol derivative.

It is known in the art that dissolution of the granules of an agrochemical composition is important from the point-of-view of the application of the agrochemical composition. Once the granules are mixed with water for application of the composition, it should result in quick dissociation and disintegration of the active ingredient(s) with minimum external force. The granules should neither be too fragile that they cannot not sustain any inevitable force (e.g., shipping and handling); nor should they be too hard that they do not break or dissociate when diluted in water for application of the composition.

The inventors observed that the presence of a diluent mixture comprising a disaccharide and an inorganic salt; and at least one salt comprising C_{8-20} alkyl alcohol derivative is required to formulate granules comprising a neonicotinoid insecticide, for better dissolution profile and greater attrition resistance. The combination of a diluent mixture comprising a disaccharide and an inorganic salt; and at least one salt comprising C_{8-20} alkyl alcohol derivative resulted into a stable insecticidal composition. During the process of preparation of the insecticidal composition, the presence of the diluent mixture comprising disaccharide and inorganic salt and at least one salt comprising C_{8-20} alkyl alcohol derivative was found to ensure that the dough remains flowable during processing and did not stick to the walls of the extruder, which led to granules with desired attrition resistance.

As used herein, the term "attrition resistance" means resistance to wearing away of the surface of a granule by friction or impact, particularly by granule-to-granule interaction. Attrition resistance determines whether a granular material is robust under normal conditions of use and transport. Attrition resistance is tested as per the Collaborative International Pesticides Analytical Council (CIPAC) method miscellaneous techniques (MT) 178.1.

In an embodiment, attrition resistance of the soluble granules obtained according to the present disclosure is more than about 98%.

In another embodiment, attrition resistance of the soluble granules obtained according to the present disclosure is more than about 99%.

As used herein, the term "dissolution rate" means number of inversions required to fully solubilise the granules.

Therefore, according to an embodiment of the present disclosure, an insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt; and
c) at least one salt comprising C_{8-20} alkyl alcohol derivative.

According to an embodiment of the present disclosure, a stable insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt; and
c) at least one salt comprising C_{8-20} alkyl alcohol derivative.

According to an embodiment of the present disclosure, the insecticidal composition comprises a neonicotinoid insecticide.

According to an embodiment of the present disclosure, the neonicotinoid insecticide is selected from the group comprising flupyradifurone, acetamiprid, thiacloprid, dicloromezotiaz, fenmezoditiaz, triflumezopyrim, clothianidin, dinotefuran, imidacloprid, imidaclothiz, thiamethoxam, cycloxaprid, nitenpyram, nithiazine, paichongding, flupyrimin, sulfoxaflor, or combinations thereof.

According to an embodiment of the present disclosure, the neonicotinoid insecticide is selected from the group comprising acetamiprid, clothianidin, imidacloprid, nitenpyram, nithiazine, thiacloprid, thiamethoxam, or combinations thereof.

According to a preferred embodiment of the present disclosure, the neonicotinoid insecticide is acetamiprid.

According to an embodiment of the present disclosure, the neonicotinoid insecticide is imidacloprid.

According to an embodiment of the present disclosure, the insecticidal composition comprises from about 1% w/w to about 70% w/w neonicotinoid insecticide of total weight of the insecticidal composition.

According to another embodiment of the present disclosure, the insecticidal composition comprises from about 10% w/w to about 70% w/w neonicotinoid insecticide of total weight of the insecticidal composition.

In a preferred embodiment of the present disclosure, the insecticidal composition comprises from about 20% w/w to about 70% w/w neonicotinoid insecticide of total weight of the insecticidal composition.

In a preferred embodiment, the insecticidal composition comprises of about 50% w/w neonicotinoid insecticide of the total weight of the insecticidal composition.

In a preferred embodiment, the insecticidal composition comprises of about 50% w/w acetamiprid of the total weight of the insecticidal composition.

According to an embodiment of the present disclosure, the diluent mixture comprises a disaccharide and an inorganic salt.

According to an embodiment of the present disclosure, the diluent mixture comprises a disaccharide selected from the group comprising lactose, sucrose, maltose, lactulose, trehalose, cellobiose, chitobiose, isomaltose, turanose, melibiose, xylobiose, sophorose, mannobiose, or combinations thereof.

According to an embodiment of the present disclosure, the diluent mixture comprises a disaccharide selected from the group comprising lactose, sucrose, maltose, or combinations thereof.

According to a preferred embodiment of the present disclosure, the disaccharide is lactose.

According to a preferred embodiment of the present disclosure, the disaccharide is lactose mono hydrate (MH).

According to a preferred embodiment of the present disclosure, the disaccharide is sucrose.

In an embodiment of the present disclosure, the insecticidal composition comprises from about 0.1% w/w to about 50% w/w diluent mixture of total weight of the insecticidal composition.

In an embodiment of the present disclosure, the insecticidal composition comprises from about 0.1% w/w to about 40% w/w diluent mixture of total weight of the insecticidal composition.

In another embodiment of the present disclosure, the insecticidal composition comprises from about 10% w/w to about 40% w/w diluent mixture of total weight of the insecticidal composition.

In a preferred embodiment, the insecticidal composition comprises of about 39.5% w/w diluent mixture of total weight of the insecticidal composition.

According to an embodiment of the present disclosure, the insecticidal composition comprises from about 0.01% w/w to about 30% w/w disaccharide of total weight of the insecticidal composition.

In another embodiment of the present disclosure, the insecticidal composition comprises from about 0.1% w/w to about 30% w/w disaccharide of total weight of the insecticidal composition.

In a preferred embodiment of the present disclosure, the insecticidal composition comprises from about 0.5% to about 30% w/w disaccharide of total weight of the insecticidal composition.

In a preferred embodiment, the insecticidal composition comprises of about 26.34% w/w disaccharide of total weight of the insecticidal composition.

In a preferred embodiment, the insecticidal composition comprises of about 26.34% w/w lactose of total weight of the insecticidal composition.

In a preferred embodiment, the insecticidal composition comprises of about 13.16% w/w disaccharide of total weight of the insecticidal composition.

In a preferred embodiment, the insecticidal composition comprises of about 13.16% w/w lactose of total weight of the insecticidal composition.

According to an embodiment of the present disclosure, the diluent mixture comprises an inorganic salt.

According to an embodiment of the present disclosure, the inorganic salt of the diluent mixture is selected from the group comprising ammonium sulfate, sodium sulfate, ammonium bicarbonate, sodium bicarbonate, magnesium sulfate, hydrogen

carbonate, sodium chloride, sodium citrate, ammonium citrate, sodium acetate bentonite, aluminium chloride, citric acid, succinic acid, or combinations thereof.

According to a preferred embodiment of the present disclosure, the inorganic salt is ammonium bicarbonate.

According to a preferred embodiment of the present disclosure, the inorganic salt is ammonium sulfate.

According to a preferred embodiment of the present disclosure, the inorganic salt is sodium citrate.

In an embodiment of the present disclosure, the insecticidal composition comprises from about 0.01% w/w to about 50% w/w inorganic salt of total weight of the insecticidal composition.

In another embodiment of the present disclosure, the insecticidal composition comprises from about 0.1% w/w to about 50% w/w inorganic salt of total weight of the insecticidal composition.

In a preferred embodiment of the present disclosure, the insecticidal composition comprises from about 0.5% to about 30% w/w inorganic salt of total weight of the insecticidal composition.

In a preferred embodiment, the insecticidal composition comprises of about 26.34% w/w inorganic salt of total weight of the insecticidal composition.

In a preferred embodiment, the insecticidal composition comprises of about 26.34% w/w ammonium sulfate of total weight of the insecticidal composition.

In a preferred embodiment, the insecticidal composition comprises of about 13.16% w/w inorganic salt of total weight of the insecticidal composition.

In a preferred embodiment, the insecticidal composition comprises of about 13.16% w/w ammonium sulfate of total weight of the insecticidal composition.

According to an embodiment of the present disclosure, the insecticidal composition comprises at least one salt(s) comprising C_{8-20} alkyl alcohol derivative.

According to an embodiment, the salt comprising C_{8-20} alkyl alcohol derivative is selected from alkali metal salt or alkaline earth metal salt of C_{8-20} alkyl alcohol derivative.

According to an embodiment of the present disclosure, the insecticidal composition comprises alkali metal salts and alkaline earth metal salts of C_{8-20} alkyl alcohol derivative.

In an embodiment, the alkali metal salts and/or alkaline earth salt(s) of C_{8-20} alkyl alcohol derivative are selected from the group comprising magnesium, sodium, potassium, lithium, calcium, or combinations thereof. Preferably, a sodium salt of C_{8-20} alkyl alcohol derivative is used.

In different embodiments of the present disclosure, the C_{8-20} alkyl alcohol derivative is an ester(s) i.e., insecticidal composition comprises salt(s) of C_{8-20} alkyl alcohol ester(s).

According to an embodiment, the C_{8-20} alkyl alcohol derivative is a sulfuric ester(s) i.e., insecticidal composition comprises salt(s) of C_{8-20} alkyl alcohol sulfuric ester(s).

In a preferred embodiment, the C_{8-20} alkyl alcohol derivative is a sulfuric ester of C_{10-16} alkyl alcohol.

According to an embodiment of the present disclosure, an insecticidal composition comprises alkali metal salt(s) and/or alkaline earth metal salt(s) of sulfuric ester(s) of C_{8-20} alkyl alcohol.

According to a preferred embodiment of the present disclosure, an insecticidal composition comprises alkali salt(s) of sulfuric ester(s) of C_{8-20} alkyl alcohol(s).

According to a preferred embodiment of the present disclosure, an insecticidal composition comprises alkali salt(s) of sulfuric ester(s) of C_{10-16} alkyl alcohol(s).

According to a preferred embodiment of the present disclosure, an insecticidal composition comprises sodium salt of sulfuric ester(s) of C_{10-16} alkyl alcohol(s).

According to an embodiment of the present disclosure, the insecticidal composition comprises from about 0.01% w/w to about 10% w/w salt(s) comprising C_{8-20} alkyl alcohol derivative of total weight of the insecticidal composition.

According to another embodiment of the present disclosure, the insecticidal composition comprises from about 0.05% w/w to about 10% w/w salt(s) comprising C_{8-20} alkyl alcohol derivative of total weight of the insecticidal composition.

In a preferred embodiment of the present disclosure, the insecticidal composition comprises from about 0.1% w/w to about 10% w/w salt(s) comprising C_{8-20} alkyl alcohol derivative of the total weight of the insecticidal composition.

In a preferred embodiment, the insecticidal composition comprises of about 0.50% w/w alkali salt(s) of sulfuric ester(s) of C_{10-16} alkyl alcohol(s) of total weight of the insecticidal composition.

In a preferred embodiment, the insecticidal composition comprises of about 0.50% w/w sodium salt of sulfuric ester(s) of C_{10-16} alkyl alcohol(s) of total weight of the insecticidal composition.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt; and
c) at least one alkali metal salt or alkaline earth metal salt of C_{8-20} alkyl alcohol derivative.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt; and
c) at least one alkali metal salt or alkaline earth metal salt of C_{8-20} alkyl alcohol ester.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt; and
c) at least one alkali metal salt or alkaline earth metal salt of C_{8-20} alkyl alcohol sulfuric ester.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt in a weight ratio ranging from about 1:2 to about 2:1; and

c) at least one salt comprising C_{8-20} alkyl alcohol derivative.

According to an embodiment of the present disclosure, the diluent mixture comprises the disaccharide and the inorganic salt in a weight ratio ranging from about 1:2 to about 2:1.

According to an embodiment of the present disclosure, the diluent mixture of the insecticidal composition comprises a disaccharide and an inorganic salt in a weight ratio of about 1:1.

According to an embodiment of the present disclosure, the diluent mixture of the insecticidal composition comprises a disaccharide and an inorganic salt in a weight ratio of about 1:2.

In a preferred embodiment, the diluent mixture of the insecticidal composition comprises lactose and ammonium sulfate in a weight ratio of about 1:2.

According to an embodiment of the present disclosure, the diluent mixture of the insecticidal composition comprises a disaccharide and an inorganic salt in a weight ratio of about 2:1.

In a preferred embodiment, the diluent mixture of the insecticidal composition comprises lactose and ammonium sulfate in a weight ratio of about 2:1.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt in a weight ratio ranging from about 1:2 to about 2:1; and
c) at least one alkali metal salt or alkaline earth metal salt of C_{8-20} alkyl alcohol derivative.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt in a weight ratio ranging from about 1:2 to about 2:1; and
c) at least one alkali metal salt or alkaline earth metal salt of C_{8-20} alkyl alcohol ester.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt in a weight ratio ranging from about 1:2 to about 2:1; and
c) at least one alkali metal salt or alkaline earth metal salt of C_{8-20} alkyl alcohol sulfuric ester.

Furthermore, according to an embodiment of the present disclosure, the insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt;
c) at least one salt comprising C_{8-20} alkyl alcohol derivative; and
d) at least one agrochemically acceptable excipient.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt;
c) at least one alkali metal salt or alkaline earth metal salt of C_{8-20} alkyl alcohol derivative; and
d) at least one agrochemically acceptable excipient.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt;
c) at least one alkali metal salt or alkaline earth metal salt of C_{8-20} alkyl alcohol ester; and
d) at least one agrochemically acceptable excipient.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt;
c) at least one alkali metal salt or alkaline earth metal salt of C_{8-20} alkyl alcohol sulfuric ester; and
d) at least one agrochemically acceptable excipient.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt in a weight ratio ranging from about 1:2 to about 2:1;
c) at least one alkali metal salt or alkaline earth metal salt of sulfuric ester of C_{8-20} alkyl alcohol; and
d) at least one agrochemically acceptable excipient.

According to an embodiment of the present disclosure, the agrochemically acceptable excipient is selected from the group comprising wetting agents, dispersing agents, anticaking agents, pH-regulating agents, preservatives, biocides, antifoaming agents, colorants, other formulation aids, or combinations thereof.

According to an embodiment of the present disclosure, the wetting agents and dispersing agents comprise anionic and non-ionic surfactants.

According to an embodiment of the present disclosure, the anionic surfactants are selected from the group comprising salts of lignosulfonates such as sodium lignosulfonate, calcium lignosulfonate, kraft lignin sulphonate, alkyl or aryl ethoxylates, alkyl or aryl ethoxylate derivatives, styrene acrylic polymers, or combinations thereof.

According to an embodiment of the present disclosure, the insecticidal composition comprises non-ionic surfactants selected from the group comprising polyethylene oxide/polypropylene oxide block copolymers, polyethylene glycol ethers of linear alcohols, reaction products of fatty acids with ethylene oxide and/or propylene oxide, furthermore polyvinyl alcohol, polyvinylpyrrolidone, copolymers of polyvinyl alcohol and polyvinylpyrrolidone, copolymers of (meth)acrylic acid and (meth)acrylic esters, alkyl ethoxylates, fatty acid-alkanolamine condensates, ethylene oxide adducts of fatty acids, ethylene oxide adducts of fatty alcohols, alkyl-aryl polyether alcohols and polypropylene glycol-ethylene oxide condensates, or combinations thereof.

In an embodiment, the present composition further comprises at least one buffering agent acting as a pH-regulating agent(s) to maintain the pH of the composition.

According to an embodiment, the preservatives used may be benzisothiazolinone or phonols, 2-bromo-2-nitropropane-1,3-diol, 5-chloro-2-methyl-4-isothiazolin-3-one & 2 methyl-4-isothiazolin -3 one, glutaraldehyde, chloromethylisothiazolinone (CMIT)/Methylisothiazolinone (MIT), 2.2-dibromo-3-nitrilopropioamide, natamycin and nisin, bronopol/CMIT/MIT.

According to an embodiment, biocide(s) may be selected from benzothiazoles, 1,2-benzisothiazolin-3-one, sodium dichloro-s-triazinetrione, sodium benzoate,

potassium sorbate, 1,2-phenyl-isothiazolin-3-one, inter chloroxylenol paraoxybenzoate butyl.

According to an embodiment, the examples of antifoaming agents that are employed to prevent any unwanted foam generated while manufacturing the compositions include silicone-based compounds, alcohols, glycol ethers, mineral spirits, acetylene diols, polysiloxanes, organosiloxanes, siloxane glycols, reaction products of silicon dioxide and organosiloxane polymer, polydimethylsiloxanes, polydimethylsiloxane emulsion, or polyalkylene glycols alone or in combination. Exemplary defoamers include silicone antifoam emulsions.

According to an embodiment, the colorants (for example in red, blue and green) are, for example, pigments, which are sparingly soluble in water, and dyes, which are water-soluble. Examples are inorganic coloring agents (for example iron oxide, titanium oxide, and iron hexacyanoferrate) and organic coloring agents (for example alizarin, azo and phthalocyanin coloring agents).

According to an embodiment, the agrochemically acceptable excipients are present in an amount ranging from about 1% w/w to about 99% w/w of total weight of the composition.

According to an embodiment, the agrochemically acceptable excipients are present in an amount ranging from about 1% w/w to about 70% w/w of total weight of the composition.

According to an embodiment, the agrochemically acceptable excipients are present in an amount ranging from about 1% w/w to about 30% w/w of total weight of the composition.

According to an embodiment of the present disclosure, the insecticidal composition further comprises one or more additional pesticides.

According to an embodiment of the present disclosure, the insecticidal composition further comprises one or more additional insecticides.

According to an embodiment of the present disclosure, the additional insecticide is selected from the group comprising alkyl halide insecticides, aminopyrimidine insecticides, aminotriazene insecticides, antibiotic insecticides, aromatic hydrocarbon insecticides, arylpyrrole insecticides, benzimidazole insecticides, benzoylurea insecticides, beta-ketonitrile insecticides, botanical insecticides, carbamate insecticides, diacylhydrazine insecticides, diamide insecticides, dinitrophenol insecticides, dithiolane insecticides, formamidine insecticides, fumigant insecticides, inorganic insecticides, isoxazoline insecticides, juvenile hormone mimics, juvenile hormones, macrocyclic lactone insecticides, meta-diamide insecticides, methoxyacrylate insecticides, neonicotinoid insecticides, nereistoxin analogue insecticides, organochlorine insecticides, organophosphorus insecticides, oxadiazine insecticides, oxadiazolone insecticides, perfluoroalkyl sulfonamide insecticides, phenol insecticides, precocenes, pyrazole insecticides, pyrethrin insecticides, pyrethroid insecticides, pyridine azomethine insecticides, pyrimidinamine insecticides, pyropene insecticides, RNA1 insecticides, salicylanilide insecticides, semicarbazone insecticides, steroid insecticides, tetramic acid insecticides, tetronic acid insecticides, thiocarbonate insecticides, thiourea insecticides, urea insecticides, unclassified insecticides, and combinations thereof.

According to an embodiment of the present disclosure, the additional insecticide is selected from the group comprising organophosphorus insecticide, oxadiazine insecticides, avermectin insecticides, phosphoramidothioate insecticides, phenylpyrazole insecticides, benzoylurea insecticides, pyrethroid insecticides, their salts, esters, optically active isomers, or combinations thereof.

According to an embodiment of the present disclosure, the additional insecticide is selected from organophosphorus insecticides such as acephate; oxadiazine insecticides such as indoxacarb, avermectin insecticides such as abamectin, emamectin, eprinomectin and ivermectin; phosphoramidothioate insecticides such as acephate, methamidophos, monocrotophos; phenylpyrazole insecticides such as flupyrazofos, pyraclofos, pyrolan, ethiprole, fipronil, flufiprole; pyridylpyrazole insecticides such as chlorantraniliprole, cyantraniliprole, cyclaniliprole, tetrachlorantraniliprole, tetraniliprole; benzoyl urea insecticides such as lufenuron, novaluron, dibenzuron, chlorfuazuron; pyrethroid insecticides such as bifenthrin, cyfluthrin, beta-cyfluthrin, cyhalothrin, gamma-cyhalothrin, lambda-cyhalothrin, cypermethrin, alpha-cypermethrin, beta-cypermethrin, theta-cypermethrin, zeta-cypermethrin, cyphenothrin, deltamethrin, dimefluthrin, fenvalerate and transfluthrin, or combinations thereof.

According to an embodiment of the present disclosure, the insecticidal composition is formulated in a form of a solid granular composition.

According to an embodiment of the present disclosure, the insecticidal composition is formulated in the form of a solid granular composition such as water dispersible granules (WDG or WG), soluble granules (SG), and broadcasting granules (GR).

According to an embodiment of the present disclosure, the insecticidal composition is in a form of soluble granules or water dispersible granules.

According to an embodiment of the present disclosure, the insecticidal composition is in a form of water dispersible granules.

According to an embodiment of the present disclosure, the insecticidal composition is in a form of soluble granules.

In an embodiment, attrition resistance of soluble granules is more than about 98%.

In another embodiment, attrition resistance of soluble granules is more than about 99%.

According to an embodiment, a stable soluble granular (SG) insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt;
c) at least one salt comprising C_{8-20} alkyl alcohol derivative; and
d) at least one agrochemically acceptable excipient.

According to an embodiment, a stable water dispersible granular (WDG or WG) insecticidal composition comprises:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt;
c) at least one salt comprising C_{8-20} alkyl alcohol derivative; and
d) at least one agrochemically acceptable excipient.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) about 1% w/w to about 70% w/w neonicotinoid insecticides;
b) about 0.1% w/w to about 50% w/w diluent mixture comprising the disaccharide and the inorganic salt; and
c) about 0.01% w/w to about 10% w/w salt comprising C_{8-20} alkyl alcohol derivative, of total weight of the insecticidal composition.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) about 10% w/w to about 70% w/w neonicotinoid insecticides;
b) about 10% w/w to about 40% w/w diluent mixture comprising the disaccharide and the inorganic salt; and

c) about 0.05% w/w to about 10% w/w salt comprising C_{8-20} alkyl alcohol derivative, of total weight of the insecticidal composition.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) about 10% w/w to about 70% w/w acetamiprid;
b) about 10% w/w to about 40% w/w diluent mixture comprising lactose and ammonium sulfate; and
c) about 0.1% to about 10% w/w salt comprising C_{8-20} alkyl alcohol derivative, of total weight of the insecticidal composition.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) about 10% w/w to about 70% w/w acetamiprid;
b) about 10% w/w to about 40% w/w diluent mixture comprising lactose and ammonium sulfate in a weight ratio from about 1:2 to about 2:1; and
c) about 0.1% to about 10% w/w sodium salt of sulfuric ester of C_{10-16} alkyl alcohol, of total weight of the composition.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) about 10% w/w to about 70% w/w acetamiprid;
b) about 10% w/w to about 40% w/w diluent mixture comprising lactose and ammonium sulfate in a weight ratio of about 1:1; and
c) about 0.1% to about 10% w/w of salt(s) of sulfuric esters of C_{10-16} alkyl alcohol(s), of total weight of the composition.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) about 10% w/w to about 70% w/w acetamiprid;

b) about 10% w/w to about 40% w/w diluent mixture comprising lactose and ammonium sulfate in a weight ratio of about 1:1; and
c) about 0.1% to about 10% w/w of alkali salt(s) of sulfuric esters of C_{10-16} alkyl alcohol(s), of total weight of the composition.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) about 1% w/w to about 70% w/w neonicotinoid insecticides;
b) about 0.01% w/w to about 30% w/w disaccharide and about 0.01% w/w to about 50% w/w inorganic salt; and
c) about 0.01% w/w to about 10% w/w at least one salt comprising C_{8-20} alkyl alcohol derivative, of total weight of the insecticidal composition.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) about 10% w/w to about 70% w/w neonicotinoid insecticides;
b) about 0.1% w/w to about 30% w/w disaccharide, and from about 0.1% w/w to about 50% w/w inorganic salt;
c) from about 0.01% w/w to about 10% w/w at least one salt comprising C_{8-20} alkyl alcohol derivative, of total weight of the insecticidal composition.

According to an embodiment of the present disclosure, the insecticidal composition comprises:

a) about 10% w/w to about 70% w/w acetamiprid;
b) about 0.1% w/w to about 30% w/w lactose, and from about 0.1% w/w to about 50% w/w ammonium sulfate; and
c) about 0.01% w/w to about 10% w/w at least one salt comprising C_{8-20} alkyl alcohol derivative, of total weight of the insecticidal composition.

According to an embodiment of the present disclosure, provided is, a process of preparing an insecticidal composition, the process comprising:

(a) mixing a neonicotinoid insecticide, a diluent mixture comprising a disaccharide and an inorganic salt, and at least one salt comprising C_{8-20} alkyl alcohol derivative to obtain a mixture,

(b) adding water to the mixture and extruding the mixture to form granules; and

(c) drying the granules to obtain the insecticidal composition.

According to an embodiment of the present disclosure, provided is, a process of preparing an insecticidal composition, the process comprising:

(a) mixing acetamiprid, lactose, ammonium sulfate and sodium salt(s) of sulfuric ester(s) of C_{10-16} alkyl alcohol(s) to obtain a mixture,

(b) adding water to the mixture and extruding the mixture to form granules; and

(c) drying the granules to obtain the insecticidal composition.

In an embodiment, the step (c) of the process comprises drying the granules at a temperature from about 30°C to about 60°C.

In an embodiment, the step (c) of the process comprises drying the granules at a temperature from about 40°C to about 55°C.

In an embodiment, the step (c) of the process comprises drying the granules at a temperature of about 50°C.

According to an embodiment of the present disclosure, provided is, use of the insecticidal composition, for controlling pests.

According to an embodiment of the present disclosure, provided is, use of an insecticidal composition comprising:

a) a neonicotinoid insecticide;

b) a diluent mixture comprising a disaccharide and an inorganic salt; and

c) at least one salt comprising C_{8-20} alkyl alcohol derivative,

for controlling pests.

According to an embodiment of the present disclosure, provided is, use of an insecticidal composition comprising:

a) a neonicotinoid insecticide;

b) a diluent mixture comprising a disaccharide and an inorganic salt; and

c) at least one salt comprising C_{8-20} alkyl alcohol derivative,

for controlling insects.

According to an embodiment of the present disclosure, provided is, a method of controlling pests by applying to a plant, or a plant propagation material, or a habitat area thereof, an insecticidal composition comprising:

a) a neonicotinoid insecticide;

b) a diluent mixture comprising a disaccharide and an inorganic salt; and

c) at least one salt comprising C_{8-20} alkyl alcohol derivative.

According to an embodiment of the present disclosure, provided is, a method of controlling insects, said method comprising applying to the plant, or a locus at which the plant is growing or intended to be grown, or a plant propagation material, or a habitat area thereof, an insecticidally effective amount of an insecticidal composition comprising:

a) a neonicotinoid insecticide;

b) a diluent mixture comprising a disaccharide and an inorganic salt; and

c) at least one salt comprising C_{8-20} alkyl alcohol derivative.

According to an embodiment of the present disclosure, provided is, a method of controlling pests, said method comprising applying to the plant, or the locus at which the plant is growing or intended to be grown, or the plant propagation material, or the habitat area thereof, an insecticidal composition comprising:

a) acetamiprid;

b) a diluent mixture comprising a disaccharide and an inorganic salt; and
c) at least one salt comprising C_{8-20} alkyl alcohol derivative.

According to an embodiment of the present disclosure, provided is, a method of controlling pests, said method comprising applying to the plant, or the locus at which the plant is growing or intended to be grown, or the plant propagation material, or the habitat area thereof, an insecticidal composition comprising:

a) imidacloprid;
b) a diluent mixture comprising a disaccharide and an inorganic salt; and
c) at least one salt comprising C_{8-20} alkyl alcohol derivative.

According to an embodiment of the present disclosure, provided is, a method of controlling pests, said method comprising applying to the plant, or the locus at which the plant is growing or intended to be grown, or the plant propagation material, or the habitat area thereof, an insecticidal composition comprising:

a) acetamiprid;
b) a diluent mixture comprising lactose and ammonium sulfate; and
c) sodium salt of sulfuric ester of C_{10-16} alkyl alcohols.

In another aspect of the present disclosure, there is provided a method of increasing yield in a crop by application of the present method using the present insecticidal composition as described herein.

According to an embodiment of the present disclosure, the insecticidal composition provides a formulation which allows the active compounds to be taken up by the target pests/insects.

According to another embodiment, the insecticidal composition of the present disclosure is found to be highly active against a wide variety of chewing, boring and sucking insects in crops.

In an embodiment, the crops can be selected from, but not limited to, cereals, such as wheat, oats, barley, spelt, triticale, rye, maize, millet, rice; crops such as sugarcane, soybean, sunflower, rape, canola, tobacco, sugar beet, fodder beet; tuber crops such as potatoes, sweet potatoes, etc.; crops such as asparagus, hops, etc.; fruit plants such as apples, pears; stone- fruits such as, for example, peaches, nectarines, cherries, plums, apricots; citrus fruits such as oranges, grapefruit, limes, lemons, kumquats, mandarins, satsumas; nuts such as pistachios, almonds, walnuts, pecan nuts; tropical fruits such as mango, papaya, pineapple, dates, bananas etc.; grapes; vegetables such as endives, lettuce, fennel, globe and loose-leaf salad, chard, spinach, chicory, cauliflower, broccoli, Chinese cabbage, kale (winter kale or curly kale), kohlrabi, Brussel sprouts, red cabbage, white cabbage and savoy; fruiting vegetables such as aubergines, cucumbers, paprika, marrow, tomatoes, courgettes, sweetcorn; root vegetables such as celeriac, turnip, carrots, swedes, radishes, horseradish, beetroot, salsify, celery; pulses such as peas, beans, etc.; bulb vegetables such as leeks, onions, etc.; oil crops such as mustard, poppy, olives, sunflowers, coconut, castor oil plants, cocoa beans, groundnuts; fibre crops such as cotton, jute, flex, hemp; crops such as tea, coffee, rubber; ornamentals including shrubs and flowering plants; vines; rangeland; and pastures.

In an embodiment, the target insect pest is a Lepidopteran, a Coleopteran, an orthopteran, a Thysanopteran, a Hemipteran, a Homopteran, or combinations thereof.

In an embodiment, Lepidopteran pest species which negatively impact agriculture include, but are not limited to, *Achoea janata, Adoxophyes spp., Adoxophyes orana, Agrotis spp.* (cutworms), *Agrotis ipsilon* (black cutworm), *Alabama argillacea* (cotton leafworm), *Amorbia cuneana, Amyelosis transitella* (navel orangeworm), *Anacamptodes defectaria, Anarsia lineatella* (peach twig borer), *Anomis sabulifera* (jute looper), *Anticarsia gemmatalis* (velvetbean caterpillar), *Archips argyrospila* (fruittree leafroller), *Archips rosana* (rose leaf roller), *Argyrotaenia* spp. (tortricid moths), *Argyrotaenia citrana* (orange tortrix), *Autographa gamma, Bonagota*

cranaodes, Borbo cinnara (rice leaf folder), *Bucculatrix thurberiella* (cotton leafperforator), *Caloptilia* spp. (leaf miners), *Capua reticulana, Carposina niponensis* (peach fruit moth), *Chilo spp., Chlumetia transversa* (mango shoot borer), *Choristoneura rosaceana* (obliquebanded leafroller), *Chrysodeixis spp., Cnaphalocerus medinalis* (grass leafroller), *Colias spp., Conpomorpha cramerella, Cossus* (carpenter moth), *Crambus spp.* (Sod webworms), *Cydia funebrana* (plum fruit moth), *Cydia molesta* (oriental fruit moth), *Cydia nignicana* (pea moth), *Cydia pomonella* (codling moth), *Darna diducta, Diaphania* spp. (stem borers), Diatraea spp. (stalk borers), *Diatraea saccharalis* (sugarcane borer), *Diatraea graniosella* (southwester corn borer), *Earias spp.* (bollworms), Earias insulata (Egyptian bollworm), *Earias vitella* (rough northern bollworm), *Ecdytopopha aurantianum, Elasmopalpus lignosellus* (lesser *cornstalk borer), Epiphysias postruttana (light brown apple moth), Ephestia spp. (flour moths), Ephestia cautella (almond moth), Ephestia elutella (tobbaco moth), Ephestia kuehniella (Mediterranean flour moth), Epimeces spp., Epinotia aporema, Erionota thrax (banana skipper), Eupoecilia ambiguella (grape berry moth), Euxoa auxiliaris (army cutworm), Feltia spp. (cutworms), Gortyna spp. (stemborers), Grapholita molesta (oriental fruit moth), Hedylepta indicata (bean leaf webber), Helicoverpa spp. (noctuid moths), Helicoverpa armigera (cotton bollworm), Helicoverpa zea (bollworm/corn earworm), Heliothis spp. (noctuid moths), Heliothis virescens (tobacco budworm), Hellula undalis (cabbage webworm), Indarbela spp. (root borers), Keiferia lycopersicella (tomato pinworm), Leucinodes orbonalis (eggplant fruit borer), Leucoptera malifoliella, Lithocollectis spp., Lobesia botrana (grape fruit moth), Loxagrotis spp. (noctuid moths), Loxagrotis albicosta (western bean cutworm), Lymantria dispar (gypsy moth), Lyonetia clerkella (apple leaf miner), Mahasena corbetti (oil palm bagworm), Malacosoma spp. (tent caterpillars), Mamestra brassicae (cabbage armyworm), Maruca testulalis (bean pod borer), Metisa plana (bagworm), Mythimna unipuncta (true armyworm), Neoleucinodes elegantalis (small tomato borer), Nymphula depunctalis* (rice caseworm), *Operophthera brumata* (winter moth), *Ostrinia nubilalis* (European corn borer), *Oxydia vesulia, Pandemis cerasana* (common currant tortrix), *Pandemis heparana* (brown apple

tortrix), *Papilio demodocus, Pectinophora gossypiella* (pink bollworm), *Peridroma* spp. (cutworms), *Peridroma saucia* (variegated cutworm), *Perileucoptera coffeella* (white coffee leafminer), *Phthorimaea operculella* (potato tuber moth), *Phyllocnisitis citrella, Phyllonorycter spp.* (leafminers), *Pieris rapae* (imported cabbageworm), *Plathypena scabra, Plodia interpunctella* (Indian meal moth), *Plutella xylostella* (diamondback moth), *Polychrosis viteana* (grape berry moth), *Prays endocarpa, Prays oleae* (olive moth), *Pseudaletia* spp. (noctuid moths), *Pseudaletia unipunctata* (armyworm), *Pseudoplusia includens* (soybean looper), *Rachiplusia nu, Scirpophaga incertulas, Sesamia* spp. (stemborers), *Sesamia inferens* (pink rice stem borer), *Sesamia nonagrioides, Setora nitens, Sitotroga cerealella* (Angoumois grain moth), *Sparganothis pilleriana, Spodoptera cosmioides* (lepidoptera), Spodoptera spp. (armyworms), Spodoptera exigua (beet armyworm), Spodoptera fugiperda (fall armyworm), Spodoptera oridania eridania (southern armyworm), Spodoptera littoralis, Diaphania nitidalis, Synanthedon spp. (root borers), Thecla basilides, Thermisia gemmatalis, Tineola bisselliella (webbing clothes moth), Trichoplusia ni (cabbage looper), *Tuta absoluta, Yponomeuta spp., Zeuzera coffeae* (red branch borer) and Zeuzera pyrina (leopard moth).

In yet another embodiment, the insect pests are of the order Orthoptera, such as *Anabrus simplex* (Mormon cricket), *Gryllotalpidae* (mole crickets), *Locusta migratoria, Melanoplus* spp. (grasshoppers), *Microcentrum retinerve* (angularwinged katydid), Pterophylla spp. (kaydids), *Chistocerca* gregaria, *Scudderia furcata* (forktailed bush katydid) and *Valanga nigricorni.*

In yet another embodiment, the insect pests are of the order Thysanoptera, such as Frankliniella fusca (tobacco thrips), Frankliniella occidentalis (western flower thrips), Frankliniella shultzei Frankliniella williamsi (corn thrips), *Heliothrips haemorrhaidalis* (greenhouse thrips), *Riphiphorothrips cruentatus, Scirtothrips spp., Scirtothrips citri* (citrus thrips), *Scirtothrips dorsalis* (yellow tea thrips), *Taeniothrips rhopalantennalis* and *Thrips* spp. *Diloboderus abderus* (coleoptera) and *Diabrotica speciosa* (coleoptera).

In an embodiment, Coleopteran insect pests may be selected from but not limited to *Acanthoscelides spp. (weevils), Acanthoscelides obtectus (common bean weevil), Agrilus planipennis (emerald ash borer), Agriotes spp. (wireworms), Anoplophora glabripennis (Asian longhorned beetle), Anthonomus spp. (weevils), Anthonomus grandis (boll weevil), Aphidius spp., Apion spp. (weevils), Apogonia spp. (grubs), Ataenius spretulus (Black Turgrass Ataenius), Atomaria linearis (pygmy mangold beetle), Aulacophore spp., Bothynoderes punctiventris (beet root weevil), Bruchus spp. (weevils), Bruchus pisorum (pea weevil), Cacoesia spp., Callosobruchus maculatus (southern cow pea weevil), Carpophilus hemipteras (dried fruit beetle), Cassida vittata, Cerosterna spp, Cerotoma spp. (chrysomeids), Cerotoma trifurcata (bean leaf beetle), Ceutorhynchus spp. (weevils), Ceutorhynchus assimilis (cabbage seedpod weevil), Ceutorhynchus napi (cabbage curculio), Chaetocnema spp. (chrysomelids), Colaspis spp. (soil beetles), Conoderus scalaris, Conoderus stigmosus, Conotrachelus nenuphar (plum curculio), Cotinus nitidis (Green June beetle), Crioceris asparagi (asparagus beetle), Cryptolestes ferrugineus (rusty grain beetle), Cryptolestes pusillus (flat grain beetle), Cryptolestes turcicus (Turkish grain beetle), Ctenicera spp. (wireworms), Curculio spp. (weevils), Cyclocephala spp. (grubs), Cylindrocpturus adspersus (sunflower stem weevil), Deporaus marginatus (mango leaf-cutting weevil), Dermestes lardarius (la rder beetle), Dermestes maculates (hide beetle), Diloboderus abderus (coleoptera), Diabrotica speciosa (coleoptera), Diabrotica spp. (chrysolemids), Epilachna varivestis (Mexican bean beetle), Faustinus cubae, Hylobius pales (pales weevil), Hypera spp. (weevils), Hypera postica (alfalfa weevil), Hyperdoes spp. (Hyperodes weevil), Hypothenemus hampei (coffee berry beetle), Ips spp. (engravers), Lasioderma serricorne (cigarette beetle), Leptinotarsa decemlineata (Colorado potato beetle), Liogenys futscus, Liogenys suturalis, Lissorhoptrus oryzophilus (rice water weevil), Lyctus spp. (wood beetles/powder post beetles), Maecolaspis joliveti, Megascelis spp., Melanotus communis, Meligethes spp., Meligethes aeneus (blossom beetle), Melolontha (common European cockchafer), Oberea brevis, Oberea linearis, Oryctes rhinoceros (date palm beetle), Oryzaephilus mercator*

(merchant grain beetle), Oryzaephilus surinamensis (sawtoothed grain beetle), Otiorhynchus spp. (weevils), Oulema melanopus (cereal leaf beetle), Oulema oryzae, Pantomorus spp. (weevils), Phyllophaga spp. (May/June beetle), Phyllophaga cuyabana, Phyllotreta spp. (chrysomelids), Phynchites spp., Popillia japonica (Japanese beetle), Prostephanus truncates (larger grain borer), Rhizopertha dominica (lesser grain borer), Rhizotrogus spp. (Eurpoean chafer), Rhynchophorus spp. (weevils), Scolytus spp. (wood beetles), Shenophorus spp. (Billbug), Sitona lineatus (pea leaf weevil), Sitophilus spp. (grain weevils), Sitophilus granaries (granary weevil), Sitophilus oryzae (rice weevil), Stegobium paniceum (drugstore beetle), Tribolium spp. (flour beetles), Tribolium castaneum (red flour beetle), Tribolium confusum (confused flour beetle), Trogoderma variabile (warehouse beetle) and Zabrus tenebioides.

In an embodiment, the insect pests are of the order Hemiptera, such as *Acrosternum hilare (green stink bug), Blissus leucopterus (chinch bug), Calocoris norvegicus (potato mind), Cimex hemipterus (tropical bed bug), Cimex lectularius (bed bug), Diaphorina citri e Tibraca limbativentris (hemíptera), Dagbertus fasciatus, Dichelops furcatus, Dichelops melacanthus, Dysdercus suturellus (cotton stainer), Edessa meditabunda, Eurygaster maura (cereal bug), Euschistus heros, Euschistus servus (brown stink bug), Helopeltis antonii, Helopeltis theivora (tea blight plantbug), Lagynotomus spp. (stink bugs), Leptocorisa oratorius, Leptocorisa varicornis, Lygus spp. (plant bugs), Lygus hesperus (western tarnished plant bug), Maconellicoccus hirsutus, Neurocolpus longirostris, Nezara viridula (southern green stink bug), Paratrioza cockerelli, Phytocoris spp. (plant bugs), Phytocoris californicus, Phytocoris relativus, Piezodorus guildinii, Poecilocapsus lineatus (fourlined plant bug), Psallus vaccinicola, Pseudacysta perseae, Scaptocoris castanea and Triatoma spp.* (bloodsucking conenose bugs/kissing bugs).

In an embodiment, the insect pests are of the order Homoptera, such as *Acrythosiphon pisum (pea aphid), Adelges spp. (adelgids), Aleurodes proletella (cabbage whitefly), Aleurodicus disperses, Aleurothrixus floccosus (woolly*

whitefly), Aluacaspis spp., Amrasca bigutella, Aphrophora spp. (leafhoppers), Aonidiella aurantii (California red scale), Aphis spp. (aphids), Aphis gossypii (cotton aphid), Aphis pomi (apple aphid), Aulacorthum solani (foxglove aphid), Bemisia spp. (whiteflies), Bemisia argentifolii, Bemisia tabaci (sweet potato whitefly), Brachycolus noxius (Russian aphid), Brachycorynella asparagi (asparagus aphid), Brevennia rehi, Brevicoryne brassicae (cabbage aphid), Ceroplastes spp. (scales), Ceroplastes rubens (red bawax scale), Chionaspis spp. (scales), Chrysomphalus spp. (scales), Coccus spp. (scales), Dalbulius maidis (homóptera), substituir Mahanarva fimbriolata, por Mahanarva sp., Dysaphis plantaginea (rosy apple aphid), Empoasca spp. (leafhoppers), Eriosoma lanigerum (woolly apple aphid), Icerya purchasi (cottony cushion scale), Idioscopus nitidulus (mango leafhopper), Laodelphax striatellus (smaller brown planthopper), Lepidosaphes spp., Macrosiphum spp., Macrosiphum euphorbiae (potato aphid), Macrosiphum granarium (English grain aphid), Macrosiphum rosae (rose aphid), Macrosteles quadrilineatus (aster leafhopper), Mahanarva frimbiolata, Metopolophium dirhodum (rose grain aphid), Mictis longicornis, Myzus persicae (green peach aphid), Nephotettix spp. (leafhoppers), Nephotettix cinctipes (green leafhopper), Nilaparvata lugens (brown planthopper), Parlatoria pergandii (chaff scale), Parlatoria ziziphi (ebony scale), Peregrinus maidis (corn delphacid), Philaenus spp. (spittlebugs), Phylloxera vitifoliae (grape phylloxera), Physokermes piceae (spruce bud scale), Planococcus spp. (mealybugs), Pseudococcus spp. (mealybugs), Pseudococcus brevipes (pine apple mealybug), Quadraspidiotus perniciosus (San Jose scale), Rhapalosiphum spp. (aphids), Rhapalosiphum maida (corn leaf aphid), Rhapalosiphum padi (oat bird-cherry aphid), Saissetia spp. (scales), Saissetia oleae (black scale), Schizaphis graminum (greenbug), Sitobion avenae (English grain aphid), Sogatella furcifera (white-backed planthopper), Therioaphis spp. (aphids), Toumeyella spp. (scales), Toxoptera spp. (aphids), Trialeurodes spp. (whiteflies), Trialeurodes vaporariorum (greenhouse whitefly), Trialeurodes abutiloneus (bandedwing whitefly), Unaspis spp. (scales), Unaspis yanonensis (arrowhead scale) and Zulia entreriana.

According to an embodiment of the present disclosure, the insecticidal composition is used as the source of active agrochemical ingredients and will typically be diluted to form end-use formulations, typically spray formulations. The dilution may be with water at from 1 to 10,000, particularly 10 to 1,000, times total weight of the composition to form the spray formulation.

In an embodiment, the spray formulations can be made by simple dilution of the insecticidal compositions.

In another embodiment, the spray formulations can be made by combining individual components used in preparing the insecticidal compositions and water.

Typically, the composition according to the disclosure is applied from a pre-dosage device, a knapsack sprayer, a spray tank, a spray plane, a drone, or an irrigation system. Typically, the insecticidal composition is made up with water, buffer, and/or further auxiliaries to the desired application concentration and the ready-to-use spray liquor or the insecticidal composition according to the disclosure is thus obtained.

According to an embodiment of the present disclosure, a kit of parts comprising an insecticidal composition is provided. The kit comprises a plurality of components, each of which components may include at least one or more of the ingredients of the insecticidal composition of the present disclosure.

In an aspect, the present disclosure provides a kit-of-parts comprising:

a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt in a weight ratio ranging from about 1:2 to about 2:1;
c) at least one alkali metal salt or alkaline earth metal salt of sulfuric ester of C_{8-20} alkyl alcohol;
d) at least one agrochemically acceptable excipient; and

optionally further comprises instructions for use.

In an aspect, the present disclosure provides a kit-of-parts comprising:

a) acetamiprid;
b) lactose and ammonium sulfate in a weight ratio ranging from about 1:2 to about 2:1;
c) sodium salt of sulfuric ester of C_{10-16} alkyl alcohol;
d) at least one agrochemically acceptable excipient; and

optionally further comprises instructions for use.

In one embodiment of the present disclosure, the kits may include one or more, including all, components that may be used to prepare the insecticidal composition. E.g., kits may include a neonicotinoid insecticide, a diluent mixture, and salt of C_{8-20} alkyl alcohol derivative. One or more of the components may already be combined or pre-formulated. In those embodiments where more than two components are provided in a kit, the components may already be combined and as such are packaged in a single container such as a vial, bottle, can, pouch, bag or canister.

In another embodiment, particle size density (PSD) D_{50} of the insecticidal composition is less than about 10 μm.

The composition disclosed throughout the specification is insecticidally active and is stable. It has been found that the combination of disaccharide and inorganic salt provided excellent stability over time and at various temperatures, and even when said insecticidal composition underwent processing of granule such as extrusion. Also, the insecticidal composition obtained has a superior dissolution, and greater attrition resistance and little particle degradation.

In view of the above, it will be seen that the several advantages of the disclosure are achieved, and other advantageous results attained. Although the present

disclosure has been disclosed in full, it will be understood that numerous additional modifications and variations could be made thereto without departing from the scope of the disclosure. The embodiments may be combined together for better understanding of the disclosure, without departing from the scope of the disclosure. In another embodiment, alternative or multiple embodiments of the disclosure disclosed herein are not to be construed as limitations. Each embodiment can be referred to and claimed individually or in any combination with other embodiments of the disclosure. One or more embodiments of the disclosure can be included in, or deleted from, the disclosure for reasons of convenience and/or patentability.

In order that the present disclosure may be more readily understood, reference will now be made, by way of example, to the following description. It will be understood that all tests and physical properties listed have been determined at atmospheric pressure and room temperature (i.e., 25°C), unless otherwise stated herein, or unless otherwise stated in the referenced test methods and procedures.

EXAMPLES:

Example 1: Acetamiprid 50% w/w soluble granule, SG (working example)

The ingredients in Table 1 were used to prepare the insecticidal composition of Example 1.

Table 1

Ingredient	Quantity (% w/w)
Acetamiprid	50.00
Ammonium sulfate	26.34
Lactose mono hydrate (MH)	13.16
Sodium salts of sulfuric esters of C_{10-16} alkyl alcohols	0.50
Anionic surfactant	10.00
Total	100

Process:

Acetamiprid and ammonium sulfate were milled together using an air classifier mill to achieve a particle size density (PSD) D_{50} of less than about 10 µm. This premix was then blended with lactose, sodium salts of sulfuric esters of C_{10-16} alkyl alcohols and an anionic surfactant to obtain a homogenous powder. Approximately 13% water was added to the formulation while mixing, in order to make an extrudable dough. The dough was then extruded through a 0.8 mm screen. The extruded granules were dried using a fluid bed drier at 50°C, until the moisture content was less than about 1%.

Example 2: Acetamiprid 50% w/w soluble granule, SG (working example)

Th ingredients in Table 2 were used to prepare the insecticidal composition of Example 2.

Table 2

Ingredient	**Quantity (% w/w)**
Acetamiprid	50.00
Ammonium sulfate	13.16
Lactose MH	26.34
Sodium salts of sulfuric esters of C_{10-16} alkyl alcohols	0.50
Anionic surfactant	10.00
Total	100

Process:

Acetamiprid, ammonium sulfate, lactose, sodium salts of sulfuric esters of C_{10-16} alkyl alcohols and anionic surfactant were mixed in above quantities and granules were made according to the process of Example 1.

Example 3: Acetamiprid 50% w/w soluble granules, SG (comparative example)

The ingredients in Table 3 were used to prepare the insecticidal composition of Example 3.

Table 3

Ingredient	Quantity (% w/w)
Acetamiprid	50.00
Ammonium sulfate	9.88
Lactose MH	26.62
Sodium salt of sulfuric esters of C_{10-16} alkyl alcohols	0.50
Anionic surfactant	13.00
Total	100

Process:

Acetamiprid, ammonium sulfate, lactose, sodium salts of sulfuric esters of C_{10-16} alkyl alcohols and anionic surfactant were mixed in above quantities and granules were made according to the process of Example 1.

Example 4: Acetamiprid 50% w/w soluble granules, SG (comparative example)

The ingredients in Table 4 were used to prepare the insecticidal composition of Example 4.

Table 4

Ingredient	Quantity (% w/w)
Acetamiprid	50.00
Ammonium sulfate	7.90
Lactose MH	31.6
Sodium salt of sulfuric esters of C_{10-16} alkyl alcohols	0.50
Anionic surfactant	10.00
Total	100

Process:

Acetamiprid, ammonium sulfate, lactose, sodium salts of sulfuric esters of C_{10-16} alkyl alcohols and anionic surfactant were mixed in above quantities and process of Example 1 was followed for preparation, but the process did not result into granule formation.

Example 5: Acetamiprid 50% w/w soluble granules, SG (Comparative example)

The ingredients in Table 5 were used to prepare the insecticidal composition of Example 5.

Table 5

Ingredient	Quantity (% w/w)
Acetamiprid	50.00
Ammonium sulfate	13.16
Lactose MH	26.34
Alkyl naphthalene sulphonate	0.50
Anionic surfactant	10.00
Total	100

Process:

Acetamiprid, ammonium sulfate, lactose, alkyl naphthalene sulfonate and anionic surfactant were mixed in above quantities and process of Example 1 was followed for preparation, but the process did not result into granule formation.

Example 6: Acetamiprid 50% w/w soluble granules, SG (Comparative example)

The ingredients in Table 6 were used to prepare the insecticidal composition of Example 6.

Table 6

Ingredient	Quantity (% w/w)
Acetamiprid	50.00
Ammonium sulfate	13.16
Lactose MH	26.34
Sodium dioctyl sulfosuccinate	0.50
Anionic surfactant	10.00
Total	100

Process:

Acetamiprid, ammonium sulfate, lactose, sodium dioctyl sulfosuccinate and anionic surfactant were mixed in above quantities and process of Example 1 was followed for preparation, but the process did not result into granule formation.

Example 7: Stability Study

Composition of Examples 1 to 4 were evaluated on the physico-chemical parameters to assess the performance of the insecticidal compositions prepared according to the present disclosure.

In composition of Example 1, extrudable dough was made and passed through the extruder. Granules showed less than about 1% loss on drying. In measuring the dissolution rate, about 0.06 g of granules were added to 100 ml tap water in 100 ml glass cylinder. A stopper was then fitted before inverting every 2 seconds until fully dissolved. Dissolution of the composition of Example 1 observed was in the acceptable range. Persistent foam was under control i.e., less than about 10 ml. The pH of the composition remained in the acceptable range from about 4 to about 6. The granules showed excellent attrition resistance of more than about 99%.

Similarly, in the composition of Example 2, granules showed less than about 1% loss on drying. Dissolution was observed to be within the acceptable range. Persistent foam was under control i.e., less than about 10 ml. The pH of the composition remained in the acceptable range from about 4 to about 6. The granules showed excellent attrition resistance of more than about 99% [Table 7, Figure 1(A) and Figure 1(B)].

In the composition of Example 3, which was formed by combining ammonium sulfate and lactose in about 1:3 weight ratio, less compaction of granules was seen therefore granules took long extrusion time. While assessing physico-chemical parameters, the granules showed acceptable loss on drying, dissolution profile, pH, foam and attrition resistance. But dustiness was observed in the extruded granules

and hence it could not meet the quality control (QC) specification and failed during QC check.

Similarly, in the composition of Example 4, which was formed by combining ammonium sulfate and lactose in about 1:4 weight ratio, less compaction of granules was seen therefore granules took long extrusion time. While assessing physico-chemical parameters, the granules showed acceptable loss on drying, dissolution profile, pH, foam and attrition resistance. But clumps were observed in the extruded granules and hence it could not meet the quality control (QC) specification and failed during QC check [Table 7, Figure 2(A) and Figure 2(B)].

Furthermore, the compositions of Example 5 and Example 6 were prepared by replacing sodium salt of sulfuric esters of C_{10-16} alkyl alcohols with alkyl naphthalene sulphonate in Example 5 and with sodium dioctyl sulfosuccinate in Example 6. In the Example 5, granules did not extrude well and whenever handled they were very fragile, which led to breaking of the granules. Drying was attempted and large clumps were formed. This composition failed and was not placed on storage. Similarly, in Example 6, granules did not extrude well and whenever handled they were very fragile, which led to breaking of the granules. Drying was not attempted and granulation was not successful. This recipe failed and was not placed on storage [Table 7, Figure 3(A) and Figure 3(B)].

Table 7

Ingredients	**Working Example 1**		**Working Example 2**		**Comparative Example 3**		**Comparative Example 4**	
	Quantity (% w/w)							
Acetamiprid assay (% w/w)	0 day	14 days AHS	0 day	14 days AHS	0 day	14 days AHS	0 day	14 days AHS
Loss on drying (%)	0.98	0.62	0.44	0.39	0.50	0.42	0.68	0.64

Dissolution rate (number of inversions)	8	35	8	4	3	4	4	5
Persistent Foam, after 1 minute (ml)	4	10	7.5	8	12.5	8.5	10	10
pH (1% dilution)	5.5	4.3	5.1	5	4.9	5	5.2	4.7
Dilution Stability Sample Mass	0.17	0.16	0.18	0.17	0.18	0.17	0.16	0.17
Attrition Resistance (%) (ambient)	99.83		99.52		99.6		99.8	
Conclusion	Passed the specification		Passed the specification		Dustiness observed in extruded granules		Clumps observed in extruded granules	

Therefore, inventors of the present disclosure successfully developed stable insecticidal composition of neonicotinoid insecticide. The composition was found to be stable in various assessment parameters. The composition also showed good dissolution profile and better attrition resistance. The presence of diluent mixture comprising a disaccharide and an inorganic salt in combination with at least one salt of C_{8-20} alkyl alcohol derivative assisted in forming the granules and imparted desired stability.

We claim:

1. An insecticidal composition comprising:
   a) a neonicotinoid insecticide;
   b) a diluent mixture comprising a disaccharide and an inorganic salt; and
   c) at least one salt comprising C_{8-20} alkyl alcohol derivative.

2. The composition as claimed in claim 1, wherein the neonicotinoid insecticide is selected from the group comprising acetamiprid, clothianidin, imidacloprid, nitenpyram, nithiazine, thiacloprid, thiamethoxam, or combinations thereof.

3. The composition as claimed in claim 1, wherein the disaccharide is selected from the group comprising lactose, sucrose, maltose, or combinations thereof.

4. The composition as claimed in claim 1, wherein the inorganic salt is selected from the group comprising ammonium sulfate, sodium sulfate, ammonium bicarbonate, sodium bicarbonate, magnesium sulfate, hydrogen carbonate, sodium chloride, sodium citrate, ammonium citrate, sodium acetate bentonite, aluminium chloride, citric acid, succinic acid, or combinations thereof.

5. The composition as claimed in claim 1, wherein the diluent mixture comprises the disaccharide and the inorganic salt in a weight ratio ranging from about 1:2 to about 2:1.

6. The composition as claimed in claim 1, wherein the salt comprising C_{8-20} alkyl alcohol derivative is selected from alkali metal salt or alkaline earth metal salt of C_{8-20} alkyl alcohol derivative.

7. The composition as claimed in claim 1, wherein the C_{8-20} alkyl alcohol derivative is an ester.

8. The composition as claimed in claim 7, wherein the C_{8-20} alkyl alcohol derivative is a sulfuric ester.

9. The composition as claimed in claim 7, wherein the C_{8-20} alkyl alcohol derivative is a sulfuric ester of C_{10-16} alkyl alcohol.

10. The composition as claimed in claim 1, wherein the composition comprises:
    a) about 1% w/w to about 70% w/w neonicotinoid insecticide;
    b) about 0.1% w/w to about 50% w/w diluent mixture comprising the disaccharide and the inorganic salt; and
    c) about 0.01% w/w to about 10% w/w salt comprising C_{8-20} alkyl alcohol derivative, of total weight of the composition.

11. The composition as claimed in claim 1, wherein the composition comprises:
    a) about 10% w/w to about 70% w/w acetamiprid;
    b) about 10% w/w to about 40% w/w diluent mixture comprising lactose and ammonium sulfate in the weight ratio from about 1:2 to about 2:1; and
    c) about 0.1% w/w to about 10% w/w sodium salt of sulfuric ester of C_{10-16} alkyl alcohol, of total weight of the composition.

12. The composition as claimed in claim 1, wherein the composition is in a form of soluble granules or water dispersible granules.

13. The composition as claimed in claim 12, wherein attrition resistance of the soluble granules is more than about 98%.

14. A process of preparing an insecticidal composition, the process comprising:

(a) mixing a neonicotinoid insecticide, a diluent mixture comprising a disaccharide and an inorganic salt, and at least one salt comprising C_{8-20} alkyl alcohol derivative to obtain a mixture,
(b) adding water to the mixture and extruding the mixture to form granules; and
(c) drying the granules to obtain the insecticidal composition.

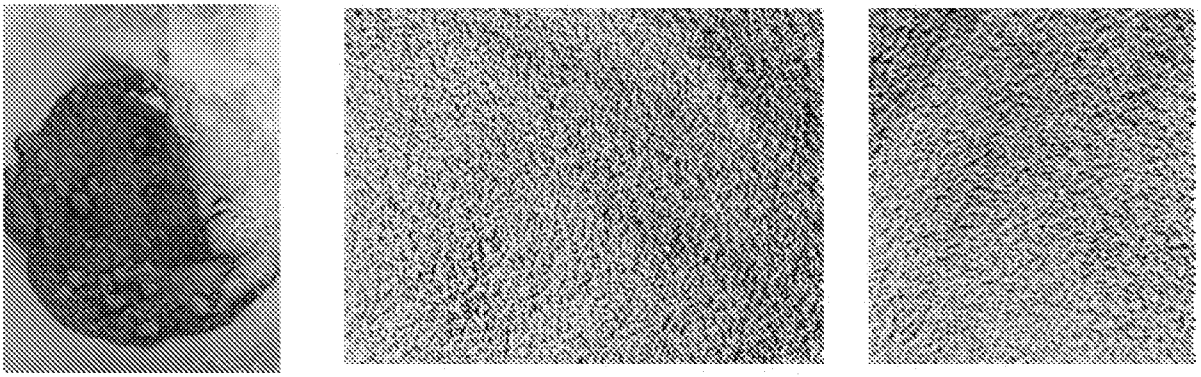
15. The process as claimed in claim 14, wherein said process comprises:
(a) mixing acetamiprid, lactose, ammonium sulfate and sodium salt of sulfuric ester of C_{10-16} alkyl alcohol to obtain a mixture;
(b) adding water to the mixture and extruding the mixture to form granules; and
(c) drying the granules to obtain the insecticidal composition.

16. A method of controlling pests by applying to a plant, or locus at which the plant is growing or intended to be grown, or a plant propagation material, or a habitat area thereof, an insecticidal composition comprising:
a) a neonicotinoid insecticide;
b) a diluent mixture comprising a disaccharide and an inorganic salt; and
c) at least one salt comprising C_{8-20} alkyl alcohol derivative.

17. The method as claimed in claim 16, wherein said insecticidal composition comprises:
a) acetamiprid;
b) a diluent mixture comprising lactose and ammonium sulfate; and
c) sodium salt of sulfuric ester of C_{10-16} alkyl alcohol.

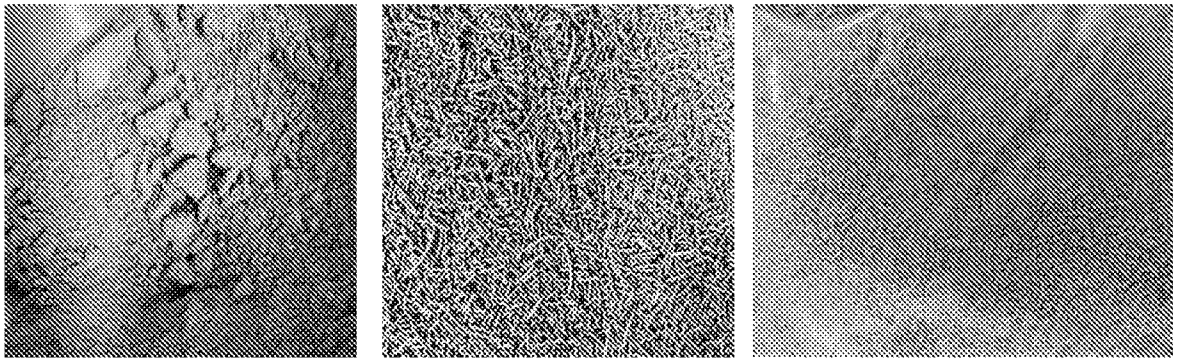
18. Use of the insecticidal composition as claimed in claim 1, for controlling pests.

DRAWINGS:



1(A)

1(B)



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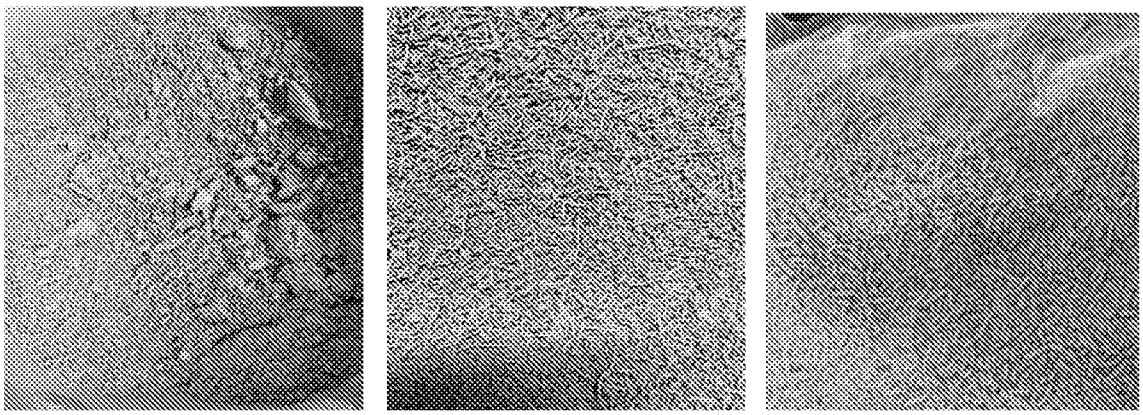
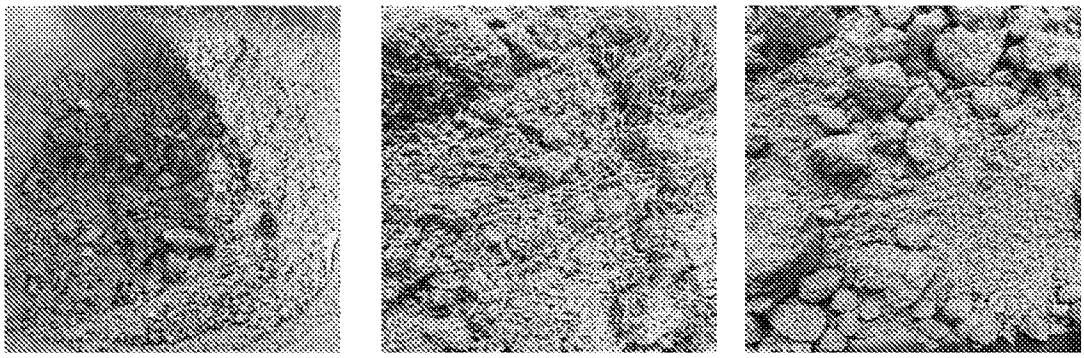


2(B)



3(A)

3(B)

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2023/051101

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01N25/12 A01P7/04
ADD.

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)
A01N A01P

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)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 104 430 485 A (SHANDONG WEIFANG RAINBOW CHEM) 25 March 2015 (2015-03-25)	1-14,16, 18
Y	Technical Field; claims 1, 6, 7, 9, 10 examples 1-5	15,17
X	CN 1 775 028 A (HEBEI WEIYUAN BIOCHEMICAL CO L [CN]) 24 May 2006 (2006-05-24)	5
Y	claims 1, 2	15,17

☐ Further documents are listed in the continuation of Box C.

☒ 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
4 July 2023	12/07/2023

Name and mailing address of the ISA/	Authorized officer
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1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2023/051101

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 104430485 A	25-03-2015	NONE	
CN 1775028 A	24-05-2006	NONE	