An aqueous suspension concentrate containing: (a) a first active ingredient comprising one or more triazolo-pyrimidines, triazolone, pyrazole or oxazole herbicides; (b) optionally, a second active ingredient, (c) a dispersant comprising a comb polymer; (d) a nonionic, alkoxylated surfactant or a block copolymer surfactant, and (e) optionally, a re-dispersing agent, wherein said aqueous suspension concentrate exhibits an acidic pH within the range from about greater than about 2 to about 4.
Suspension Concentrate

Field of the Invention
[0001] The invention relates to aqueous suspension concentrates exhibiting low pH, high stability, and a redispersion agent to avoid the formation of hard sediment and facilitate re-suspension of any settled particulates.

Background of the Invention
[0002] Agrochemicals are typically available in a number of different physical forms and formulations. Some of these forms are intended to address the varying strengths and weaknesses of the active ingredient as well as the applicable regulations associated with that ingredient. Other forms address the area where the product is most likely to be used and the types of application equipment that tend to prevail in that region. High concentration formulations of single or multiple active ingredients are desirable for a variety of economic and environmental reasons, including the reduction of shipping and handling costs. Liquid pre-mix concentrates containing two or more active ingredients are useful in a wide variety of agricultural applications. For example, two or more pesticidal active ingredients may be combined in order to control a wider spectrum of pests, or to utilize multiple modes of action, compared to the individual active ingredients alone.
[0003] The term "aqueous suspension concentrates" refers to suspension concentrates based on water. The water component of the suspension concentrates of the invention can be in an amount of about 25-98% by weight in general. The unit "% by weight" (percent by weight) generally refers to the relative weight of the respective component based on the total weight of the formulation.
[0004] Active ingredients in a suspension concentrate can be soluble or insoluble in aqueous solutions. Both present their own problems in formulating a suspension concentrate. For example, the production of a stable, water-based suspension concentrate formulation of a water-soluble
pesticide is difficult due to the formation of clogging crystals in the process known as Ostwald ripening. Finely divided solids suitable for suspension can also agglomerate during storage and form aggregates that are sufficiently large to clog spray nozzles or form sediment in the container or spray tank. Maintaining a stable suspension concentrate with a uniform particle size distribution (i.e., no large crystals) is most important for this type of formulation in order to prevent settling of particles during storage.

[0005] The preparation of liquid single active concentrates and pre-mix concentrates that are physically stable remain a challenge as temperature fluctuations can materially affect the solubility characteristics of relatively insoluble active ingredients that have been formulated into a suspension. Symptoms of physical instability include phase separation, crystallization, settling, sedimentation, gelling, and agglomeration. Formulations that also combine a water-soluble ingredient (even in the ppm range) with a water-insoluble ingredient, e.g., solids present additional challenges.

[0006] In general, "water insoluble" refers to pesticides having sparing solubility in deionized water at 20° C, e.g., of not greater than about 100 milligrams per liter (mg/L). In some embodiments the pesticides have solubility in deionized water at 20° C of not greater than about 75 mg/L. In some embodiments the pesticides have solubility in deionized water at 20° C of not greater than about 50 mg/L. In some embodiments the pesticides have solubility in deionized water at 20° C of not greater than about 25 mg/L. In certain embodiments, "solid" refers to pesticides having a melting point not less than about 75° C. In some embodiments, the water insoluble pesticide has a melting point not less than about 100° C, and in other embodiments, not less than about 150° C.

[0007] Published U.S. Patent Application No. 2013/0331267 describes suspension premix concentrates that contain a dispersed phase containing a water insoluble pesticide, a continuous phase containing a water soluble salt of a pesticide, a rheology agent, and a wetting-dispersing agent.

[0008] U.S. Patent No. 6,569,809 teaches a pre-mix concentrate made with a water soluble agent dissolved in the aqueous phase and a water insoluble agent that is surrounded by a barrier layer made with an organic
solvent or emulsifying agent with an HLB of at least 15. A suitable viscosity modifying agent is colloidal hydrophilic silica that is dispersed in the aqueous phase.

[0009] WO 2002/036595 teaches a sulfonamide in an aqueous suspension concentrate containing deionized water, xanthan gum, carboxymethyl cellulose; 1, 2-benzisothiazolin-3-one; naphthalene sulfonate; silicone fluid; ethylene oxide/propylene oxide block copolymer; phosphoric acid; and propylene glycol.

[0010] US Patent No. 8,653,002 relates to an aqueous suspension concentrate having a pH within the range of 2-7 and containing 2-chloro-5-[3,6-dihydro-3-methyl-2,6-dioxo-4-(trifluoromethyl)-l-(2H)pyrimidinyl]-4-fluoro-N-[[methyl(l-methylethyl)amino]sulfonyl] benzamide (saflufenacil) in the form of its crystalline anhydrate; at least one non-ionic surfactant selected from polyoxyethylene-polyoxy-C3-C4-alkylene block copolymers; and at least one anionic surfactant comprising at least one arylsulfonate group.

[0011] Triazolopyrimidine, triazolone, pyrazole and oxazole herbicides have posed unique challenges for a suspension concentrate. These active ingredients exhibit increased water solubility as the pH and/or water hardness of the water system is increased. This solubility has generated agglomerates during storage and upon dilution with water sources of varying chemical properties, such as especially hard water or high pH, to the end use product. These agglomerates can cause substantial clogging problems with spray equipment. These active ingredients can also form a hard sediment that does not readily redisperse when trying to make the end use product.

[0012] Rheology modifying additives can be used to thicken aqueous suspension concentrates. If, however, the aqueous phase has a high content of water soluble salt of a herbicidal active ingredient, the thickeners may be incompatible with the high ionic strength of the aqueous phase. This incompatibility can develop phase separation as well as precipitation of solids upon storage and/or shipping under the effects of changing
temperature and quiescent storage time. Unless the precipitates can be readily redispersed, the product cannot be used or sold.

**Summary of the Invention**

[0013] In accordance with the present invention, aqueous suspension concentrates according to the invention comprise: (a) an active ingredient whose water solubility increases as the pH increases towards neutral, such as a triazolopyrimidine, triazolone, pyrazole or oxazole; (b) a dispersant comprising a comb polymer; (c) an acid stable, anionic surfactant; and (d) optionally, a redispersion agent, wherein the suspension concentrate exhibits an acidic pH within the range from about 2.5 to about 3.5.

[0014] The present formulation provides a stable, high concentration suspension of triazolopyrimidine, triazolone, pyrazole, and oxazole herbicides as well as mixtures thereof and mixtures with one or more active ingredients of a different type that exhibit good redispersability and convenient use. The comb polymer and polyarylphenol phosphate provide a stable dispersion system, and the optional redispersion agent provides a soft lattice of suspending nucleating agents that avoid the formation of hard sediment of any precipitated active agent, even when hard water and/or high pH water are used for dilution to the end use product. Moderate agitation or shaking of the container will redisperse any such sediment so that the end use product can be made without nozzle clogging agglomerates.

**Detailed Description of the Invention**

[0015] A stable aqueous suspension concentrate according to the invention comprises: (a) a first active ingredient comprising one or more triazolopyrimidine, triazolone, pyrazole or oxazole herbicides; (b) an optional second active ingredient; (c) a dispersant comprising a comb polymer; (d) an acid stable, nonionic surfactant; and, (e) optionally, a redispersion agent, wherein said suspension concentrate exhibits an acidic pH within the range from greater than about 2 to about 4, preferably about 2.5 to about 3.5.

[0016] Compositions according to the invention comprise concentrations according to the table 1:
The suspension concentrate of the present invention provides an aqueous suspension that contains an amount of the active ingredient that is within the range from about 1 g/1 to about 800 g/1, preferably within the range from about 240 to about 480 g/1.

As used herein, the term "stable composition" refers to compositions that are stable physically and/or chemically for defined periods of time to the environments in which they are produced, transported and/or stored. Aspects of "stable compositions" include, but are not limited to: physical stability at temperatures that range from about 0°C to about 60°C, homogeneity, pourability, liquids that do not exhibit appreciable sedimentation or Ostwald ripening of the dispersed particles, compositions that form little or no precipitated solids or exhibit phase separation, compositions that readily disperse when poured into a spray tank of water and retain their biological efficacy when applied, for example, by spray application to target pests. In some embodiments, the compositions form stable, homogeneous suspension concentrates that do not exhibit syneresis and/or exhibit very little change in viscosity under the storage conditions.

In some embodiments, the described compositions are stable at temperatures of greater than or equal to about 40°C for a period of at least 4 weeks, preferably about 3-4 months. In some embodiments, the described compositions are stable at temperatures greater than or equal to about 54°C for a period of at least about 3-4 months. In some embodiments, the compositions do not exhibit or do not significantly exhibit separation or precipitation (or crystallization) of any of the components at low temperatures.
In some embodiments, the compositions remain as homogeneous suspension concentrates at temperatures in typical chemical storage conditions for 1-2 seasons. At lower temperatures, the present invention does not freeze or generally separate so as to precipitate sediment. If any such sediment does form, the sediment is a soft lattice that is readily redispersed by gentle mixing.

In some embodiments, the compositions remain as homogeneous suspension concentrates after subjecting them to freeze/thaw (F/T) conditions where the temperature is cycled from about -15°C for 24 hours to about 54°C for another 24 hours as one cycle. Typical testing is performed for 5-10 cycles or more. This testing is intended to represent conditions that are typically much harsher than most products would experience under natural weather conditions.

**First Active Ingredients**

Suspended or dispersed in the aqueous phase of the compositions described herein are one or more water-insoluble solid pesticides of the triazolopyrimidines, triazolones, pyrazoles or oxazoles.

Examples of suitable triazolopyrimidine herbicides include cloransulam, diclosulam, ilorasulam, flumetsulam, metosulam, penoxsulam and pyroxsulam. Preferred triazolopyrimidine herbicides include cloransulam, ilorasulam, flumetsulam and penoxsulam.

Examples of suitable aryl triazolones include amicarbazone, bencarbazone, carfentrazone, carfentrazone-ethyl, flucarbazone, ipfencarbazone, propoxycarbazone, sulfentrazone, and thiencarbazone, or an agriculturally acceptable salt, carboxylic acid, carboxylate salt, or ester thereof. Preferred aryl triazolones include amicarbazone, carfentrazone, carfentrazone-ethyl, flucarbazone, propoxycarbazone, sulfentrazone, and thiencarbazone.

Examples of suitable pyrazole herbicides include azimsulfuron, difenzoquat, halosulfuron, metazachlor, metazosulfuron, pyrazosulfuron, pyroxasulfone. Preferred pyrazole herbicides include halosulfuron, metazachlor, and pyroxasulfone. Examples of suitable oxazole herbicides include carboxazole, fenoxasulfone, isouron, isoxaben, isoxachlortole,
isoxaflutole, methiozolin, monisouron, pyroxasulfone, and topramezone. Preferred oxazole herbicides include isoxaben, isoxaflutole, pyroxasulfone, and topramezone.

[0027] The present invention is particularly well suited for making a suspension concentrate containing cloransulam-methyl. Cloransulam-methyl is an off-white powder that is typically formulated as water-dispersible granules in premeasured water-soluble packets. Suspension concentrates have traditionally been difficult to formulate for cloransulam-methyl due to its tendency to precipitate when mixed in water and form hard, crystalline sediment that is difficult to re-disperse.

[0028] Optional 2nd Active

[0029] If desired, the present formulation can contain a second type of active ingredient in acid, encapsulated, or protected form that is not a triazolopyrimidine, triazolone, pyrazole or oxazole but which is stable in a low pH system. Such suitable second active ingredients generally include acid forms of: 4-CPA; 4-CPB; 4-CPP; 2,4-D; 2,4-D choline salt, 2,4-D esters and amines, 2,4-DB; 3,4-DA; 3,4-DB; 2,4-DEB; 2,4-DEP; 3,4-DP; 2,3,6-TBA; 2,4,5-T; 2,4,5-TB; acetochlor, acifluorfen, aclonifen, acrolein, alachlor, allidochlor, alloxydim, allyl alcohol, alorac, ametridione, ametryn, amibuzin, amicarbazone, amidosulfuron, aminocyclopyrachlor, aminopyralid, amiprofos-methyl, amitrole, ammonium sulfamate, anilofos, anisuron, asulam, atraton, atrazine, azafenidin, azimsulfuron, aziprotryne, barban, BCPC, beflubutamid, benazolin, bencarbazone, benfluralin, benfuresate, bensulfuron-methyl, bensulide, benthiocarb, bentazon- sodium, benzadox, benzfendizone, benzipram, benzobicyclon, benzofenap, benzofluor, benzoylprop, benzthiazuron, bialaphos, bicyclopyrone, bifenox, bilanafos, bispyribac-sodium, borax, bromacil, bromobonil, bromobutide, bromofenoxim, bromoxynil, brompyrazon, butachlor, butafenacil, butamifos, butenachlor, buthidazole, buthiuron, butralin, butroxydim, buturon, butylate, cacodylic acid, cafenstrole, calcium chlorate, calcium cyanamide, cambendichlor, carbasulam, carbetamide, carboxazole chlorprocarb, carfentrazone-ethyl, CDEA, CEPC, chlormethoxyfen, chloramben, chloranocryl, chlorazifop, chlorazine, chlorbromuron, chlorbufam,
chloreturon, chlorfenac, chlorfenprop, chlorilurazole, chlorilurenol, chloridazon, chlorimuron, chlornitrifen, chloropon, chlorotoluron, chloroxuron, chloroxynil, chlorpropham, chlorsulfuron, chlorthal, chlorthiamid, cinidon-ethyl, cinmethylin, cinosulfuron, cisamid, cledithram, cledinafop-propargyl, clofop, clomazone, clomeprop, cloproxydim, clopyralid, CMA, copper sulfate, CPMF, CPPC, credazine, cresol, cumyluron, cyanatryn, cyanazine, cycloate, cyclopyrimorate, cyclosulfamuron, cycloxydim, cyhalofop-butyl, cyperquat, cyprazine, cyprazole, cyprosulfamuron, cyroxyfop, cyrozol, daimuron, dalapon, dazomet, delachlor, desmedipham, desmetryn, di-allate, dicamba, dichlofen, dichloralurea, dichloramate, dichlorprop, dichlorprop-P, diclofop-methyl, diethamquat, diethatyl, difenopenten, difenoxuron, difenzoquat, diflufenican, diflufenzopyr, dimefuron, dimethametryn, dimethenamid, dimethenamid-P, dimethoate, dimethoxyfuran, dinofenate, dinoprop, dinosam, dinoseb, dinoterb, diphenamid, dipropetryn, diquat, diuron, DMA, DNOC, DSMA, EBEP, eglinazine, endothal, epronaz, EPTC, erbon, esprocarb, ethalfluralin, ethbenzamide, ethametsulfuron, ethidimuron, ethiolate, ethbenzamide, ethofumesate, ethoxyfuran, ethoxysulfuron, etinofen, etipropamide, etobenzamid, EXD, fenazurin, fenoprop, fenoxaprop, fenoxaprop-P-ethyl, fenoxaprop-P-ethyl+isoxadifen-ethyl, fenoxasulfuron, fenteracol, fenthiaprop, fenuron, ferrous sulfate, flamprop, flamprop-M, flazasulfuron, flazifop, flazifop-P-butyl, fluazolate, flucarbazone, flucetosulfuron, fluchloralin, flufenacet, flufenican, flufenpyr-ethyl, flumezin, flumecuron, flumefural, flumethoate, flumiclorac-pentyl, flumibenzuron, flumipropyn, fluometuron, fluoridone, fluorodifen, fluoroglycofen, fluoromide, florochloridone, fluroxypyr, fluroxypyr-ethyl, flurtamone, fluthiacet, fomesafen, foramsulfuron, fosamine, fumiclorac, furyloxyfen, glufosinate, glufosinate-ammonium, glufosinate-P-ammonium, glyphosate salts and esters, haloxifen, haloxifen-methyl, halosafan, halosulfuron-methyl, haloxydine, haloxyfop-methyl, haloxyfop-P-methyl, hexachloroacetone, hexaflurate, hexazinone, imazamethabenz, imazamox, imazapic, imazapyr, imazaquin,
imazosulfuron, cloransulam-methyl, indanofan, indaziilam, iodobonil, iodomethane, iodosulfuron, iodosulfuron-ethyl-sodium, iofensulfuron, oxynil, ipazine, ipfencarbazone, iprymidam, isocarbazid, isocil, isomethiozin, isonoruron, isopollinate, isopropalin, isoproturon, isouron, isoxaben, isoxachlortole, isoxadifluor, isox⇔rifop, karbutilate, ketospiradox, lactofen, lenacil, linuron, MAA, MAMA, MCPA esters and amines, MCPA-thioethyl, MCPB, mecoprop, mecoprop-P, medinoterb, mfenacet, mefluidide, mesoprazine, mesosulfuron, metazachlor, metam, metamifop, metamitron, metazosulfuron, metbromuron, methabenzthiazuron, methalpropalin, methazole, methiobencarb, methiozolin, methiuron, methomeron, methoxybromide, methyl isothiocyanate, methylidymron, metobenzuron, metobromuron, molinate, monalide, monisouron, monochloroacetic acid, monolinuron, monuron, morfamquat, MSMA, naproanilide, napropamide, naptalam, neburon, nicosulfuron, nipyraclorofen, nitralin, nitrofen, nitrofluorfen, norflurazon, noruron, OCH, orbencarb, ortho-dichlorobenzene, orthosulam, oryzalin, oxadiargyl, oxadiazon, oxapyrazon, oxasulfuron, oxaziclamome, oxyfluorfen, paraflufen-ethyl, paralfluron, paraquat, pebulate, pelargonic acid, pendimethalin, pentachlorophenol, pentanochlor, pentoxazone, perfluidone, pethoxamid, phenisopham, phenmedipham, phenmedipham-ethyl, phenobenzuron, phenylmercury acetate, picloram, picolinafen, pinoxaden, piperphos, potassium arsenite, potassium azide, potassium cyanate, pretilachlor, primisulfuron-methyl, procyazine, prodiamine, profluzoisal, profluralin, profoxydim, proglinazine, prohexadione-calcium, prometon, prometryn, pronamide, propachlor, propanil, propaquizafop, propazine, propamid, propisochlor, propoxycarbazone, propyrisulfuron, propyzamide, prosulfalin, prosulfocarb, prosulfuron, proxan, pyralachlor, pydanon, pyraclonil, pyraflufen-ethyl, pyrasulfotole, pyrazogyl, pyrazolynate, pyrazosulfuron-ethyl, pyrazoxyfen, pyribenoxim, pyribifencarb, pyriclor, pyridafol, pyridate, pyritofoal, pyriminobac, pyrimisulfan, pyrithiobac-sodium, pyroxasulfone, quinclorac, quinmerac, quinoxamine, quinonamid, quinclorac, quizalofop, quizalofop-P-ethyl, rhodethanil,
rimsulfuron, sailufenacil, S-metolachlor, sebuthylazine, secbumeton, sethoxydim, siduron, simazine, simeton, simetryn, SMA, sodium arsenite, sodium azide, sodium chloride, sulcotrione, sulfallate, sulfometuron, sulfosate, sulfosulfuron, sulfuric acid, sulglycapin, swep, SYN-523, TCA, tebutam, tebuthiuron, tefuryltrione, tembotrione, tepraloxydim, terbacil, terbucarb, terbuchlor, terbumeton, terbuthylazine, terbutryn, tetrafluoron, thenylchlor, thiazafluoron, thiazopyr, thidiazimin, thidiazuron, thienacarbazone-methyl, thifensulfuron, thifensulfurn-methyl, thiobencarb, tiocarbazil, tioclorim, topramezone, tralkoxydim, triamline, triafluron, triasulfuron, triaziflam, tribenuron, tribenuron-methyl, tricamba, triclopyr choline salt, triclopyr esters and salts, tridiphane, trietazine, trifloxysulfuron, trifluralin, trifluralin, triflusulfuron, trifop, trifopsime, trihydroxytriazine, trimeturon, tripropindan, tritac tritosulfuron, vernolate, xylachlor and salts, esters, optically active isomers and mixtures thereof.

Particularly suitable suspension concentrates according to the invention are mixtures of one or more triazolopyrimidines, triazolones, pyrazoles or oxazoles with one or more second active ingredients that include the amide herbicides, the aromatic acid herbicides, the diphenyl ether herbicides, and the organophosphorus herbicides. These actives amenable to the present invention due to their high water solubility at neutral pH and difficulty in water-based, suspension-concentrates.

Amide herbicides useful in the invention include the sub-groups of anilide herbicides, arylicotline herbicides, chloracetanilide herbicides, sulfonanilide herbicides, sulphonamide herbicides and thioamide herbicides. Suitable amide herbicides include allicidochlor, amicarbazone, beilubutamid, benzodox, benzzipram, bromobutide, cafenstrole, CDEA, cyprazole, dimethenamid, dimethenamid-P, diphenamid, epronaz, etniprodimid, fentrazamide, flucarbazone, ilupoxam, fomesafen, halosafen, huangcaoling, isocarbarim, isoxaben, napropamide, napropamide-M, naptalam, pethoxamid, propyzamide, quinonamid, sailufenacil, tebutam, and tiafenacil.

Suitable anilide herbicides include chloranocryl, cisnaphide, clomeprop, cypermeth, diflufenican, erlulixiancaooan, etobenatan, fenasulam,
ilufenacet, ilufenican, ipfencarbazone, mfenacet, meiluidide, metamifop, monalide, naproanilide, pentanochlor, picolinafen, propanil, sulfentrazone, and triafamone.

[0033] Suitable aryllalanine herbicides include benzoylprop, and flamprop especially flamprop-M.

[0034] Suitable chloroacetanilide herbicides include acetochlor, alachlor, butachlor, butenachlor, delachlor, diethatyl, dimethachlor, ethachlor, ethaprochlor, metazachlor, metolachlor especially S,-metolachlor, pretilachlor, propachlor, propisochlor, prynachlor, terbucharl, thenylchlor, and xylachlor.

[0035] Suitable sulfonanilide herbicides include benzfuror, cloransulam, diclosulam, florasulam, flumetsulam, metosulam, perfluidone, profluazol, and pyrimisulfan.

[0036] Suitable sulfonamide herbicides include asulam, carbasulam, fenasulam, oryzalin, penoxsulam, and pyroxsulam.

[0037] Suitable thioamide herbicides include bencarbazone and chlorthiamid.

[0038] Suitable aromatic acid herbicides include benzoic acid herbicides (such as cambendichlor, chloramben, dicamba, 2,3,6-TBA, and tricamba); pyrimidinyloxybenzoic acid herbicides (such as bispyribac and pyriminobac); pyrimidinylthiobenzoic acid herbicides (such as pyrithiobac); phthalic acid herbicides (such as chlorthral); picolinic acid herbicides (such as aminopyralid, clopyralid, halaxif, and picloram); and quinolinecarboxylic acid herbicides (such as quinclorac and quinmerac).

[0039] Suitable diphenyl ether herbicides include ethoxyfen and nitrophenyl ether herbicides (such as acifluorfen, aclonifen, bifenox, chloromethoxyfen, chlornitrofen, etniproimid, fluorodifen, fluoroglycofen, iluronitrofen, fomesafen, fucaomi, furyloxyfen, halosafen, lactofen, nitrofen, nitrofluorfen, and oxyfluorfen).

[0040] Suitable organophosphorus herbicides include amipros-methyl, amiprophos, anilofos, bensulide, bilanafos, butamifos, clacyfus, 2,4-DEP, DMPA, EBEP, fosamine, glufosinate especially glufosinate-P, glyphosate, huangcaoling, piperophos, and shuangjiaancaolin.
Particularly preferred combinations and mixtures for use in the suspension concentrate of the invention include mixtures with herbicidal amides (such as saflufenacil, dimethenamid-p, and pethoxamid); chloroacetanilides (such as metolachlor, s-metolachlor, and acetochlor); dinitroanilines (such as pendimethalin and trifluralin); nitrophenylethers (such as acifluorfen, fomesafen, lactofen, and oxyfluorfen); benzoic acids (such as dicamba acid, diglycoamine salt of dicamba, and tridentate amine salt of dicamba such as bapma-dicamba); phenoxyacetic acids (such as 2.4-d, choline salt of 2.4-d, and 4-chloro-2-methylphenoxy) acetic acid (aka MCPA); and organophosphates (such as glyphosate and glufosinate).

A comb polymer is used in the present invention to aid dispersion of the insoluble components. Comb polymers are so named because of their structure: a main polymeric backbone chain with two or more, three-way branch points and linear side chains. If the side chains that form the "combs" are identical, the comb polymer molecule is said to be regular. Comb polymers can be formed from a number of polymers including polyetheramines (e.g. US 8,247,353 and 8,420,573), hyper comb-branched polymers (US 5,919,442), amphiphilic comb polymers (US 2014/0018277), and PPEM 9376 (Akzo) which is believed to be made with ethoxylated anionic carboxylate-containing copolymer of comb-structure with pendant C14-hydrophobic aliphatic groups, polyalkylene glycol mono(meth)acrylate or allyl alcohol alkoxylate (such as polyethylene glycol allyl ether) in polymerized form, preferably polyethylene glycol monoalkyl ether (meth)acrylate with a molar mass Mn of 100 to 5000 g/mol (US2012/0238641). See also Group F of US 2012/0053221 and US Patent No. 8,618,022.

The preferred comb polymers for use in the present invention are those made according to WO 2014/191288, the disclosure of which is hereby incorporated by reference. Such copolymers are carboxylated, water soluble, polymers based on one or more ethylenically unsaturated carboxylic acids, 5-55% of which have been esterified with a polyalkoxylated polystyrylphenol. Such water soluble carboxylated polymers may be
prepared in two steps by i) radically polymerizing ethylenically unsaturated mono carboxylic acids, bi-carboxylic acids or anhydride thereof, and ii) esterifying in a subsequent step the thus obtained carboxylated polymer with specific amounts of the polyalkoxylated polystyrylphenol such as poly(oxy-1,2-ethanediyl), alpha-phosphono-omega-(2,4,6-tris(l-phenylethyl)phenoxy) (CAS 114535-82-9). Even more preferably, a) at least 85% by moles of the monomer units derive from ethylenically unsaturated C3-Cs mono carboxylic acids, bi-carboxylic acids or anhydride thereof and from 0 to 15% by moles of the monomer units derive from one or more non-carboxylated ethylenically unsaturated monomers, b) from 5% to 55% of the carboxylic acid groups of the polymer are esterified with at least one polyalkoxylated polystyrylphenol, the water soluble polymer being obtained by i) radically polymerizing at least 85% by moles of ethylenically unsaturated C3-Cs mono carboxylic acids, bi-carboxylic acids or anhydride thereof and from 0 to 15% by moles of one or more noncarboxylated ethylenically unsaturated monomers, ii) esterifying the thus obtained carboxylated polymer with from 5% to 55% of equivalents, based on the carboxylic acid groups of the polymer, of a polyalkoxylated polystyrylphenol such as distyrylphenol and tristyrylphenol, and also the analogue di- and tri-a- ethylstyrerylphenol. The term "polyalkoxylated" mean alkoxylated with more than one mole of at least one alkylene oxide, which is typically ethylene oxide, propylene oxide or butylene oxide.

[0045] By way of summary, the polymer of WO 2014/ 191288 has at least 85 mole %, preferably 100%, of the monomer units derive from ethylenically unsaturated C3-Cs mono carboxylic acids, bi-carboxylic acids or anhydrides thereof that are selected among acrylic acid, methacrylic acid, maleic acid, fumaric acid, crotonic acid, itaconic acid and anhydrides thereof.

[0046] From 0 to 15% by moles of the monomer units of the comb polymer derive from one or more non-carboxylated ethylenically unsaturated nonionic or ionic monomers. Examples of such non-carboxylated monomers are amides, alkyl esters, with or without hydroxyl or amino groups in the ester radical, alcohols, sulfonic acids and ethers with ethylenically unsaturated radicals, olefins and styrene. Specific examples of non-
carboxylated monomers are acrylamide, methacrylamide, 2-acrylamido-2-
methylpropanesulfonic acid, vinylsulfonic acid, allylsulfonic acid, vinylphosphonic acid, allylphosphonic acid, vinyl acetate, vinyl propionate, methyl acrylate and methacrylate, ethyl acrylate and methacrylate, hydroxyethyl acrylate and methacrylate, hydroxypropyl acrylate and methacrylate, dialkylaminoethyl acrylate and methacrylate, vinylglycol, allyl alcohol, ethylene, propylene, isobutylene, methyl vinyl ether, ethyl vinyl ether, isobutyl vinyl ether, styrene and butadiene. Preferably, the non-
carboxylated monomers are nonionic, and the sum of the ethylenically unsaturated C3-Cs mono carboxylic acids, bi-carboxylic acids or anhydrides thereof and the non-carboxylated monomers is 100% by moles, which improves the versatility of the polymer.

[0047] The carboxylic acid groups of the water soluble polymer are esterified with at least one polyalkoxylated polystyrylphenol which is polyethoxylated tristyrylphenol, most preferably they are esterified with at least one tristyrylphenol which is polyethoxylated with from 10 to 30 moles of ethylene oxide; from 5 to 55%, preferably from 8% to 30%, most preferably from 10% to 15%, of the carboxylic acid groups of the water soluble polymer are esterified with the polyalkoxylated polystyrylphenol.

[0048] Acid Stable Surfactant

[0049] One or more acid stable surfactants are preferably used in the present invention to enhance suspensive capacity and storage stability. Generally suitable surfactants include nonionic alkoxylated surfactants and block copolymer surfactants. Examples of useful alkoxylated surfactants for the invention include castor oil ethoxylate, tridecyl alcohol ethoxylate, nonyl phenol ethoxylate, octyl phenol ethoxylate, tristyryl phenol ethoxylate, phosphate ester ethoxylate, tallow amine ethoxylate, cocoa amine ethoxylate, and oleyl amine ethoxylate. Preferred acid stable surfactants include alkylphenol ethoxylates and the alkoxylated polyarylpHenol phosphates that are described in US Patent Nos. 4,853,026 and 5,912,267 and alkoxylated polyarylphenol phosphate esters optionally including alkoxylated lignosulfonate salts as described in US Patent No. 7,238,645.

[0050] Redispersion Agent
[0051] The present invention also includes the optional use of a redispersion agent in the formulation to avoid the formation of hard sediment and aid in the redispersion and re-suspension of any sediment. While not wishing to be bound by theory, it is believed that the present redispersion agent acts as a soft lattice or nucleating agents that capture precipitating solids whether they are the insoluble active component falling out of dispersion or the second active ingredient (soluble or insoluble in water) that might begin to form sediment crystals. The redispersion agent interacts with the precipitating solids to form a soft cloud on the bottom of the contain that is readily redispersed and suspended with only gentle agitation without forming nozzle clogging agglomerates.

[0052] Suitable redispersion agents include finely divided silica, aluminosilicates, aluminomagnesiumsilicates, and water-swellable clays which will hydrate in the presence of water, i.e., will swell in the presence of water. Suitable water swellable clays are from the kaolinite, montmorillonite or ilite groups. Exemplary and preferred montmorillonite clays that can be used in the present invention is bentonite including water-swellable sodium bentonite clay or a low-swellable calcium bentonite clay. A preferred bentonite is sodium bentonite which is basically a hydratable montmorillonite clay of the type generally found in the Black Hills region of South Dakota and Wyoming. This clay has sodium as a predominant exchange ion. However, the bentonite utilized in accordance with this embodiment of the present invention may also contain other cations such as magnesium and iron. There are cases wherein a montmorillonite predominant in calcium ions can be converted to a high swelling sodium variety through a well-known process called "peptizing". The colloidal clay utilized in this invention may be one or more peptized bentonites.

[0053] The redispersion agent may also be a clay of the dioctahedral or trioctahedral smectite group or mixtures thereof. Examples of smectite clays are Beidellite, Nontronite, Hectorite, Sepiolite and Samonite.

[0054] Clays used as redispersion agents according to the invention may be subjected to the re-wetting and re-drying treatment described in e.g., US Patent No. 5,114,893.
Uses

The suspension concentrates of the invention can be used in their suspension concentrate form to control plant growth, preferably via inhibition of plant amino acid synthesis - acetohydroxyacid synthase (AHAS) or acetylactate synthase (ALS) - at application rates consistent with known rates for the specific active ingredient. For example, the suspension concentrate can be combined with an acidifying agent, e.g., in a tank mix procedure or otherwise, to form a herbicidal formulation, and can optionally be further combined with other ingredients such as an additional, different, active herbicidal compounds.

The preferred use for the suspension concentrate of the invention is for use in a process for controlling the growth of undesired plants among desired plants. For example, cloransulam-methyl herbicidal suspensions according to the invention can be used for soil-applied and postemergence control of broadleaf weeds in soybeans. This active ingredient is readily absorbed by broadleaf weeds via roots, shoots, and foliage.

Preferred herbicidal formulations of the invention exhibit a pH within the range from about 1.5 to about 5, preferably about 2 to about 4 that can be adjusted with an agrochemically-friendly acid such as phosphoric acid. The low pH allows for reduced formation of crystals, particle agglomerates and solubility of the active ingredient.

Examples

Example 1

In this example, a representative suspension concentrate according to the invention includes the following ingredients in Table 2:
The formulation was made as follows:

1. Weigh 90% of the water into a mixing vessel equipped with an agitator and a load cell.

2. Weigh wetting agent (1) into the water and mix to incorporate.

3. Weigh wetting agent (2) into the mixing vessel and mix to incorporate.

4. Weigh comb polymer into the mixing vessel and mix to incorporate.

5. Weigh polyalkoxylated polystyryl phenol into the mixing vessel and mix to incorporate.

6. Weigh cloransulam-methyl technical into the mixing vessel and mix until fully dispersed.

Table 2

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Wt%</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloransulam-methyl, 99.0% A.I.</td>
<td>22.630</td>
<td>Active Ingredient</td>
</tr>
<tr>
<td>Wetting agent (optional)</td>
<td>1.500</td>
<td>Primarily as acidic wetting agent with dispersant effects</td>
</tr>
<tr>
<td>Nonionic block copolymer</td>
<td>1.000</td>
<td>Wetting agent</td>
</tr>
<tr>
<td>Comb polymer</td>
<td>1.000</td>
<td>Dispersant</td>
</tr>
<tr>
<td>Bentonite swelling clay</td>
<td>1.000</td>
<td>Rheology Aid</td>
</tr>
<tr>
<td>Polystyryl phenol - Poly(oxy-1,2-ethanediyl), alpha-phosphono-omega-(2,4,6-tris(1-phenylethyl)phenoxy)</td>
<td>1.000</td>
<td>Acidic dispersant/wetting agent</td>
</tr>
<tr>
<td>Propylene Glycol</td>
<td>4.500</td>
<td>Anti-Freeze</td>
</tr>
<tr>
<td>Xanthan gum</td>
<td>0.400</td>
<td>Thickener</td>
</tr>
<tr>
<td>Biocide (20% water and dipropylene glycol solution of 1,2-benzisothiazolin-3-one)</td>
<td>0.100</td>
<td>Anti-Microbial agent</td>
</tr>
<tr>
<td>Polydimethylsiloxane emulsion</td>
<td>0.200</td>
<td>Antifoaming agent</td>
</tr>
<tr>
<td>Water</td>
<td>67.920</td>
<td>Diluent</td>
</tr>
</tbody>
</table>
7. Weigh swelling clay into the mixing vessel and mix until incorporated.

8. Wet mill the dispersion until the desired particle size is achieved, preferably 2-3 microns median particle size.

9. Transfer the milled dispersion to a tared mixing vessel and record the weight.

10. IMPORTANT: The post-milled dispersion batch weight will typically be less than the pre-mill batch weight, therefore ratio the remaining ingredients based on the post milling batch weight in order to balance the formula correctly.

11. Add remaining ingredients and mix to incorporate.

Example 2

An example of a suspension concentrate containing a greater amount of the active ingredient is presented in this example. The ingredients are listed in Table 3. The formulation process was the same as in example 1.
Table 3

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Wt%</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloransulam-Methyl, 97.8% A.I.</td>
<td>40.490</td>
<td>Active Ingredient</td>
</tr>
<tr>
<td>Comb polymer</td>
<td>2.000</td>
<td>Dispersant</td>
</tr>
<tr>
<td>Block copolymer</td>
<td>1.500</td>
<td>Dispersant</td>
</tr>
<tr>
<td>Polyalkoxylated polystyryl phenol</td>
<td>1.500</td>
<td>Dispersant</td>
</tr>
<tr>
<td>Tridecyl alcohol</td>
<td>0.500</td>
<td>Wetting agent</td>
</tr>
<tr>
<td>Bentonite swelling clay</td>
<td>0.650</td>
<td>Rheology Aid</td>
</tr>
<tr>
<td>Biocide (20% water and dipropylene glycol solution of 1,2-benzisothiazolin-3-one)</td>
<td>0.100</td>
<td>Anti-Microbial</td>
</tr>
<tr>
<td>Propylene Glycol</td>
<td>4.000</td>
<td>Anti-Freeze</td>
</tr>
<tr>
<td>Xanthan gum</td>
<td>0.150</td>
<td>Rheology Aid</td>
</tr>
<tr>
<td>Polydimethylsiloxane emulsion</td>
<td>0.250</td>
<td>Antifoam</td>
</tr>
<tr>
<td>Phosphoric acid, 85%</td>
<td>0.100</td>
<td>pH Modifier</td>
</tr>
<tr>
<td>Water</td>
<td>48.760</td>
<td>Diluent</td>
</tr>
</tbody>
</table>

[0075] **Example 3**

The formulations of Examples 1 and 2 were tested by standard testing for two year simulated storage stability. In each case, the formulation did not flocculate and any precipitate was soft and readily re-dispersed with only minor effort. Efficacy testing of the active ingredient did not reveal any material degradation in performance. Thus, the formulations of the invention were deemed good and commercially acceptable.

[0076] It will be understood that the preferred embodiments described herein are not intended to serve as substantive limitations on the scope of the appended claims and are presented for illustrative and explanatory purposes.

[0077] Each of the patents referred to herein is hereby incorporated by reference.
WHAT IS CLAIMED IS:

1. An aqueous suspension concentrate composition comprising: (a) a first active ingredient comprising one or more triazolopyrimidine, triazolone, pyrazole or oxazole herbicides; (b) optionally, a second active ingredient, (c) a dispersant comprising a comb polymer; (d) a nonionic, alkoxyalkyl surfactant or a block copolymer surfactant, and (e) optionally, a re-dispersing agent, wherein said aqueous suspension concentrate exhibits an acidic pH within the range from about greater than about 2 to about 4.

2. A suspension concentrate according to claim 1 wherein said first active ingredient comprises a triazolopyrimidine herbicide.

3. A suspension concentrate according to claim 2 wherein said first active ingredient comprises a triazolopyrimidine herbicide selected from the group consisting of cloransulam, cloransulam-methyl, diclosulam, florasulam, flumetsulam, metosulam, penoxsulam, and pyroxsulam.

4. A suspension concentrate according to claim 2 wherein said first active ingredient comprises cloransulam or cloransulam-methyl.

5. A suspension concentrate according to claim 1 wherein said first active ingredient comprises a triazolone herbicide.

6. A suspension concentrate according to claim 5 wherein said first active ingredient comprises a triazolone herbicide selected from the group consisting of amicarbazone, bencarbazone, carfentrazone, flucarbazone, ipfencarbazone, propoxycarbazone, sulfentrazone, and thiencarbazone.

7. A suspension concentrate according to claim 6 wherein said first active ingredient comprises sulfentrazone.
8. A suspension concentrate according to claim 1 wherein said first active ingredient comprises a pyrazole herbicide.

9. A suspension concentrate according to claim 1 wherein said first active ingredient comprises a pyrazole herbicide selected from the group consisting of azimsulfuron, difenzoquat, halosulfuron, metazachlor, metazosulfuron, pyrazosulfuron, and pyroxasulfone.

10. A suspension concentrate according to claim 1 wherein said first active ingredient comprises an oxazole herbicide.

11. A suspension concentrate according to claim 1 wherein said first active ingredient comprises an oxazole herbicide selected from the group consisting of carboxazole, fenoxasulfone, isouron, isoxaben, isoxachlortole, isoxaflutole, methiozolin, monisouron, pyroxasulfone, and topramezone.

12. A suspension concentrate according to claim 1 wherein said comb polymer comprises a carboxylated water soluble polymer in which a) at least 85% by moles of the monomer units derive from ethylenically unsaturated C3-C5 mono carboxylic acids, bi-carboxylic acids or anhydride thereof and from 0 to 15% by moles of the monomer units derive from one or more non-carboxylated ethylenically unsaturated monomers, b) from 5% to 55% of the carboxylic acid groups of the polymer are esterified with at least one polyalkoxyalted polystyrylphenol.

13. A suspension concentrate according to claim 12 wherein in said carboxylated water soluble polymer, 100% of the monomer units derive from ethylenically unsaturated C3-C5 mono carboxylic acids, bi-carboxylic acids or anhydride thereof.

14. A suspension concentrate according to claim 12 wherein the carboxylic acid groups of the carboxylated water soluble polymer are
esterified with a polyalkoxylated polystyrylphenol which is a polyethoxylated tristyrylphenol.

15. A suspension concentrate according to claim 1 further comprising a redispersion agent comprising a water swellable clay.

16. A suspension concentrate according to claim 15 wherein said clay comprises bentonite clay.

17. A suspension concentrate according to claim 1 comprising a second active ingredient that comprises at least one of a herbicidal amide, a herbicidal chloroacetanilide, a herbicidal dinitroaniline, a herbicidal nitrophenylether, a herbicidal benzoic acid, a herbicidal phenoxyacetic acid, or a herbicidal organophosphate.

18. A suspension concentrate according to claim 17 wherein said second active ingredient comprises at least one of saflufenacil; dimethenamid-P; pethoxamid; metolachlor; S-metolachlor; acetochlor; pendimethalin; trifluralin; acifluorfen; fomesafen; lactofen; oxyfluorfen; dicamba acid; diglycoamine amine salt of dicamba; tridentate amine salt of dicamba; 2,4-D; choline salt of 2,4-D; 4-chloro-2-methylphenoxy) acetic acid; glyphosate; and glufosinate.

19. A suspension concentrate according to claim 1 comprising sulfentrazone and dicamba acid.

20. A suspension concentrate according to claim 1 comprising sulfentrazone and 2,4-D.

21. A suspension concentrate according to claim 1 comprising cloransulam-methyl and dicamba acid.

22. A suspension concentrate according to claim 1 comprising sulfentrazone and 2,4-D.
23. A suspension concentrate according to claim 1 wherein said composition comprises ingredient concentrations according to the following table:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Range (total wt%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active ingredient</td>
<td>5-85</td>
</tr>
<tr>
<td>Comb polymer dispersant</td>
<td>0.01-15</td>
</tr>
<tr>
<td>Nonionic surfactant</td>
<td>0.25-10 % of each</td>
</tr>
<tr>
<td>Redispersion agent</td>
<td>0.1-10</td>
</tr>
</tbody>
</table>

24. A suspension concentrate according to claim 1 wherein said composition comprises ingredient concentrations according to the following table:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Range (total wt%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active ingredient</td>
<td>5-65</td>
</tr>
<tr>
<td>Comb polymer dispersant</td>
<td>0.1-7.5</td>
</tr>
<tr>
<td>Nonionic surfactant</td>
<td>0.5-5 % of each</td>
</tr>
<tr>
<td>Redispersion agent</td>
<td>0.3-5</td>
</tr>
</tbody>
</table>

25. A suspension concentrate according to claim 1 further comprising phosphoric acid.

26. A process for controlling the growth of unwanted plants by a process that comprises applying to the loci of the unwanted plants a diluted suspension concentrate, said concentrate comprising: (a) a first active ingredient comprising one or more triazolopyrimidine, triazolone, pyrazole or oxazole herbicides; (b) optionally, a second active ingredient, (c) a dispersant comprising a comb polymer; (d) a nonionic, alkoxyalted surfactant or a block copolymer surfactant, and (e) optionally, a re-dispersing agent, wherein said aqueous suspension concentrate exhibits an acidic pH within the range from about greater than about 2 to about 4.
INTERNATIONAL SEARCH REPORT

International application No. PCT/US 16/44925

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A01N 43/90; A01N 25/04 (2016.01)
CPC - A01N43/90; A01N25/04

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)

IPC(8) - A01N 43/90; A01N 25/04 (2016.01)
CPC - A01N43/90; A01N25/04

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

Patents and NPL (classification, keyword; search terms below)

USPC - 504/240; 504/241

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


C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>US 2014/0141977 (Wacker et al.) 22 May 2014 (22.05.2014); para [0003], [0080], [0123]-[0125], [0131]-[0133], [0135]-[0136], [0148], [0158], [0209]</td>
<td>1-4, 12-16, 23-25</td>
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<tr>
<td>Y</td>
<td>WO 2012/130923 (BASF SE) 04 October 2012 (04.10.2012); pg 1 in 3; pg 25 in 34-36; pg 27 in 5-8; pg 34 in 19-26; pg 37 in 40; pg 51 in 31-32</td>
<td>1-4, 12-16, 23-25</td>
</tr>
<tr>
<td>Y</td>
<td>WO 2014/191288 (Lamberti SPA) 04 December 2014 (04.12.2014); para [0022]-[0023], [0031], [0044]-[0045]</td>
<td>12-14</td>
</tr>
<tr>
<td>A</td>
<td>US 2007/0253016 (Hodge et al.) 8 November 2007 (08.11.2007); para [0017], [0024], [0053], [0062]-[0063], [0070]-[0071], [0085], [0088]</td>
<td>1-4, 12-16, 23-25</td>
</tr>
</tbody>
</table>

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

* 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
  "S" document member of the same patent family

Date of the actual completion of the international search: 27 October 2016

Date of mailing of the international search report: 28 DEC 2016

Authorized officer: Lee W. Young

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)
# INTERNATIONAL SEARCH REPORT

**International application No.:**

PCT/US 16/44925

<table>
<thead>
<tr>
<th>Box No. II</th>
<th>Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)</th>
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</thead>
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<tr>
<td>1. ☐ Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:</td>
<td></td>
</tr>
<tr>
<td>2. ☐ Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:</td>
<td></td>
</tr>
<tr>
<td>3. ☐ Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).</td>
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</table>

<table>
<thead>
<tr>
<th>Box No. III</th>
<th>Observations where unity of invention is lacking (Continuation of item 3 of first sheet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>This International Searching Authority found multiple inventions in this international application, as follows: Please see attached sheet-</td>
<td></td>
</tr>
</tbody>
</table>

| 1. ☑ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims. |
| 2. ☑ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees. |
| 3. ☑ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.: |
| 4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-4, 12-16, 23-25 |

**Remark on Protest**

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (January 2015)
INTERNATIONAL SEARCH REPORT

Box III: Lack of Unity:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

Group I+: Claims 1-25 directed to an aqueous suspension concentrate composition comprising:
(a) a first active ingredient comprising one or more triazolopyrimidine, triazolone, pyrazole or oxazole herbicides;
(b) optionally, a second active ingredient;
(c) a dispersant comprising a comb polymer;
(d) a nonionic, alkoxylated surfactant or a block copolymer surfactant, and
(e) optionally, a re-dispersing agent, wherein said aqueous suspension concentrate exhibits an acidic pH within the range from about greater than 2 to about 4.

The suspension concentrate will be searched to the extent that the suspension concentrate encompasses a triazolopyrimidine herbicide as the first and only active ingredient. It is believed that claims 1-4, 12-16 and 23-25 read on this first named invention, and thus these claims will be searched without fee to the extent that they encompass a triazolopyrimidine herbicide as the first active ingredient. Applicant is invited to elect additional suspension concentrate(s), wherein each additional suspension concentrate selected will require one additional invention fee. Applicants must specify the claims that encompass any additionally elected suspension concentrate. Applicants must further indicate, if applicable, the claims which encompass the first named invention, it different than what was indicated above for this group. Failure to clearly identify how any paid additional invention fees are to be applied to the ‘+’ group(s) will result in only the first claimed invention to be searched. Additionally, an exemplary election wherein different actual variables are selected is suggested. An exemplary election would be a suspension concentrate according to claim 1, wherein - a triazolopyrimidine herbicide is the first active ingredient and
-a dicamba acid is the second active ingredient (i.e., claims 1-4, 12-18, 21 and 23-25).

Group II: Claim 26, directed to a process for controlling the growth of unwanted plants by a process that comprises applying to the loci of the unwanted plants a diluted suspension concentrate, said concentrate comprising:
(a) a first active ingredient comprising one or more triazolopyrimidine, triazolone, pyrazole or oxazole herbicides; (b) optionally, a second active ingredient, (c) a dispersant comprising a comb polymer; (d) a nonionic, alkoxylated surfactant or a block copolymer surfactant, and (e) optionally, a re-dispersing agent, wherein said aqueous suspension concentrate exhibits an acidic pH within the range from about greater than 2 to about 4.

The group of inventions listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Special Technical Features:

Group I+ includes the technical feature of a unique suspension concentrate, which is not required by any other invention of Group I+.

Group II includes the technical feature of a process for controlling the growth of unwanted plants, not required by Group I+.

Common technical features:

The inventions of Group I+ share the technical feature of an aqueous suspension concentrate composition comprising:
(a) a first active ingredient comprising one or more triazolopyrimidine, triazolone, pyrazole or oxazole herbicides;
(b) optionally, a second active ingredient;
(c) a dispersant comprising a comb polymer;
(d) a nonionic, alkoxylated surfactant or a block copolymer surfactant, and
(e) optionally, a re-dispersing agent, wherein said aqueous suspension concentrate exhibits an acidic pH within the range from about greater than 2 to about 4.

Groups I+ and II also share the technical feature of a suspension concentrate composition comprising:
(a) a first active ingredient comprising one or more triazolopyrimidine, triazolone, pyrazole or oxazole herbicides;
(b) optionally, a second active ingredient;
(c) a dispersant comprising a comb polymer;
(d) a nonionic, alkoxylated surfactant or a block copolymer surfactant, and
(e) optionally, a re-dispersing agent, wherein said aqueous suspension concentrate exhibits an acidic pH within the range from about greater than 2 to about 4.

— Cont. in the next Supplemental Box —
Cont. of the previous Supplemental Box:

This shared technical feature, however, does not provide a contribution over the prior art, as being obvious over US 2007/0259016 A1 to Hodge et al. (hereinafter ‘Hodge’).

Hodge teaches an aqueous suspension concentrate composition (para [0017], [0024], [0053], [0062]-[0063], [0070]-[0071], [0085], [0088]), comprising:
(a) a first active ingredient comprising one or more triazolopyrimidine herbicides (para [0024],...have advantageously found...a
suspensible formulation to include... surfactants and dispersants...; para [0070],...produce slurries or suspensions of particulate biocidal material...; para [0017],...method of manufacture of a concentrated chlorothalonil slurry,... balance of the product is one or more of the following components,... water, surfactants and dispersants,... buffers, co-biocides...; para [0062], biocides include herbicides,...; para [0063], examples of classes of compound’s that have herbicidal activity...include...triazolopyrimidine sulfonamides such as flumetsulam...);
(c) a dispersant comprising a comb polymer (para [0017],...a concentrated chlorothalonil slurry,...balance of the product is one or more of the following components,... dispersants,...; para [0085], aqueous dispersing agents for such dispersed solids,... include...nonionic surfactants such as ethylene oxide/propylene oxide block copolymers,...maleic anhydride-diiobutylene copolymers...);
(d) a nonionic, alkoxylated surfactant or a block copolymer surfactant (para [0071],...liquid dispersion media include water... particularly water having added surface active agents (surfactant),...is a preferred medium...; para [0088], examples of suitable classes of surface active agents include... nonionics such as ethoxylated derivatives of fatty alcohols... block copolymeric surfactants derived from alkylene oxides such as ethylene oxide/propylene oxide (e.g., PLURONIC, which is a class of nonionic PEO-PPO co-polymer surfactant...), and the pH of aqueous suspension concentrate can be adjusted to ensure substantial insolubility, or at least sparing solubility of herbicides (para [0053],...the pH of the aqueous dispersion can be adjusted to ensure substantial insolubility, or at least sparing solubility, of these biocides). Hodge does not specifically teach an aqueous suspension concentrate exhibits an acidic pH within the range from about greater than about 2 to about 4. To a person of ordinary skill in the art it would have been obvious through routine experimentation to include an aqueous suspension concentrate exhibits an acidic pH within the range from about greater than about 2 to about 4 in the teaching of Hodge, because Hodge teaches aqueous suspension concentrate includes buffers (para [0017]), and that pH of aqueous suspension concentrate can be adjusted to ensure substantial insolubility, or at least sparing solubility of herbicide (para [0053]), in order to produce a superior aqueous suspension concentrate.

As said suspension concentrate was known at the time of the invention, this cannot be considered a special technical feature which would otherwise unify the inventions of Groups I+, and those of Groups I, and II.

The inventions of Group I+, II thus lack unity under PCT Rule 13.