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(73) Titulaire(s) :

UPL LIMITED,
UPL House, 610 B/2,
Bandra Village, off Western
Express Highway, Bandra-East,
MUMBAI 400051 (IN)

(72) Inventeur(s) :

SARAPH, Sanjay (IN);
BHOGE, Satish Ekanath (IN)

(74) **Mandataire : S.C.P AKKUM, AKKUM & Associates, No. 1777, rue 6.261, Yaoundé 2, Auditorium Jean Paul II boulevard, Face Brigade de Gendarmerie, Mbankolo, B.P. 4966, YAOUNDE (CM).**

(54) **Titre : A tank mix compatible composition.**

(57) **Abrégé :**

A composition includes a dithiocarbamate fungicide, a salt thereof, a derivative thereof, or a combination thereof. Also disclosed are a process of preparing the tank mix compatible composition and a method of controlling a fungal disease in a crop or a locus thereof with said composition.

TITLE: A TANK MIX COMPATIBLE COMPOSITION

Field of the invention

The present disclosure relates to a tank mix compatible composition, and in particular, to a tank mix compatible composition comprising a dithiocarbamate fungicide. The present disclosure also relates to a process for preparing the tank mix compatible composition and a method of controlling a fungal disease using the tank mix compatible composition.

Background of the Invention:

Dithiocarbamate compounds such as ethylene bisdithiocarbamate (EBDC) fungicides, are generally known to have effective fungicidal activity. EBDC fungicides are important plant protection substances used for broad-spectrum fungal disease control because of their high tolerance by crop plants and general usefulness for controlling fungal plant diseases which are resistant to certain fungicides that are only active at a single target site in the fungus.

Mancozeb is a broad spectrum fungicide and member of the EBDC class of fungicides, and can be formulated as both solid and liquid formulations. However, there are disadvantages associated with solid mancozeb formulations such as poor dispersion, low suspensibility, and poor wettability of fungicide, as well as ineffective coverage when the formulation is applied on crops.

Liquid formulations address some of the shortcomings of the solid mancozeb formulations. The liquid products have the advantages of good miscibility, easy handling, good efficacy, and effective application onto crops.

Mancozeb is frequently formulated as oil dispersion (OD). The agrochemical oil dispersions (OD) are stable suspensions of agrochemical active ingredients, such as pesticides and crop protection chemicals, in non-aqueous fluids, which may contain other dissolved active ingredients. Oil dispersions are particularly useful for formulating oil insoluble solid active ingredients. Oil dispersion formulations are a concentrate which is diluted with water before use to produce an aqueous composition which is used in crop protection.

Oil dispersion formulations provide certain advantages to the farmer. Active ingredients which are usually unstable in water can be formulated as suspended form. Oil-based adjuvants may also be combined with these types of formulations in order to enhance efficacy. Further, suspension of active ingredients in non-aqueous liquid carrier can possibly lead to higher active ingredient strength formulations than would otherwise be possible. Dithiocarbamates have also been formulated as oil dispersions (OD). A disadvantage of existing oil dithiocarbamate dispersion formulations is their propensity for phase separation during storage. This problem is further exacerbated when formulators try to achieve increased loading of dithiocarbamate based active ingredients in the formulation. For example, storage of such high loading formulations, even at ambient temperatures, leads to aggregation, lump formation or pronounced settling of the suspended phase. Depending on the density of the active ingredient and of the nonaqueous liquid carrier used, it is also possible for the active ingredient particles to separate from the non-aqueous liquid carrier. In some cases, the effects are irreversible. Another disadvantage is the compatibility of the oil dispersion with other tank mix partners. Due to its susceptible nature in the presence of other chemicals, and with changing environments, the application of an oil dispersion including a dithiocarbamate in combination with other tank-mix partners can be difficult.

Various methods have been evaluated for handling phase separation in a dithiocarbamate oil dispersion.

WO2009/00428 describes the use of a thickener to prepare physically stable oil dispersion. The thickeners include organoclays such as smectite, hectorite or montmorillonite clays, which are organophilic and thus compatible with non-aqueous formulations.

WO 2012/167321 is directed to an agricultural oil-based suspension formulation comprising an active ingredient suspended as a finely divided form in an oil and at least one unsaturated rubber-type copolymer comprising at least styrene as a residue.

WO 2012/167322 is directed to an agricultural oil-based suspension formulation comprising an active ingredient suspended as finely divided form in an oil, and at least one surfactant selected from a polyalkylene glycol-fatty acid condensate or a polyalkylene glycolether fatty acid condensate.

WO 2012/080208 is directed to a method of preparing an agrochemical oil dispersion comprising a thickener. The thickener is an amide obtained by reacting a polyhydroxystearic acid with diethylene triamine and/or triethylene tetramine.

WO 2014/169363 is directed to agrochemical formulations that comprise at least one active ingredient suspended in an oil phase, a dispersant, a clay-based rheological additive, a cellulose-derived rheological additive, an emulsifier, and optionally at least one additional active ingredient solubilized in the oil phase.

However, there remains a need for a stable oil dispersion concentrate including a dithiocarbamate fungicide which overcomes phase separation challenges, especially when a formulation including a high concentration, i.e., a high loading, of dithiocarbamate is desired in addition to a wider spectrum of tank mix compatibility.

Objectives of the Invention:

An object of the present disclosure is to provide tank mix compatible composition including a dithiocarbamate fungicide.

Another object of the present disclosure is to provide tank mix compatible composition including a high concentration (loading) of a dithiocarbamate fungicide.

Yet another object of the present disclosure is to provide a process of preparing tank mix compatible composition of high loading dithiocarbamate fungicide.

Still another object of the present disclosure is to provide a method of controlling a fungal disease in a crop or a locus therein which comprise applying an agrochemically effective amount of the disclosed tank mix compatible composition to the crop or the locus thereof.

Further object of the present invention is to use tank mix compatible composition of high loading dithiocarbamate fungicide in controlling pests.

Summary of the invention:

In an aspect, the present invention provides a tank mix compatible composition comprising:

a dithiocarbamate fungicide, a salt thereof, a derivative thereof, or a combination thereof;

at least two non-ionic surfactants each having an HLB value of greater than 6; and at least two anionic surfactants.

In another aspect, disclosed herein is a process of preparing tank mix compatible composition comprising:

combining at least two non-ionic surfactants each having an HLB value of greater than 6 and optionally an auxiliary ingredient to obtain a mixture;

adding at least two anionic surfactants to the mixture to obtain a pre-mix, and

adding a dithiocarbamate fungicide to the pre-mix with continuous stirring to obtain the tank mix compatible composition.

In yet another aspect, disclosed herein is a method of controlling a fungal disease in a crop or a locus thereof, comprising applying an agrochemically effective amount of the tank mix compatible composition disclosed herein to the crop or the locus thereof.

In another aspect, disclosed herein is the use of the present tank mix compatible composition to control a wide range of fungal diseases.

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

DETAIL DESCRIPTION OF THE INVENTION:

The present invention now will be described hereinafter with reference to the accompanying drawings and examples, in which embodiments of the invention are shown. This description is not intended to be a detailed catalogue of all the different ways in which the invention may be implemented, or all the features that may be added to the instant invention. 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 invention contemplates that in some embodiments of the invention, 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 invention. Hence, the following descriptions are intended to illustrate some particular embodiments of the invention, and not to exhaustively specify all permutations, combinations and variations thereof.

The use of the terms "a" and "an" and "the" and similar referents (especially in the context of the following claims) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. The terms first, second etc. as used herein are not meant to denote any particular ordering, but simply for convenience to denote a plurality of, for example, layers. The terms "comprising", "having", "including", and "containing" are to be construed as open-ended terms (i.e., meaning "including, but not limited to") unless otherwise noted. "About" or "approximately" as used herein is 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. 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 invention and does not pose a limitation on the scope of the invention unless otherwise claimed. No language in the specification should be construed as indicating any non-claimed element as essential to the practice of the invention as used herein.

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 invention belongs. The terminology used in the description of the invention herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention.

As used herein, the term 'tank mix' means the addition of at least one agrochemical active ingredient to a spray medium, such as water or oil, at the point of use.

As used herein, the term 'tank mix compatible' composition means a composition that can be mixed with other tank mix partners without altering the physicochemical characteristics of itself or the tank mix partner.

The agrochemical oil dispersions (OD) disclosed herein are stable suspensions of agrochemical active agents (e.g., pesticides, crop protection chemicals) in a non-aqueous fluid (oil), and which may contain other dissolved ingredients. Oil dispersions are particularly useful for formulating oil insoluble, solid active agents.

A "tank mix compatible composition" refers to a concentrated oil dispersion formulation which is diluted with water to produce an aqueous based composition prior to its application to a crop.

As used herein, "effective amount" is an amount of active ingredient, such as the disclosed dithiocarbamate fungicide, which has an adverse effect on a fungus and/or which prevents a fungal disease in a plant. The adverse effect can include killing of the fungus (fungicidal), preventing growth of the fungus, blocking of biosynthetic pathway(s), or a combination thereof.

As used herein, an "agriculturally acceptable salt", or a salt of a dithiocarbamate fungicide, means a salt which is known and accepted for use in agricultural or horticultural applications.

"Alkyl" as used herein means a straight or branched chain saturated aliphatic hydrocarbon having the specified number of carbon atoms, specifically 1 to 12 carbon atoms, more specifically 1 to 6 carbon atoms. Alkyl groups include, for example, groups having from 1 to 50 carbon atoms (C1 to C50 alkyl).

The term "locus" as used herein refers to the vicinity, area, or place in which the plants are growing, where plant propagation materials of the plants are sown, and/or where the plant propagation materials of the plants will be placed into the soil. Unless otherwise specified, the locus includes the soil in which the plant is growing or is intended to be grown.

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 other parts of plants, germinated plants, and/or young plants which are

to be transplanted after germination or emergence from the soil. These young plants may be protected prior to transplantation by a total or partial immersion treatment/system.

The term "disease control" of "controlling of a disease" as it relates to fungal diseases herein, refers to the treatment and prevention of a disease. Controlling effects include deviation from natural development of the disease, for example, killing of the fungal agent, retardation of disease development, and decrease in amount of the fungal disease.

The term "plant" encompasses all of the physical parts of a plant, including for example, seeds, seedlings, saplings, roots, tubers, stems, stalks, foliage, and fruits. A "crop" refers to a plurality of plants.

Surprisingly, inventors of the present invention found that a formulation including a high concentration (i.e., loading) of a dithiocarbamate fungicide can be attained when the dithiocarbamate fungicide is combined with at least two non-ionic surfactants having a hydrophilic-lipophilic balance (HLB) value of greater than 6 and at least two anionic surfactants. Such high loading dithiocarbamate fungicide compositions comprising the at least two non-ionic surfactants and the at least two anionic surfactants exhibit excellent compatibility with a greater number of tank mix partners. The high loading dithiocarbamate fungicide compositions also demonstrate increased storage stability and dilution stability, as well as tank mix compatibility.

The tank mix compatible composition of the present disclosure comprises greater than 400 g/L, or more than 500 g/L, or more than 600 g/L of the dithiocarbamate fungicide, a salt thereof, a derivative thereof, or a combination thereof.

According to an embodiment, a composition comprises:

a dithiocarbamate fungicide, a salt thereof, a derivative thereof, or combination thereof;

at least two non-ionic surfactants each having an HLB value of greater than 6; and

at least two anionic surfactants.

According to an embodiment, the dithiocarbamate fungicide comprises azithiram, carbamorph, cufraneb, cuprobam, disulfiram, ferbam, metam, nabam, tecoram, thiram, ziram, dazomet, mancopper, mancozeb, maneb, metiram, propineb, zineb, a salt thereof, a derivative thereof, or a combination thereof.

According to an embodiment, the dithiocarbamate fungicide mancozeb.

According to an embodiment of the present invention, the dithiocarbamate fungicide maneb.

According to an embodiment of the present invention, the dithiocarbamate fungicide zineb.

According to an embodiment, the tank mix compatible composition comprises from about 40% w/w to about 90% w/w, or from about 50% w/w to about 80% w/w, or from about 60% w/w to about 70% w/w of the dithiocarbamate fungicide based on the total weight of the tank mix compatible composition.

According to an embodiment, a tank mix compatible composition comprises at least two non-ionic surfactants each having an HLB value of greater than 6.

According to an embodiment, examples of the at least two non-ionic surfactants comprise an alkyl polyethylene glycol ether, oxo alcohol ethoxylate, a C_{10}-Guerbet alcohol ethoxylate comprising 3-9 ethylene oxide (EO) units (for example, a C_{10}-Guerbet alcohol ethoxylate comprising 4EO, and a C_{10}-Guerbet alcohol ethoxylate comprising 5EO), a C_{10}-Guerbet alcohol comprising 3-9 EO units (for example C_{10}-Guerbet alcohol comprising 3EO, and C_{10}-Guerbet alcohol comprising 4EO), C_{10}-Guerbet alcohol comprising 5EO, a C_{13}-C_{15} oxo alcohol comprising 2-20 EO units (for example C_{13} oxo alcohol comprising 3-10 EO units, C_{13} oxo alcohol comprising 3EO, C_{13} oxo alcohol comprising 4EO, and C_{13} oxo alcohol comprising 5EO), an alkyl alkoxylate, an ethylene oxide/propylene oxide diblock copolymer, an alkyl initiated ethylene oxide/propylene oxide monoblock copolymer, a sorbitan derivative (for example polyoxyethylene monooleate (PEG 400 monoleate), polyoxyethylene monostearate (PEG 400 Monostearate), polyoxyethylene monolaurate (PEG 400 Monolaurate), sodium oleate, triethanolamine oleate, polyoxyethylene sorbitan monolaurate, polyoxyethylene sorbitan monolaurate, polyoxyethylene sorbitan monopalmitate, polyoxyethylene sorbitan monostearate, polyoxyethylene sorbitan tristearate, polyoxyethylene sorbitan monooleate, and polyoxyethylene sorbitan trioleate), or a combination thereof.

According to an embodiment, the tank mix compatible composition comprises from about 1% w/w to about 30% w/w, or from about 2% w/w to about 25% w/w, or from about 3% to about 20% w/w of the at least two non-ionic surfactants based on the total weight of the tank mix compatible composition.

According to an embodiment, the tank mix compatible composition comprises at least two anionic surfactants.

According to an embodiment, the at least two anionic surfactants comprise a carboxylic acid-containing type surfactant, a sulfate-containing surfactant, a sulfonic acid-containing surfactant, a phosphate-containing surfactant, or a combination thereof.

According to an embodiment, the tank mix compatible composition comprises at least two anionic surfactants selected from the following group of surfactants:

a. Carboxylic acid containing surfactants, including for example, carboxylic acids such as polyacrylic acid, polymethacrylic acid, polymaleic acid, a copolymer of maleic acid and an olefin (such as isobutylene and/or diisobutylene), copolymer of acrylic acid and itaconic acid, copolymer of methacrylic acid and itaconic acid, copolymer of maleic acid and styrene, copolymer of acrylic acid and methacrylic acid, copolymer of acrylic acid and methyl acrylate, copolymer of acrylic acid and vinyl acetate, copolymer of acrylic acid and maleic acid, an N-methyl-(C_{12}-C_{18} fatty acid) sarcosinate, resin acid, a C_{12}-C_{18} fatty acid, salts thereof, or a combination thereof.

b. Sulfate containing surfactants, including, for example sulfates such as (C_{12}-C_{18} alkyl) sulfates, polyoxyethylene (C_{12}-C_{18} alkyl) ether sulfates, polyoxyethylene ((mono- or di-) C_8-C_{12} alkyl)phenyl ether sulfates, sulfates of polyoxyethylene ((mono- or di-) C_8-C_{12} alkyl)phenyl ether polymers, polyoxyethylene (mono-, di- or tri-)phenyl phenyl ether sulfates, polyoxyethylene (mono-, di- or tri-)benzyl phenyl ether sulfates, polyoxyethylene (mono-, di- or tri-)styryl phenyl ether sulfates, sulfates of polyoxyethylene (mono-, di- or tri-) styryl phenyl ether polymers, sulfates of polyoxyethylene polyoxypropylene block copolymers, sulfonated oil, sulfated fatty acid esters, sulfated fatty acids, sulfated olefins, salts thereof, or a combination thereof.

c. Sulfonic acid containing surfactants including, for example sulfonic acids such as (C_{12}-C_{22} paraffin)sulfonic acids, (C_8-C_{12} alkyl)benzenesulfonic acids, formalin condensates of (C_8-C_{12} alkyl)benzenesulfonic acids, formalin condensates of cresol sulfonic acid, (α-olefin(C_{14}-C_{16}))sulfonic acids, di(C_8-C_{12} alkyl)sulfosuccinic acids, lignin sulfonic acid, polyoxyethylene ((mono- or di-) C_8-C_{12} alkyl)phenyl ether sulfonic acids, polyoxyethylene (C_{12}-C_{18} alkyl)ether sulfosuccinic acid half esters, naphthalenesulfonic acid, ((mono- or di-) C_1-C_6alkyl) naphthalenesulfonic acids, formalin condensate of naphthalenesulfonic acid,

formalin condensates of ((mono- or di-)C1-C6 alkyl)naphthalenesulfonic acids, formalin condensate of creosote oil sulfonic acid, (C_8-C_{12} alkyl)diphenyl ether disulfonic acids, sodium N-methyl-n-oleoyltaurate (e.g. IGEPON® T;), polystyrene sulfonic acid, copolymer of styrenesulfonic acid and methacrylic acid, salts thereof, or a combination thereof.

d. Phosphate containing surfactants including, for example phosphates such as (C_8C_{12} alkyl)phosphates, polyoxyethylene (C_{12}-C_{18} alkyl) ether phosphates, polyoxyethylene ((mono- or di-) C_8-C_{12} alkyl) phenyl ether phosphates, phosphates of polyoxyethylene ((mono-, di- or tri-) C_8-C_{12} alkyl)phenyl ether polymers, polyoxyethylene (mono-, di- or tri-)phenyl phenyl ether phosphates, polyoxyethylene (mono-, di- or tri-)benzyl phenyl ether phosphates, polyoxyethylene (mono-, di- or tri-)styryl phenyl ether phosphates, phosphates of polyoxyethylene (mono-, di- or tri-)styryl phenyl ether polymers, phosphates of polyoxyethylene polyoxypropylene block polymers, phosphatidyl choline, phosphatidyl ethanolamine, condensed phosphoric acid (such as tripolyphosphoric acid), salts thereof, or a combination thereof.

The salts in (a) to (d) above include alkali metals (such as lithium, sodium and potassium), alkaline earth metals (such as calcium and magnesium), ammonium, and amines (such as alkylamines, cycloalkylamines and alkanolamines).

According to an embodiment, the at least two anionic surfactants comprise polyalkoxylated surfactants (such as tristryl phenol ethoxylate), for example polyethoxylated surfactants which are ionically modified, for example by conversion of the terminal free hydroxyl function of the alkylene oxide block into a sulfate or phosphate ester (such as sulfated polyaryl phenol ethoxylates ammonium salt); alkali metal and alkaline earth metal salts of alkylarylsulfonic acids having a straight-chain or branched alkyl chain; alkali metal and alkaline earth metal salts of paraffin-sulfonic acids such as chlorinated paraffin-sulfonic acids; polymeric ester of isotridecyl ethylene glycol and phosphoric acid (e.g., Hostaphat 1306, also known as phosphate ester); polyelectrolytes, such as lignosulfonates; condensates of naphthalenesulfonate and formaldehyde; polystyrenesulfonate or sulfonated unsaturated or aromatic polymers; anionic esters of alkylpolyglycosides, such as alkylpolyglucoside sulfosuccinate or alkylpolyglucoside citrate; sulfosuccinates which are esterified once or twice with linear, or branched aliphatic,

cycloaliphatic and/or aromatic alcohols, or sulfosuccinates which are esterified once or twice with (poly)alkylene oxide adducts of alcohols.

In an embodiment, the at least two anionic surfactants comprise, for example, a salt of an alkylarylsulfonic acid, a salt of a sulfosuccinic acid, a polyelectrolyte from the polycondensation of naphthalenesulfonate and formaldehyde, or a combination thereof.

According to an embodiment of the present invention, the tank mix compatible composition comprises from about 1% w/w to about 30% w/w, or from about 2% w/w to about 25% w/w, or from about 3% to about 20% of the at least two anionic surfactants based on the total weight of the tank mix compatible composition.

According to an embodiment, the tank mix compatible composition may further include one or more agrochemically acceptable auxiliary ingredients such as adjuvants. In an embodiment, the tank mix compatible composition further includes an adjuvant selected from wetting agents, oil, thickeners, fertilizers, dispersing agents, compatibility agents, stabilizers, defoamers, antimicrobial agents, antioxidants, correctives, and spray colorants (dyes).

According to an embodiment, the tank mix compatible composition further comprises a wetting agent selected from soaps; salts of aliphatic monoesters of sulphuric acid including but not limited to, sodium lauryl sulphate; sulfoalkylamides and salts thereof including but not limited to N-methyl-N-oleoyltaurate Na salt; alkylarylsulfonates including but not limited to alkylbenzenesulfonates; alkylnaphthalenesulfonates and salts thereof; and salts of ligninsulfonic acid.

According to an embodiment, the tank mix compatible composition further comprises a dispersing agent having a low HLB value (e.g., HLB of less than 6) selected from ethoxylated isotridecanol, a polymeric ester dispersant (e.g., ATLOX® 4916, ATLOX® 4912 or ATLOX® 4914; Croda), a modified styrene acrylic copolymer dispersant (e.g., ATLOX® Metasperse 550S, ATLOX® Metasperse 500L, or ATLOX® Metasperse), glycol distearate, sorbitan trioleate, propylene glycol isostearate, glycol stearate, sorbitan sesquioleate, glyceryl stearate, lecithin, steareth-2, oleth-2, glyceryl laurate, ceteth-2, PEG-30 dipolyhydroxystearate, glyceryl stearate SE, sucrose cocoate, methyl glucose sesquistearate, and lecithin.

According to an embodiment, the tank mix compatible composition further comprises a rheological modifier (thickener) selected from organically modified hectorite clays such as BENTONE® 38 and SD3; organically modified bentonite clays, such as BENTONE® 34, SD1 and SD2; organically modified sepeolite such as PANGEL® B20, hydrophilic silica such as AEROSIL® 200, hydrophobic silica such as AEROSIL® R972, R974 and R812S; attapulgite such as ATTAGEL® 50; or organic rheological modifiers based on modified castor oil such as THIXCIN® R and THIXATROL® ST.

According to an embodiment, the tank mix compatible composition further comprises a stabilizer derived from an organic acid, for example a C_8-C18 fatty acid such as oleic acid, stearic acid, myristic acid, palmitic acid, lauric acid, and polyhydroxystearic acid.

According to an embodiment, the tank mix compatible composition comprises a diluent which does not dissolve the active ingredient enough to cause crystal growth or physical instability. The diluent is selected from paraffin oil, such as a kerosene, mineral oil for example, one of the EXXSOL® D range available from Exxon Chemical and more preferably, EXXSOL® D130; PROPAR®12 available from Caltex; and HYDROSEAL® G250H available from Total. Seed oil esters, such as methyl and ethyl oleate, methyl and ethyl soyate and their corresponding fatty acids are also suitable. Aromatic hydrocarbons, such as alkyl benzenes and alkylnaphthalenes, polyalkylene glycol ethers, fatty acid diesters, fatty alkylamides and diamides, dialkylene carbonates, ketones and alcohols may also be suitable.

According to an embodiment, the tank mix compatible composition comprises a defoamer selected from silicone-based compounds, alcohols, glycol ethers, mineral spirits, acetylene diols, polysiloxanes, organosiloxanes, siloxane glycols, reaction products of silicon dioxide and organosiloxane polymer, polydimethylsiloxanes, polyalkylene glycols, or a combination thereof. Defoamers that are suitable includes Silcolapse-O and SAG-1572.

According an embodiment, the tank mix compatible composition is formulated as an oil dispersion (OD).

According to an embodiment, the tank mix compatible composition comprises from about 40% w/w to about 99% w/w dithiocarbamate fungicide, from about 1% w/w to about 30% w/w of the at least two non-ionic surfactants having an HLB of greater than 6, and

from about 1% w/w to about 25% w/w of the at least two anionic surfactants, based on the total weight of the tank mix compatible composition.

According to an embodiment, the tank mix compatible composition comprises from about 45% w/w to about 99% w/w dithiocarbamate fungicide, from about 1% w/w to about 30% w/w of the at least two non-ionic surfactants having an HLB of greater than 6, and from about 1% w/w to about 30% w/w of the at least two anionic surfactants, based on the total weight of the tank mix compatible composition.

According to an embodiment, the tank mix compatible composition comprises from about 45% w/w to about 99% w/w dithiocarbamate fungicide, from about 5% w/w to about 25% w/w of the at least two non-ionic surfactants having an HLB greater than 6, and from about 5% w/w to about 25% w/w of the at least two anionic surfactants, based on the total weight of the tank mix compatible composition, and wherein the tank mix compatible composition is in the form of liquid composition.

According to an embodiment, the tank mix compatible composition comprises from about 45% w/w to about 99% w/w dithiocarbamate fungicide, from about 5% w/w to about 25% w/w of the at least two non-ionic surfactants having HLB greater than 6, and from about 5% w/w to about 25% w/w of the at least two anionic surfactants, based on the total weight of the tank mix compatible composition, and wherein said tank mix compatible composition is in the form of oil dispersion (OD).

According to an embodiment, there is provided a tank mix compatible composition comprising:

a dithiocarbamate fungicide, a salt thereof, a derivative thereof, or combination thereof;

at least two non-ionic surfactants each having an HLB value of greater than 6;

at least two anionic surfactants and

at least on agrochemically acceptable agents.

According to an embodiment, the present compositions further comprise an oil, an adjuvant, an additional fungicide, an insecticide, a herbicide, and other agrochemical ingredients or a combination thereof.

According to an embodiment, a process of preparing a tank mix compatible composition comprises:

combining at least two non-ionic surfactants each having HLB value of greater than 6 and optionally an auxiliary ingredient to obtain a mixture;
adding at least two anionic surfactants to the mixture to obtain a pre-mix; and
adding dithiocarbamate fungicide to the pre-mix with continuous stirring to obtain the tank mix compatible composition.

According to an embodiment, a process of preparing the tank mix compatible composition comprises:

combining at least two non-ionic surfactants each having HLB value greater than 6, a diluent, and optionally an auxiliary ingredient to obtain a mixture;
adding at least two anionic surfactants to the mixture to obtain a pre-mix; and
adding a dithiocarbamate fungicide to the pre-mix with continuous stirring to obtain tank mix compatible composition, wherein the dithiocarbamate fungicide comprises mancozeb.

According to an embodiment, the process comprises applying shear to the mixture of the dithiocarbamate fungicide, at least two non-ionic surfactants, at least two anionic surfactants, and optional auxiliary agents in order to reduce particle size. Suitable devices for applying shear include high shear mixers, (such as an Ultra-Turrax apparatus, and dissolver mixers), static mixers (e.g. systems having mixing nozzles), bead mills, vibratory mills, agitator bead mills, colloid mills, cone mills, circulating mills (e.g., agitator ball mills with pin grinding system), disk mills, annular chamber mills, double cone mills, sprocket dispersers, homogenizers, or any combination thereof.

According to an embodiment, the mixing of the at least two non-ionic surfactants, dithiocarbamate fungicide, and at least two anionic surfactants with a diluent (hereinafter referred to as the "mixing step") is carried out under low shear to obtain an oil dispersion.

According to an embodiment, the tank mix compatible composition is diluted with water (or an aqueous liquid) to form an end-use agrochemical formulation, for example, a spray formulation.

According to an embodiment, the tank mix compatible composition has a pH ranging from 5-7.

According to an embodiment, the pH of the tank mix compatible composition varies no more than 20%, or no more than 10%, or no more than 5%, when stored at 54°C for a period of 24 hours to 14 days.

According to an embodiment, the tank mix compatible composition is used as the source of agrochemical active ingredient and is diluted to provide an end-use agrochemical formulations prior to application. The tank mix compatible composition may be diluted with water or an aqueous solution 1 to 10,000 fold, or 10 to 1,000 fold, to form the end-use agrochemical formulations (e.g., spray formulation). The tank mix compatible composition may be diluted to provide an end-use agrochemical formulation having an active ingredient (dithiocarbamate fungicide) concentration of about 0.001 wt.% to about 1 wt.%, or about 0.5 wt.% to about 1 wt.% based on the total weight of the end-use agrochemical formulation.

According to an embodiment, the mixing steps in the process are carried out at a temperature in the range of about 20° C. to about 80° C., more preferably from about 20° C to about 40° C.

According to an embodiment, the continuous mixing is carried out for a period of about 30 seconds to about 24 hours, preferably from about five minutes to about three hours.

According to an embodiment, a method of controlling a fungal disease in a crop or a locus thereof comprises applying an agrochemically effective amount of the tank mix compatible composition to the crop or the locus thereof.

According to an embodiment, a method of controlling a fungal disease in a crop or a locus thereof comprises applying an agrochemically effective amount of tank mix compatible composition comprising mancozeb, at least two non-ionic surfactants each having HLB value greater than 6, and at least two anionic surfactants.

According to another embodiment, the method comprises applying an agrochemically effective amount of tank mix compatible composition to a plant, a locus thereof, or soil in which the plant is growing or intended to be grown.

According to an embodiment, the tank mix compatible composition is compatible with ingredients such as oils, adjuvants, additional fungicides, herbicides, insecticides, and other agrochemical ingredients.

According to an embodiment, the present tank mix compatible composition is compatible at tank mixing with fungicides.

The fungicide can be added directly to the present tank mix compatible composition on its own or as a component in a different formulation.

According to an embodiment, the tank mix compatible composition is combined with a conazole fungicide such as azaconazole, cyproconazole, difenoconazole, epoxiconazole, hexaconazole, propiconazole, prothioconazole, triadimenol, tebuconazole, tetraconazole, and/or triticonazole.

According to an embodiment, the tank mix compatible composition is combined with a strobilurin fungicide such as azoxystrobin, fluoxastrobin, pyraclostrobin, trifloxystrobin, and/or kresoxim-methyl.

According to an embodiment, the tank mix compatible composition is combined with an anilide fungicide such as bixafen, boscalid, and/or metalaxyl, metalaxyl-M.

According to an embodiment, the tank mix compatible composition is combined with a morpholine fungicide such as dimethomorph and/or fenpropimorph.

According to an embodiment, the tank mix compatible composition is combined with an anilinopyrimidine fungicide such as cyprodinil, mepanipyrim, and/or pyrimethanil.

According to an embodiment, the tank mix compatible composition is combined with a fungicide such as acibenzolar, benzalkonium chloride, bromothalonil, spiroxamine, and/or tricyclazole.

According to an embodiment the tank mix compatible composition is used to control fungal diseases cause by a wide range of different fungi.

According to an embodiment, the tank mix compatible composition can be used for treatment of plant crops and/or for the treatment of inanimate materials e.g., in the household.

According to an embodiment, the tank mix compatible composition is useful for controlling fungal disease in plant crops including: cotton, flax, grapevines, fruit, vegetables, such as *Rosaceae* sp. (for example pome fruit such as apples and pears, but also stone fruit such as apricots, cherries, almonds and peaches, and berry fruits such as strawberries), *Ribesioidae* sp., *Juglandaceae* sp., *Betulaceae* sp, *Anacardiaceae* sp., *Fagaceae* sp., *Moraceae* sp., *Oleaceae* sp., *Actinidaceae* sp., *Lauraceae* sp., *Muscaceae* sp. (for example banana trees and plantations), *Rubiaceae* sp. (for example coffee), *Theaceae* sp., *Sterculiceae* sp., *Rutaceae* sp. (for example lemons, organs and grapefruit), *Solanaceae* sp. (for example tomatoes), *Liliaceae* sp., *Asteraceae* sp. (for example lettuce), *Umbelliferae sp., Cruciferae sp., Chenopodiaceae* sp., *Cucurbitaceae* sp. (for example cucumbers), *Alliaceae* sp. (for example leeks, onions), *Papilionaceae* sp. (for example peas), main crop plants such as *Gramineae* sp. (for example maize, turfgrass, cereals such as wheat, rye, rice, barley, oats, sorghum/millet and triticale), *Asteraceae* sp. (for example sunflowers), *Brassicaceae* sp. (for example white cabbage, red cabbage, broccoli, cauliflower, Brussels sprouts, Pak Choi, kohlrabi, radishes, and rapeseed, mustard, horseradish and cress), *Fabacae* sp. (for example beans, peanuts), *Papilionaceae* sp. (for example soya beans), *Solanaceae* sp. (for example potatoes), *Chenopodiaceae* sp. (for example sugar beet, fodder beet, chard, beetroot), sugarcane, poppies, olives, coconuts, cocoa, tobacco, useful and ornamental plants in gardens and forests, genetically modified varieties of each of these plants, the seeds of these plants, or any combination thereof.

According to an embodiment, the tank mix compatible composition and/or the end-use agrochemical formulation can be applied as a liquid formulation using customary methods, i.e., for example by spraying, pouring or injecting.

According to an embodiment, the present disclosure provides a kit comprising a plurality of components, each of which comprises at least one of the ingredients of the tank mix compatible composition disclosed herein.

In an embodiment, the kit may include at least one, or all, of the components used to prepare the tank mix compatible composition. For example, the kit may include the

dithiocarbamate fungicide, a salt thereof, a derivative thereof, or a combination thereof, the at least two non-ionic surfactants each having HLB value of greater than 6, and the at least two anionic surfactants. One or more of the components may already be combined together or pre-formulated. When more than two components are provided in a kit, the components may already be combined together and as such are packaged in a single container such as a vial, bottle, can, pouch, bag or canister.

It will be understood that the specification and examples are illustrative but not limiting of the present invention and that other embodiments within the spirit and scope of the invention will suggest themselves to those skilled in the art. Other embodiments can be practiced that are also within the scope of the present invention. The following examples illustrate the invention, but by no means intend to limit the scope of the claims.

EXAMPLES

Example 1: Preparation of Mancozeb 620g/L oil dispersion (OD)

Ingredients	Quantity (g/L)
Mancozeb	620
Tristryl phenol ethoxylate	7.5
C_{10} guerbet alcohol alkoxylate + 4EO	15
Phosphate ester	20
Sulfated polyaryl phenol ethoxylate Ammonium salt	7.5
Thickener	2.5
Oleic acid	5
Diluent	Q. S. to 1000ml

Process: 7.5g tristryl phenol ethoxylate and 15g C_{10} guerbet alcohol alkoxylate + 4EO were charged into a mixing vessel. About 500 ml diluent (mineral oil) was then added

to the same mixing vessel and mixed by stirring. Then 20g phosphate ester, 7.5g sulfated polyaryl phenol ethoxylate ammonium salt, 2.5g thickener, and 5g oleic acid were added to the mixing vessel and homogenized with continuous stirring to obtain a pre-mix. Under continuous stirring, 620g mancozeb was slowly added to the pre-mix followed by addition of remaining diluent to obtain the oil dispersion.

Example 2: Preparation of Mancozeb 620g/L oil dispersion (OD)

Ingredients	**Quantity (g/L)**
Mancozeb	620
C_{10} guerbet alcohol alkoxylate + 4 EO	80
C_{10} guerbet alcohol alkoxylate + 5 EO	15
Phosphate ester	20
Tristrylphenol ethoxylate	7.5
Polymeric ester dispersant	37.5
Thickener	2.5
Oleic acid	5
Sulfated polyaryl phenol ethoxylate Ammonium salt	7.5
Diluent	Q. S. to 1000ml

Process: Mancozeb, C_{10} guerbet alcohol alkoxylate + 4EO, C_{10} guerbet alcohol alkoxylate + 5EO, phosphate ester, tristrylphenol ethoxylate, polymeric ester dispersant, thickener, oleic acid, sulfated polyaryl phenol ethoxylate ammonium salt, and diluent (mineral oil) were mixed in the above mentioned quantities, and an oil dispersion was prepared as described in Example 1.

Example 3: Preparation of Mancozeb 620g/L oil dispersion (OD)

Ingredients	**Quantity (g/L)**
Mancozeb Technical	620

C_{10} guerbet alcohol alkoxylate +4 EO	80
C_{10} guerbet alcohol alkoxylate + 5EO	15
Phosphate ester	20
Tristryl phenol ethoxylate	7.5
Polymeric ester dispersant	37.5
Thickener	2.5
Oleic acid	5
Sulfated polyaryl phenol ethoxylate Ammonium salt	7.5
Mineral oil	Q. S. to 1000ml

Process: Mancozeb, C_{10} guerbet alcohol alkoxylate, 4EO, C_{10} guerbet alcohol alkoxylate + 5EO, phosphate ester, tristrylphenol ethoxylate, polymeric ester dispersant, thickener, oleic acid, sulfated polyaryl phenol ethoxylate ammonium salt, and diluent (mineral oil) were mixed in the above mentioned quantities and an oil dispersion was prepared as described in Example 1.

Comparative Study

Examples 4-11 were prepared to assess the effect of the presence of non-ionic surfactants and anionic surfactants on the high loading of mancozeb in the OD compositions. The compositions of Example 4, Example 5 and Example 6 included at least two non-ionic surfactants, each having an hydrophilic-lipophilic balance (HLB) of greater than 6 and at least two anionic surfactants. As shown in Table 1, it was observed that all three of the compositions of Examples 4-6 exhibited very good stability with a very soft sediment that became completely flowable upon gentle shaking. Following dilution, each of the compositions of Examples 4-6 formed good dispersions without any cream or sediment. On the contrary, the compositions of Example 7 & Example 8 with only one non-ionic surfactant, Example 9 and Example 10 with only one anionic surfactant, and Example-11 with no non-ionic surfactant did not exhibit the desired stability. The compositions of Examples 7-11 resulted in a hard sediment which was not dispersible upon shaking. Also, upon dilution, the compositions of Example 7-11 resulted in a poor dispersion.

Table 1

	Examples							
Examples	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Mancozeb	620	620	620	620	620	620	620	620
NIS1	7.5	7.5	7.5	0	7.5	7.5	7.5	0
NIS2	80	0	80	80	0	0	0	0
NIS3	15	15	15	0	0	0	0	0
NIS4	0	37.5	37.5	0	0	37.5	37.5	0
AS1	20	20	20	20	20	20	0	0
AS2	7.5	7.5	7.5	7.5	7.5	0	0	7.5
Thickener	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Oleic acid	5	5	5	5	5	5	5	5
Diluent	q.s. 1000 ml	q.s. 1000 ml	q.s. 1000 ml	q.s. 1000 ml	q.s. 1000 ml	q.s. 1000ml	q.s. 1000ml	q.s. 1000 ml
% sedimentation	Soft	Soft	soft	Hard sediment	Hard sediment	Hard sediment	Hard sediment	Hard sediment
Viscosity	560	560	560	NA	NA	NA	NA	NA
Bleeding	5%	5%	5%	5%	5%	5%	5%	5%
Visual observation (14 days at 54° , AHS)	After shaking sample completely flowable	After shaking sample completely flowable	After shaking sample completely flowable	After shaking sample completely flowable	Hard sediment	Hard sediment	Hard sediment	Hard sediment
Dispersion in Water	Good dispersion no cream & no sediment	Good dispersion no cream & no sediment	Good dispersion no cream & no sediment	Poor dispersion	Very Poor dispersion	Poor dispersion	Poor dispersion	Poor dispersion

NIS1: Tristryl phenol ethoxylate, NIS2: C_{10} guerbet alcohol alkoxylate+4EO (Lutensol-40), NIS3: C_{10} guerbet alcohol alkoxylate+5EO (Lutensol 50), NIS4: atlox 4916, AS1: phosphate ester, AS2: sulfated polyaryl phenol ethoxylates ammonium salt.

AHS (Accelerated heat stability), Agricultural Health Study. Similarly, Examples 12-18 were prepared and tested for stability by assessing physico-chemical parameters. The results are shown in Table 2 below.

The compositions of Example 12 and Example 15 were prepared using only one anionic surfactant, and resulted in a hard sediment. These same compositions reported 5% bleeding. Although, after 14 days AHS, it became flowable after shaking but resulted into a poor dispersion when diluted with water. The compositions of Example 13 and Example 14, prepared using one anionic surfactant and one non-ionic surfactant, also resulted in a hard sediment, reported 5% bleeding, became flowable after shaking in the 14 day AHS study and but resulted into a poor dispersion when diluted with water. Composition of Example-17 and 18 were prepared using at least two anionic surfactants and two non-ionic surfactants. The non-ionic surfactants POE-(2)-cetyl alcohol (HLB:5.3), sorbitan monostearate (HLB:4.7) and polyalkylene glycol (HLB: 3) used were all less than 6 HLB. These compositions resulted into hard/stick sediment, bleeding between 5-15% and gave poor dispersion in water.

Table 2

Ingredients	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Mancozeb Technical	620	620	620	620	620	620	620
NIS1	7.5	7.5	0	7.5	0	7.5	7.5
NIS2	0	0	0	0	80	0	0
NIS3	0	0	0	0	0	0	0
NIS4	37.5	0	37.5	0	0	0	0
NIS5	0	0	0	0	0	80	80
NIS6	0	0	0	0	0	0	15
NIS7	0	0	0	0	0	15	0
AS1	0	20	0	0	20	20	20
AS2	7.5	0	7.5	7.5	0	7.5	7.5

Clay	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Oleic acid	5	5	5	5	5	5	5
Mineral oil	Qs	qs	Qs	qs	Qs	Qs	Qs
% sedimentation (14 days, 54°C, AHS)	Hard sediment	Hard sediment	Hard sediment	Hard sediment	Hard sediment	Hard sediment	Sticky
Viscosity	NA	NA	NA	NA	NA	396	605
Bleeding	5%	5%	5%	5%	5%	15%	7%
Visual observation (14 days, 54°C, AHS)	After shaking sample completely flowable	After shaking sample completely flowable	After shaking sample completely flowable	After shaking sample completely flowable	Hard sediment	Hard sediment at the bottom	Very sticky & hard Sediment
Dispersion in Water	Poor dispersion	Poor dispersion	Poor dispersion	Poor dispersion	Very Poor dispersion	Poor dispersion	Poor dispersion

NIS1: Tristryl phenol ethoxylate(BSU), NIS2: Lutensol 40, NIS3: Lutensol 50, NIS4: atlox 4916, NIS5: POE-(2)-cetyl alcohol (HLB:5.3), NIS6: Sorbitan monostearate(HLB:4.7), NIS7: Polyalkylene glycol (HLB: 3), AS1: phosphate ester, AS2: sulfated polyaryl phenol ethoxylate ammonium salt (3D484).

Tank Mix compatibility study

The compositions of Examples 1-16 were diluted with water and mixed with other tank mix partners. Observations were made to see if there is any separation and sedimentation in the tank. The results are shown in Table 3. The observations were made for different time intervals: 10 min, 20 min, and 30 min. While performing the tank mix study, the selected tank mix partners (as per Table 3 below) were added to about 20 ml water in a beaker, and subjected to gentle stirring to obtain mixture. Then the Example tank mix

compatible compositions disclosed above were added to the above-described mixture followed by the addition of remaining water, with gentle stirring, to make a final volume of 50 ml. The percentage separation and percentage sedimentation of each tan mix was observed at various intervals of time, specifically, 10 min, 20 min and 30 min. As shown in Table 3, the compositions of Examples 1-6 exhibited good compatibility with other tank mix partners and resulted in a uniform tank mix dilution without any sedimentation or separation. (Table 3)

Table 3

Composition	Mixing partner	% Separation			% Sedimentation		
		10 Min	20 Min	30 Min	10 Min	20 Min	30 Min
Examples 1- 8	Oil	0	0	0	0	0	0
Example -1, Example 2, Example 3	Propiconazole 250 EC	0	0	0	0	0	0
Example 6	Tebuconazole 225+ Triadimenol 75EC	0	0	0	0	0	0
Example 5	Pyraclostrobin 250 EC	0	0	0	0	0	0
Example 4, Example 5, Example 6	Fenpropimorph 88 OL	0	0	0	0	0	0
Examples 1-7	Azoxystrobin 25SC	0	0	0	0	0	0
Example 4, Example 5, Example 6	Pyrimethanil 600SC	0	0	0	0	0	0
Example 4, Example 5, Example 6	Boscalid 500 SC	0	0	0	0	0	0
Examples 1-7	Tebuconazole 25SC	0	0	0	0	0	0
Examples 1-7	Difenconazole 250 EC	0	0	0	0	0	0
Examples 1-7	Spiroxamine 500 EC	0	0	0	0	0	0

Further, the compositions of Examples 9-12 were tested for tank-mix compatibility with different tank-mix partners, and either separation or flocculation was observed. Hence Examples 9-12 were not considered to have good tank-mix compatibility (Table 4). Similarly, when the compositions of Examples 13-14 and Examples 15-16 were tested for tank-mix compatibility with different tank-mix partners, either separation or flocculation was observed and hence they were not considered to have good tank-mix compatibility. (Tables 5 & 6).

Table 4

Composition	**Mixing partner**	**% Separation**			**% Sedimentation**		
		10 Min	20 Min	30 Min	10 Min	20 Min	30 Min
Examples 9 - 12	Oil	2	7	35			
Examples 9 – 12	Propiconazole 250 EC	Flocculation					
Examples 9 – 12	Tebuconazole 225 + Triadimenol 75EC	Flocculation					
Examples 9 – 12	Pyraclostrobin 250 EC	Flocculation					
Examples 9 – 12	Fenpropimorph 88 OL	Flocculation					
Examples 9 – 12	Azoxystrobin 25SC	Flocculation					
Examples 9 – 12	Pyrimethanil 600 SC	Flocculation					
Examples 9 – 12	Boscalid500 SC	Flocculation					
Examples 9 – 12	Tebuconazole 25SC	Flocculation					
Examples 9 – 12	Difenconazole 250 EC	Flocculation					

Examples 9 – 12	Spiroxamine 500 EC	Flocculation

Table 5

Composition	Mixing partner	% Separation			% Sedimentation		
		10 Min	20 Min	30 Min	10 Min	20 Min	30 Min
Example-13 Example 14	Oil	1 5	4 15	16 20	0 0	0 2	1 2
Example-13 Example 14	Propiconazole 250 EC	Flocculation					
Example-13 Example 14	Tebuconazole 225+ Triadimenol 75EC	8 8	13 10	28 35			
Example-13 Example 14	Pyraclostrobin 250 EC	Flocculation					
Example-13 Example 14	Fenpropimorph 88 OL	Flocculation					
Example-13 Example 14	Azoxystrobin 25SC	0 1	4 10	16 25	2 5	2 9	3 10
Example-13 Example 14	Pyrimethanil 600SC	12 3	25 14	38 31			
Example-13 Example 14	Boscalid500 SC	0 1	5 9	27 32			
Example-13 Example 14	Tebuconazole25SC	7 2	19 10	30 22			
Example-13 Example 14	Difenconazole250 EC	2 0	14 5	42 24			
Example-13 Example 14	Spiroxamine500 EC	Flocculation					

Table 6

Composition	Mixing partner	% Separation			% Sedimentation		
		10 Min	20 Min	30 Min	10 Min	20 Min	30 Min
Example-15	Oil	2	6	30	0	1	1 1
Example 16	Oil	4	10	30	0	1	1
Examples 15-16	Propiconazole 250 EC	Flocculation					
Example 15	Tebuconazole 225+ Triadimenol 75EC	10	14	26 18	0	0	0
Example 16	Tebuconazole 225+ Triadimenol 75EC	6	8	18	0	0	1
Example 15-16	Pyraclostrobin 250 EC	Flocculation					
Examples 15-16	Fenpropimorph 88 OL	Flocculation					
Example 15	Azoxystrobin 25SC	0 1	5 10	20 25	0 2	3 5	10 5
Example 16	Azoxystrobin 25SC	1	10	25	2	5	5
Example-15- 16	Pyrimethanil 600SC	20 4	25 10	40 30	5	5	7
Example 15	Tebuconazole 25SC	2	15	30	0	1	1
Example 16	Tebuconazole 25SC	0	4	16	0	1	1
Examples 15- 16	Difenconazole250 EC	Flocculation					
Examples 15- 16	Spiroxamine500 EC	Flocculation					

Therefore, the successful development of a tank mix compatible composition of a high loading of dithiocarbamate fungicide has been advantageously developed, which includes at least two non-ionic surfactants each having an HLB of greater than 6 and at least two anionic surfactants. The combination of the at least two non-ionic surfactants and the at least two anionic surfactants has been found to be essential for the preparation of tank mix

compatible composition including a high loading of a dithiocarbamate fungicide. The tank mix compatible composition exhibits good storage stability, dilution stability, and tank mix compatibility for a wide number of formulations of various agrochemical compositions.

While the invention 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 invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the appended claims. Any combination of the above-described elements in all possible variations thereof is encompassed by the invention unless otherwise indicated herein or otherwise clearly contradicted by context.

We claim,

1. A composition comprising:

a dithiocarbamate fungicide, a salt thereof, a derivative thereof, or a combination thereof;

at least two non-ionic surfactants each having an HLB value of greater than 6; and

at least two anionic surfactants.

2. The composition as claimed in claim 1, wherein said dithiocarbamate fungicide comprises mancozeb, azithiram, carbamorph, cufraneb, cuprobam, disulfiram, ferbam, metam, nabam, tecoram, thiram, ziram, dazomet, mancopper, maneb, metiram, propineb, zineb, a salt thereof, a derivative thereof, or a combination thereof.

3. The composition as claimed in claim 1, wherein said composition comprises from about 40% w/w to about 99% w/w of the dithiocarbamate fungicide based on the total weight of the the composition.

4. The composition as claimed in claim 1, wherein said non-ionic surfactants with HLB value of greater than 6 is selected from the group comprising of alkyl polyethyleneglycol ethers based, Oxo alcoholethoxylate, C10-Guerbet alcohol ethoxylate and 3-9 Ethylene Oxide (EO) units, C10-Guerbet alcohol ethoxylate + 4EO, C10-Guerbet alcohol ethoxylate + 5EO, C10-Guerbet alcohol and 3-9 EO units, C10-Guerbet alcohol+ 3EO, C10-Guerbet alcohol+ 4EO, C10-Guerbet alcohol+ 5EO, C13 oxo alcohol and 2-20 EO units, C13 oxo alcohol + 3EO, C13 oxo alcohol + 4EO, C13 oxo alcohol + 5EO, C13-C15 oxo alcohol and 3-10 EO units, alkyl alkoxylates or ethylene oxide/propylene oxide diblock copolymers or alkyl initiated ethylene oxide/propylene oxide monoblock copolymers, sorbitan derivatives such as Polyoxyethylene monooleate (PEG 400 monoleate), Polyoxyethylene monostearate (PEG 400 Monostearate), Polyoxyethylene monolaurate (PEG 400 Monolaurate), Sodium oleate, Triethanolamine oleate, Polyoxyethylene sorbitan monolaurate , Polyoxyethylene sorbitan monolaurate, Polyoxyethylene sorbitan monopalmitate, Polyoxyethylene sorbitan monostearate,

Polyoxyethylene sorbitan tristearate, Polyoxyethylene sorbitan monooleate, Polyoxyethylene sorbitan trioleate.

5. The composition as claimed in claim 1, wherein the composition comprises from about 1% w/w to about 30% w/w non-ionic surfactants with HLB above 6 of the total weight of the composition.

6. The composition as claimed in claim 1, wherein the at least two anionic surfactants comprise a carboxylic acid-containing surfactants, a sulfate-containing surfactants, a sulfonic acid-containing surfactant, a phosphate-containing surfactant, or a combination thereof.

7. The composition as claimed in claim 1, wherein the at least two anionic surfactants comprise a (C_{12}-C_{18} alkyl) sulfate, a polyoxyethylene (C_{12}-C_{18} alkyl) ether sulfate, a C_8-C_{12}alkyl benzenesulfonic acid, a polyoxyethylene (C_{12}-C_{18} alkyl) ether phosphate, a phosphate of polyoxyethylene polyoxypropylene block copolymer, phosphatidyl choline, tristrylphenol ethoxylate sulphate, a polymeric ester of isotridecyl ethylene glycol and phosphoric acid, an alkylpolyglucoside salt, or a combination thereof.

8. The composition as claimed in claim 1, wherein said composition comprises from about 1% w/w to about 30% w/w of the at least two anionic surfactants based on the total weight of the composition.

9. The composition as claimed in claim 1, wherein said composition is an oil dispersion.

10. The composition as claimed in claim 1, wherein said composition further comprises an oil, an adjuvant, an additional fungicide, an insecticide, a herbicide, and other agrochemical ingredients or a combination thereof.

11. The composition as claimed in claim 1, wherein the composition is compatible with ingredients such as oils, adjuvants, additional fungicides, herbicides, insecticides, and other agrochemical ingredients.

12. A process of preparing a composition, comprising:

combining at least two non-ionic surfactants each having an HLB value of greater than 6 and optionally an auxiliary ingredient to obtain a mixture;

adding at least two anionic surfactants to the mixture to obtain a pre-mix, and

adding dithiocarbamate fungicide to the pre-mix with continuous stirring to obtain the composition.

13. The process as claimed in claim 12, wherein the continuous stirring is performed under low shear.

14. A method of controlling a fungal disease in a crop or a locus thereof, comprising applying an agrochemically effective amount of composition as claimed in claim 1 to the crop or the locus thereof.

15. The method as claimed in claim 14, wherein said composition comprises mancozeb.

16. Use of a composition for controlling a fungal disease in a crop or a locus thereof, wherein the composition comprising a dithiocarbamate fungicide, a salt thereof, a derivative thereof, or a combination thereof;

at least two non-ionic surfactants each having an HLB value of greater than 6; and

at least two anionic surfactants.

Abstract

A composition includes a dithiocarbamate fungicide, a salt thereof, a derivative thereof, or a combination thereof. Also disclosed are a process of preparing the tank mix compatible composition and a method of controlling a fungal disease in a crop or a locus thereof with said composition.