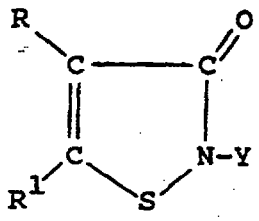
Description

This invention is concerned with stable compositions of 3-isothiazolones, their preparation, and their use in controlling living organisms. The isothiazolones which are stabilized in this invention include those disclosed in US-A-3,523,121 and 3,761,488 as represented by the following structural formula:



wherein

Y is one of: (C_1-C_{18})alkyl or (C_3-C_{12})cycloalkyl each optionally substituted with one or more of hydroxy, halo, cyano, alkylamino, dialkylamino, arylamino, carboxy, alkoxy, aryloxy, alkylthio, arylthio, haloalkoxy, cycloalkylamino, carbamoxy or isothiazolonyl; an unsubstituted or halo-substituted (C_2-C_8)alkenyl or alkynyl; a (C_7-C_{10}) aralkyl optionally substituted with one or more of halogen, (C_1-C_4)alkyl or (C_1-C_4)alkoxy; or an aryl optionally substituted with one or more of halogen, nitro, (C_1-C_4)alkyl, (C_1-C_4)alkyl-acylamino, carb(C_1-C_4)alkoxy or sulfamyl;

R is hydrogen, halo, or a (C_1-C_4)alkyl and R^1 is hydrogen, halo or (C_1-C_4)alkyl.

Representative Y substituents include methyl, ethyl, propyl, isopropyl, butyl, hexyl, octyl, cyclohexyl, benzyl, 3,4-dichlorobenzyl, 4-methoxybenzyl, 4-chlorobenzyl, 3,4-dichlorophenyl, 4-methoxyphenyl, hydroxymethyl, chloromethyl and chloropropyl.

Preferred isothiazolones are 5-chloro-2-methyl-3-isothiazolone, 2-methyl-3-isothiazolone, 2-octyl-3-isothiazolone, 4,5-dichloro-2-cyclohexyl-3-isothiazolone and 4,5-dichloro-2-octyl-3-isothiazolone.

Japanese Patent 12243/83 discloses stabilizing a mixture of an isothiazolone and 2-hydroxymethyl-2-nitro-1,3-propanediol with a diol solvent. However, 2-hydroxymethyl-2-nitro-1,3-propanediol is a formaldehyde releaser, which is known to stabilize isothiazolones (see US-A-4,165,318 and 4,129,448).

EP-A-194,146 discloses stabilizing isothiazolones in non-aqueous, salt-free systems by several hydroxylic solvents, outstanding among them dipropylene glycol.

A series of patents to Burk et al. teaches stabilization of halogenated amide antimicrobials, such as 2,2-dibromonitrilopropionamide, usually in the presence of some water, with a variety of organic stabilizers. US-A-4241080 teaches acid or anhydride stabilizers. There is no suggestion that any of these stabilizers would be useful in the neat or non-aqueous stabilization of isothiazolones.

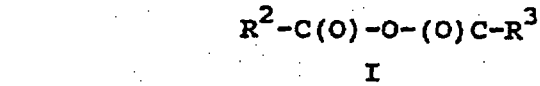
Thus, until now means for stabilization of isothiazolones against thermal degradation or storage degradation has generally been by metal salts, formaldehyde or formaldehyde releasers.

Both formaldehyde or formaldehyde-releasers and salt stabilization of isothiazolones have some drawbacks. Formaldehyde is a suspected carcinogen, and it is desirable not to use formaldehyde in applications where contact with human skin or lungs may occur.

This invention is directed to stable microbicidal isothiazolone compositions in which (1) water may be substantially eliminated, (2) salt neutralization may be eliminated and (3) the need for nitrate stabilizer salts may be substantially eliminated. Such stabilization is accomplished by the addition of organic anhydrides.

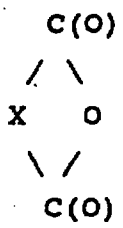
As used herein, the term "microbicidal" is intended to include but is not limited to bactericidal, fungicidal and algaecidal activity.

The anhydrides used in this invention (I - IV, infra) are those of the following general formulae:



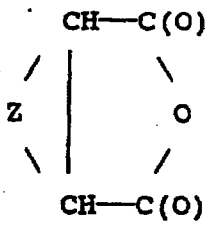
I

where R^2 and R^3 are the same or different radical and are each one of alkyl, cycloalkyl, aryl, alkylaryl, arylalkyl, or -C(O)-OR^4, where R^4 is hydrogen, alkyl, cycloalkyl, aryl, alkylaryl, or arylalkyl;



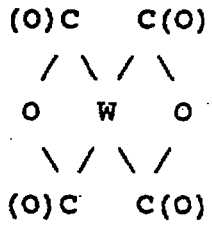
II

where X is $CR^5=CR^6$, $CR^5R^6-CR^5=CR^6$, or $(CR^5R^6)_n$, where n is 2 or 3, and where R^5 and R^6 are the same or different and are chosen from the class of R^2, R^3, H or Cl;



III

where Z completes a 4, 5, 6 or 7-membered saturated or unsaturated ring which may be heterocyclic, which Z may be substituted with one or more R^5 or R^6 groups;



(IV)

where W is an aromatic nucleus, preferably a benzene nucleus (although nuclei comprising two or more fused rings are possible).

This invention includes compositions comprising one or more isothiazolones and an effective amount of anhydride of Formulas I to IV (supra), the anhydride preferably being in the range of from 0.1 to about 99.9 parts by weight of the total isothiazolone(s) plus anhydride(s).

More preferably, the composition comprises at least one isothiazolone wherein Y is C_1-C_{18} alkyl or C_3-C_{12} cycloalkyl; R is hydrogen or halo; and R^1 is hydrogen or halo. Typical formulation ranges are illustrated in the following Table (all percentages are parts by weight) for both a concentrated solution of the isothiazolone and a dilute solution. For certain uses, such as shipping of large quantities, more concentrated solutions may also be utilized. In certain instances, where the anhydride is a solid at temperatures which might be reached in storage, such as about 55 °C or above, it may be desirable to co-blend the isothiazolone and the anhydride in a solid mixture. Such anhydrides as maleic (mp. 60°C), succinic anhydride (mp. 120°C) and phthalic anhydride (mp. 132°C) may be utilized.

It will be appreciated that proportions expressed in this table and elsewhere as percentages are equivalent to proportions expressed as parts by weight elsewhere in the specification.

FORMULATIONS TABLE

Isothiazolone	anhydride (I - IV, supra)	Solvent
0.1 - 99.9%	0.1% - 99.9%	0 - 99.8%
Preferred		
1 - 50%	1 - 25%	25 - 98%
More Preferred		
1 - 25%	1 - 10%	65 - 98%

When it is desired to package the isothiazolone with only the stabilizer and no other organic solvent or water present the amount of stabilizer or mixture of stabilizers employed will generally be from 1 percent to 25 percent. The isothiazolone may be present in a bulk form or packaged or encapsulated in some manner, including a form for controlled release. The ratio of anhydride to isothiazolone is preferably from 1:7 to 1.5:1.

Solvents other than anhydrides may be used to dissolve the isothiazolones and may be any organic solvent which dissolves the isothiazolones, is compatible with the proposed end use, does not destabilize the isothiazolone, and does not react with the anhydride to eliminate its stabilizing action. For this reason, hydroxylic solvents, for example, polyols, such as glycols, alcohols and the like, are less preferred.

In certain formulations, hydrocarbons, either aliphatic or aromatic, are useful solvents.

Preferred solvents are capped polyols, wherein the free hydroxy is replaced with an ether or ester function. Especially preferred are 2,5,8,11-tetraoxadecane, commonly known as triethylene glycol dimethyl ether or triglyme, and 4,7-dioxaundecanol-1 acetate, commonly known as diethylene glycol butyl ether acetate.

The amounts of anhydride employed will vary depending on use conditions and concentrations of the isothiazolone in the mixture. In more concentrated solutions, effective amounts of anhydride based on isothiazolone are in the ratios of from 1:4 to 1:2. Obviously higher amounts may be used, but at additional cost. At low levels of dilution of the isothiazolone (such as from 1 to 2 percent isothiazolone in the solvent), the ratio of stabilizer to isothiazolone can range from 1:7 to 2:1.

This invention permits the stabilization of isothiazolones so that the previously necessary stabilization salts are substantially reduced and even eliminated. Useful stabilization salts which can be employed are those disclosed in US-A-3,870,795 and 4,067,878 and include stabilization salts selected from:

1) Metal nitrates, where the metal is barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, lithium, magnesium, manganese, mercury, nickel, sodium, silver, strontium, tin, zinc and the like; and

2) Copper (2+) salts where the anion is halide, sulfate, nitrate, nitrite, acetate, chlorate, perchlorate, bisulfate, bicarbonate, oxalate, maleate, carbonate, or phosphate and the like.

Uses of these new organically stabilized microbicides are typically at any locus subject or susceptible to contamination by bacteria, fungi or algae. Typically loci are in aqueous systems such as water cooling, laundry

wash water, oil systems such as cutting oils, oil fields and the like where microorganisms need to be killed or where their growth needs to be controlled.

The stabilized microbicide compositions of this invention are advantageous over salt stabilized isothiazolones described in the art and are the biocides of choice where salts pose a problem. For example, certain emulsions upon the addition of a salt may coagulate. The compositions of this invention can avoid this problem and therefore may be used in emulsions such as photographic emulsions, coating emulsions, (e.g. paints) to form solid protective or decorative films; electronic circuitry, wood, metals, plastics, fibers, membranes, carpet backings, ceramics and the like where surfaces need to be coated or protected, adhesives, caulks, and sensitive emulsions.

In many salt stabilized microbicide systems of the prior art there is a potential for solids formation caused by interactions with other salts in the system, interaction with certain salt forming organics, by the conversion to organic salts, or simply by incompatibility with the system. The stabilized microbicide compositions of this invention would be preferred in those systems. Also, the compositions of this invention are useful in fuel systems such as diesel fuel, gasoline, kerosene, certain alcohols, and the like, because they eliminate the possibility of salt deposits on component parts. Another reason for eliminating salts is to avoid an environment in which corrosion can occur. For example, chloride salts (among others) have a corrosive effect on many metals and are to be avoided where possible. In water treatment systems where low cation and anion levels are important, this is especially true. Those familiar with the art in various areas where biological growth needs to be controlled will quickly recognize those applications where significant reduction of or elimination of salts will be desired. In many cases it is necessary to eliminate interactions between the stabilizing salts and other components of the system or formulation components which otherwise could reduce the performance or value of such systems.

It is also recognized that the isothiazolone stabilizers of this invention have other applications known to those skilled in the art. For example, anhydrides are known to serve as reactive scavengers for molecules containing -OH, $-NH_2$, -SH and other nucleophilic groups. A microbicide formulation stabilized with an anhydride would be particularly advantageous where the dual function of biocidal/biostatic activity and scavenging would lead to advantageous results.

Because isothiazolone microbicides are so active, the low level required to achieve stabilization also makes them ideal when compared to many known microbicides because at such low levels they are not likely to interfere with other components in systems requiring protection or with systems upon which the protected systems will be applied.

Potential areas of general application include disinfectants, sanitizers, cleaners, deodorizers, liquid and powder soaps, skin removers, oil and grease removers, food processing chemicals, dairy chemicals, food preservatives, animal food preservatives, wood preservation, paint, lazures, stains, mildewcides, hospital and medical antiseptics, metal working fluids, cooling water, air washers, petroleum production, paper treatment, paper mill slimicides, petroleum products, adhesives, textiles, pigment slurries, latexes, leather and hide treatment, petroleum fuel, laundry sanitizers, agricultural formulations, inks, mining, nonwoven fabrics, petroleum storage, rubber, sugar processing, tobacco, swimming pools, cosmetics, toiletries, pharmaceuticals, chemical toilets, household laundry products, diesel fuel additives, waxes and polishes and many other applications where water and organic materials come in contact under conditions which allow the growth of undesired microorganisms.

In the stabilization of plastic articles, it is desirable to eliminate salts in the isothiazolones, as salts may contribute to deterioration of optical properties and/or increase water pickup and haze levels.

In some cosmetic formulations, it is also important to have low water and salt content. Eliminating nitrate salts avoids the possibility of nitrosamine formation with any amines present in the formulation. Removal of multivalent cations from the microbicide may also eliminate the known possibility of creating physical incompatibility problems in certain cosmetic formulations caused by precipitation of salts or complexes.

It is known in the art that the performance of microbicides can frequently be enhanced by combination with one or more other microbicides. In fact, there have been numerous examples of synergistic combinations of microbicides. Thus,other known microbicides may be combined advantageously with the stabilized isothiazolones of this invention.

Isothiazolones are used as disinfectants, in oil field water treatment, as watercooling system microbicides, as preservatives for aqueous dispersions or organic polymers, as wood pulp white water slimicides, as cosmetic preservatives, as cutting oil, jet fuel, and heating oil preservatives, and the like. Solutions of isothiazolones are also applied to a solid substrate, such as fabric, leather, or wood, as a preservative, or admixed with plastics.

The products of this invention are especially useful as preservatives for the following:

1. Cosmetics, as their use eliminates or substantially reduces the presence of nitrates which under certain

conditions in the presence of amines or amine precursors may lead to the formation of nitrosoamines.
2. Oils and fuels, since added salts and moisture are eliminated or minimized thus preventing potential corrosion, deposition or sludge formation.
3. Emulsions and dispersions that are sensitive to the divalent cations are those contained in a wide variety of products, such as paints, cosmetics, floor polishes and binders.
4. Plastics, as their use eliminates or substantially reduces precipitated salts which can contribute directly or indirectly to haze, opacity, or physical weakness in the surface.

The following examples will further illustrate this invention, but are not intended to limit it in any way. All parts and percentages are by weight and all temperatures in degrees Centigrade, unless otherwise stated.

For comparison of the stabilization of the compositions of this invention with known materials the following tests were employed: using a thermally-controlled solid metal block with bored holes as receptacles for the vials and with demonstrated temperature control, vials of stabilizer, solvent, and isothiazolone were made up and heated for fixed periods of time. The percentage of the starting isothiazolone remaining was determined by high performance liquid chromatography (HPLC). Temperatures of 40°C, 55°C, and 70°C were used. Results were considered indicative of acceptable stability when remainder values indicated essentially no loss during the time specified for the isothiazolone or isothiazolone mixture studied.

I. Stability Test for 5-Chloro-2-methylisothiazolin-3-one/2-Methylisothiazolin-3-one

The 3:1 mixture of 5-chloro-2-methylisothiazolin-3-one/2-methylisothiazolin-3-one (16.2%) is mixed at 14% active ingredient (AI) in triglyme (76.8%) with the chosen stabilizer (7%). The retention of AI is measured after four weeks at 40°C and after one and two weeks at 70°C. HPLC is used to measure AI.
This is compared with a 3:1 mixture of 5-chloro-2-methylisothiazolin-3-one/2-methylisothiazolin-3-one stabilized with magnesium nitrate (15%).

The following results were obtained.

EXAMPLE 1 - Stabilization Imparted by Organic anhydrides

Stabilizer	1 week, 70 °	2 weeks, 70 °	4 weeks, 40 °
None	--	<10	32
$Mg(NO_3)_2$, 15%	>85	>85	>85
Acetic anhydride	74	20	95
Pivalic anhydride	97	0	97
Succinic anhydride	0	0	76
Maleic anhydride	0	--	71
Dichloromaleic anhydride	72	30	101
Glutaric anhydride	12	0	64

EXAMPLE 2- Stabilization of Neat Mixture of 3:1 2-Methyl-5-Chloroisothiazolone and 3-Methylisothiazolone

An admixture of the isothiazolones (no metal salt stabilizer) was prepared with 5% or 10% of the following stabilizers, stored at 40°C for four weeks, and tested for active ingredient as in the previous examples.

	Retention of Activity	
Stabilizer (S)	5 % S	10 % S
-- (Control)	73.8	73.8
Acetic anhydride	84.3	82.3

Example 3 - Hair Shampoo

A solution containing 1.5% of N-methyl-5-chloroisothiazolin-3-one and N-methylisothiazolin-3 -one (approximately 3:1 mixture) and 2.0% of pyromelletic anhydride stabilizer in 96.5 % dipropylene glycol diacetate is used as a preservative for a hair shampoo at 15 ppm AI.

Example 4 - Salt Shock of Emulsions

The advantage of eliminating salt shock in polymer emulsions is shown in the following example. Salt shock is observed as a precipitate or gelatinous mass that forms in the polymer emulsion when isothiazolone, containing stabilizers composed of divalent metal ions (e.g. Mg++, Cu++), is added as a preservative.

The polymer emulsion is initially passed through a 325 mesh screen to remove any gel that might be present from manufacture. Isothiazolone is added to a total amount of 30 ppm AI based on total polymer emulsion. A 250g. emulsion sample in a pint container is used. The sample is gently swirled after pipetting the appropriate amount of isothiazolone. The sample is inverted twice to mix and allowed to stand at ambient temperature for sixty minutes. The sample is again passed through a 325 mesh screen. Any gel or precipitate on the screen is washed with deionized water to remove residual, uncoagulated polymer emulsion. The material remaining on the screen is collected and dried overnight at 50°C. This is followed by heating 1 hour at 150°C to remove any remaining water. The residue is then weighed. The amount of anhydride stabilizer is equal to that of the isothiazolone, and the solvent is butyl carbitol acetate.

Only a small amount of gel is formed when the emulsion is preserved with salt-free anhydride-stabilized isothiazolone, and this will not be detrimental in the use of the emulsion in various applications such as paints, caulks, and the like. The amount of gel formed when salt-stabilized isothiazolone is used as a preservative is easily visible and objectionable.

Example 5 - Microbial Speed-of-Kill

The following test, when carried out to determine the microbial speed of kill of an anhydride stabilized isothiazolone compared to the nitrate stabilized isothiazolone, illustrate equivalent bactericidal activity when either the nitrate or anhydride stabilizer is used.

The speed-of-kill test measures bactericidal activity in water free of organic matter. It measures the loss of cell viability in an aqueous suspension of bacterial cells as a function of time when these cells are contacted with a defined concentration of test compound in the water. This is done by taking aliquots of the cell suspensions at the appropriate time interval and assaying the number of viable cells per milliliter by plate count or most probable number (MPN) methodology. These measurements are done on the cell suspensions containing no test compound. The viable cell counts of the test and control samples are then compared to determine cell death.

The inoculum is prepared by growing the bacteria on a slant for 24 hours and then harvesting the cells

into phosphate buffer. To start the test at zero time, one volume of bacterial inoculum is added to 100 volumes of test solution containing compound at the final test concentration. At appropriate time intervals, such as 2, 4 and/or 24 hours, aliquots of all the test samples and controls are assayed for viable cell count, reported as most probable number (MPN) per ml.

In this test, addition of anhydride stabilizer does not diminish the efficacy of a freshly prepared solution of a metal-salt-free isothiazolone in an organic solvent at either relatively high (14% AI) or relatively low (1.5%) isothiazolone concentrations. Comparisons are made against the unstabilized solution and against a metal-salt stabilized aqueous solution at the same AI level.

Example 6 - Minimum Inhibitory Content Testing

A minimum inhibitory concentration (MIC) test is used to evaluate the antimicrobial activity of a test compound in preservative applications. The MIC value is obtained in the following manner. A volume of the stock solution containing 1% AI is dispensed into enrichment broth to give an initial starting test concentration of 250 ppm compound. At the start of the test, each vessel in the dilution series, except the first vessel, contains an equal volume of the compound free broth. The first vessel contains twice the volume of broth with the starting concentration of test compound. One half of the broth from the first vessel is transferred to the second vessel. After being mixed, one half the resulting volume is removed from the second vessel and transferred to the third vessel. The entire cycle is repeated 8 to 12 times, depending on the number of dilutions desired. The result is a two-fold serial dilution of test compound in the enrichment broth.

Each vessel is then inoculated with a cell suspension of the appropriate test organism. Bacteria are grown in broth and fungi on agar slants, for a time and at a temperature appropriate to the species being tested. At the end of the growth period, the broth is vortexed to disperse the cells. In the case of fungi, the spores are harvested by pipetting water onto the slant and dislodging the spores with a sterile loop. The cell/spore suspensions are standardized by controlling incubation time and temperature and the volume of the diluent. Once inoculated, the vessels are incubated at the appropriate temperature, and then examined for growth/no growth. The minimum inhibitory concentration (MIC) is defined as the lowest concentration of compound that results in complete inhibition of growth of the test organism.

In this test, typical values for water-based salt stabilized systems are shown below. AI = isothiazolone I 3 parts (R^1=Cl,R=H,Y=CH3)+1 part (R^1=R=H, Y=CH_3).

System I: 14% AI in water, 15% magnesium nitrate.

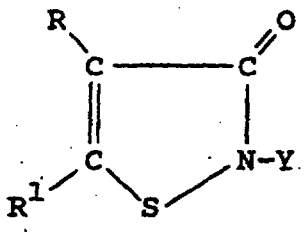
System II: 1.5%Alin water, 1.6% $Mg(NO_3)_2$, 0.15% copper nitrate.

Microorganism:	System I	System II
Psfl = Pseudomonas fluorescens	2	2
Psal = Pseudomonas aeruginosa	4	4
Saur = Staphylococcus aureus	16	16
Ecol = Escherichia coli	8	4
Calb = Candida albicans	2	2
Anig = Aspergillus niger	2	2
Apul = Aureobasidium pullulans	1	2/1

Values obtained for freshly-prepared salt-free solutions at similar AI levels are approximately the same as those shown above, and these values are essentially unaffected by the presence of anhydride stabilizers of the present invention at use levels (relative to the AI concentration chosen) taught herein. Useful formulations are: 1.5 % AI, 2% maleic anhydride, 96.5% diethylene glycol butyl ether acetate or 14% AI, 9% succinic anhydride, 77% propylene glycol methyl ether acetate.

Claims

1. A stabilized composition comprising at least one isothiazolone of the formula:



wherein

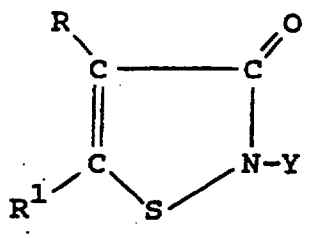
Y is one of: (C_1-C_{18})alkyl or (C_3-C_{12})cycloalkyl each optionally substituted with one or more of hydroxy, halo, cyano, alkylamino, dialkylamino, arylamino, carboxy, alkoxy, aryloxy, alkylthio, arylthio, haloalkoxy, cycloalkylamino, carbamoxy or isothiazolonyl; an unsubstituted or halo-substituted (C_2-C_8)alke-

Microorganism:		System I	System II
Psfl =	Pseudomonas fluorescens	2	2
Psal =	Pseudomonas aeruginosa	4	4
Saur =	Staphylococcus aureus	16	16
Ecol =	Escherichia coli	8	4
Calb =	Candida albicans	2	2
Anig =	Aspergillus niger	2	2
Apul =	Aureobasidium pullulans	1	2/1

Values obtained for freshly-prepared salt-free solutions at similar Al levels are approximately the same as those shown above, and these values are essentially unaffected by the presence of anhydride stabilizers of the present invention at use levels (relative to the Al concentration chosen) taught herein. Useful formulations are: 1.5 % Al, 2% maleic anhydride, 96.5% diethylene glycol butyl ether acetate or 14% Al, 9% succinic anhydride, 77% propylene glycol methyl ether acetate.

Claims

1. A stabilized composition comprising at least one isothiazolone of the formula:

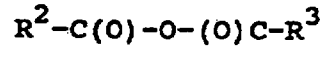


wherein

Y is one of: (C_1-C_{18})alkyl or (C_3-C_{12})cycloalkyl each optionally substituted with one or more of hydroxy, halo, cyano, alkylamino, dialkylamino, arylamino, carboxy, alkoxy, aryloxy, alkylthio, arylthio, haloalkoxy, cycloalkylamino, carbamoxy or isothiazolonyl; an unsubstituted or halo-substituted (C_2-C_8)alke-

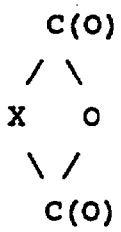
nyl or alkynyl; a (C_7-C_{10}) aralkyl optionally substituted with one or more of halogen, (C_1-C_4)alkyl or (C_1-C_4)alkoxy; or an aryl optionally substituted with one or more of halogen, nitro, (C_1-C_4)alkyl, (C_1-C_4)alkyl-acylamino, carb(C_1-C_4)alkoxy or sulfamyl;

R and R^1 is each independently hydrogen, halo or alkyl; and an effective amount of an anhydride selected from:



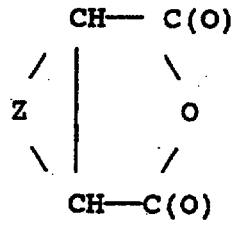
I

where R^2 and R^3 are each independently one if alkyl, cycloalkyl, aryl, alkylaryl, arylalkyl, or -C(O)-OR^4, where R^4 is hydrogen, alkyl, cycloalkyl, aryl, alkylaryl, or arylalkyl;



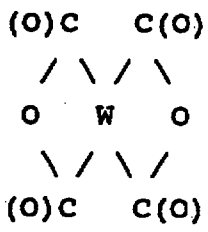
II

where X is CR^5=CR^6, CR^5R^6-CR^5=CR^6, or $(CR^5R^6)_n$, where n is 2 or 3, and where R^5 and R^6 are each independently one of R^2, R^3, H or Cl;



III

where Z completes a 4, 5, 6 or 7-membered saturated or unsaturated ring which may be heterocyclic, which Z may be substituted with one or more R5 or R6 groups;



where W is an aromatic nucleus, preferably a benzene nucleus.

2. Composition according to claim 1, comprising from 0.1 to 99.9 preferably from 1 to 50, parts by weight of the or each isothiazolone; from 0.1 to 99.9, preferably from 1 to 25 parts by weight of anhydride; and from 0 to 99.8, preferably from 25 to 98, parts by weight of a solvent.

* C L M S *

3. Composition according to claim 2 which comprises from 1 to 25 parts of the or each isothiazolone, from 1 to 10 parts of the anhydride and from 65 to 98 parts of a solvent.

4. Composition according to any preceding claim wherein Y is C_1-C_{18} alkyl or C_3-C_{12} cycloalkyl; R and R^1 are each independently hydrogen or halo; R^2, R^3, R^5 are each a lower alkyl, and X is hydrogen, alkyl, or aryl.

5. Composition according to claim 4 which comprises 14 parts of either 5-chloro-2-methyl-3-isothiazolone, 2-methyl-3-isothiazolone, 2-octyl-3-isothiazolone, or 4,5-dichloro-2-octyl-3-isothiazolone.

6. Composition according to claim 4 which comprises 1.5 parts of either 5-chloro-2-methyl-3-isothiazolone, 2-methyl-3-isothiazolone, 2-octyl-3-isothiazolone, or 4,5-dichloro-2-octyl-3-isothiazolone.

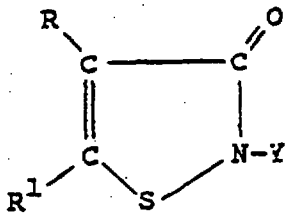
7. Composition according to any preceding claim in which the anhydride is acetic anhydride, pivalic anhydride, succinic anhydride, maleic anhydride, monochloromaleic anhydride, glutaric anhydride, phthalic anhydride, or pyromellitic anhydride.

8. A method for inhibiting the growth of bacteria, fungi, or algae in a locus subject or susceptible to contamination by bacteria, fungi, or algae, which comprises incorporating onto or into the locus, in an amount which is effective to adversely affect the growth of bacteria, fungi, or algae, a composition according to any preceding claim.

9. A method according to claim 8 wherein the locus is an aqueous medium, a cutting oil formulation, a water-cooling system, a solid protective or decorative film, fabric, leather, paper, or wood, laundry wash water, a cosmetic formulation, a fuel system, plastic or an emulsion.

Patentansprüche

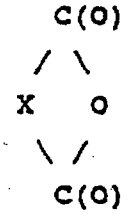
1. Stabilisierte Zusammensetzung, enthaltend mindestens ein Isothiazolon der Formel:



in der Y ist eines von (C_1-C_{18})-Alkyl oder (C_3-C_{12})-Cycloalkyl, jeweils gegebenenfalls substituiert mit einem oder mehreren von Hydroxy, Halogen, Cyano, Alkylamino, Dialkylamino, Arylamino, Carboxy, Alkoxy, Aryloxy, Alkylthio, Arylthio, Haloalkoxy, Cycloalkylamino, Carbamoxy oder Isothiazolonyl, ein unsubstituiertes oder mit Halogen substituiertes (C_2-C_8)-Alkenyl oder Alkynyl, ein (C_7-C_{10})-Aralkyl, gegebenenfalls substituiert mit einem oder mehreren von Halogen, (C_1-C_4)-Alkyl oder (C_1-C_4)-Alkoxy, oder ein Aryl, gegebenenfalls substituiert mit einem oder mehreren von Halogen, Nitro, (C_1-C_4)-Alkyl, (C_1-C_4)-Alkyl-acylamino, Carb(C_1-C_4)-Alkoxy oder Sulfamyl,
R und R^1 sind jeweils unabhängig Wasserstoff, Halogen oder Alkyl; und eine wirksame Menge eines Anhydrids, ausgewählt aus

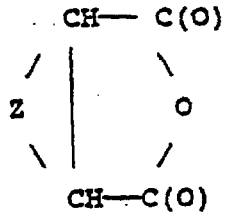
$$R^2\text{-}C(O)\text{-}O\text{-}(O)C\text{-}R^3 \qquad (I)$$

in der R^2 und R^3 jeweils unabhängig sind eines von Alkyl, Cycloalkyl, Aryl, Alkylaryl, Arylalkyl, oder -C(O)-OR^4, wobei R^4 Wasserstoff, Alkyl, Cycloalkyl, Aryl, Alkylaryl oder Arylalkyl ist,



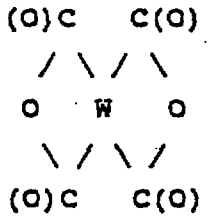
(II)

in der X ist $CR^5=CR^6$, $CR^5R^6-CR^5=CR^6$ oder $(CR^5R^6)_n$, wobei n 2 oder 3 ist und wobei R^5 und R^6 jeweils unabhängig eines von R^2, R^3, H oder Cl ist,



(III)

wobei durch Z ein 4-, 5-, 6- oder 7-gliedriger gesättigter oder ungesättigter Ring, der heterozyclisch sein kann, ausgebildet wird, wobei Z mit einer oder mehreren R^5- oder R^6-Gruppen substituiert sein kann,



wobei W ein aromatischer Kern, vorzugsweise ein Benzolkern, ist.

2. Zusammensetzung nach Anspruch 1,
dadurch gekennzeichnet,
daß sie enthält von 0,1 bis 99,9, vorzugsweise von 1 bis 50 Gewichtsteile des oder jedes Isothiazolons, von 0,1 bis 99,9, vorzugsweise von 1 bis 25 Gewichtsteile Anhydrid und von 0 bis 99,8, vorzugsweise von 25 bis 98 Gewichtsteile eines Lösemittels.

3. Zusammensetzung nach Anspruch 2,
dadurch gekennzeichnet,
daß sie enthält von 1 bis 25 Gewichtsteile des oder jedes Isothiazolons, von 1 bis 10 Gewichtsteile Anhydrid und von 65 bis 98 Gewichtsteile eines Lösemittels.

4. Zusammensetzung nach einem der vorstehenden Ansprüche,
dadurch gekennzeichnet,
daß Y ist C_1-C_{18}-Alkyl oder C_3-C_{12}-Cycloalkyl, R und R^1 sind jeweils unabhängig Wasserstoff oder Halogen, R^2, R^3, R^5 sind jeweils ein niederes Alkyl und X ist Wasserstoff, Alkyl oder Aryl.

5. Zusammensetzung nach Anspruch 4,
dadurch gekennzeichnet,
daß sie 14 Teile entweder 5-Chlor-2-methyl-3-isothiazolon, 2-Methyl-3-isothiazolon, 2-Octyl-3-isothiazolon oder 4,5-Dichlor-2-octyl -3-isothiazolon enthält.

6. Zusammensetzung nach Anspruch 4,
dadurch gekennzeichnet,

daß sie enthält 1,5 Teile entweder 5-Chlor-2-methyl-3-isothiazolon, 2-Methyl-3-isothiazolon, 2-Octyl-3-isothia- zolon oder 4,5-Dichlor-2-octyl-3-isothiazolon.

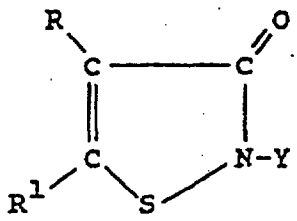
7. Zusammensetzung nach einem der vorstehenden Ansprüche,
dadurch gekennzeichnet,
daß das Anhydrid Essigsäureanhydrid, Pivalinsäureanhydrid, Bernsteinsäureanhydrid, Maleinsäureanhydrid, Monochlormaleinsäureanhydrid, Glutarsäureanhydrid, Phthalsäureanhydrid oder Pyromellitsäureanhydrid ist.

8. Verfahren zum Hemmen des Wachstums von Bakterien, Pilzen oder Algen an einer Stelle, die verunreinigt oder empfindlich für Verunreinigung durch Bakterien, Pilze oder Algen ist, durch Einbringen in oder auf die Stelle einer Zusammensetzung nach einem der vorstehenden Ansprüche in einer wirksamen Menge, um das Wachstum von Bakterien, Pilzen oder Algen gegenteilig zu beeinflussen.

9. Verfahren nach Anspruch 8,
dadurch gekennzeichnet,
daß die Stelle ein wäßriges Medium, eine Schneidölformulierung, ein Wasserkühlsystem, ein fester Schutzfilm oder dekorativer Film, Gewebe, Leder, Papier oder Holz, Wäschereiwaschwasser, eine kosmetische Formulierung, ein Brennstoffsystem, Kunststoff oder eine Emulsion ist.

Revendications

1. Composition stabilisée comprenant au moins une isothiazolone de formule suivante :

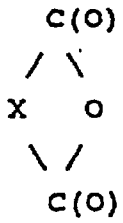


dans laquelle :
Y est un groupe alkyle en C_1-C_{18} ou cycloalkyle en C_3-C_{12}, chacun d'entre eux étant éventuellement substitué par un ou plusieurs des groupes hydroxy, halo, cyano, alkylamino, dialkylamino, arylamino, carboxy, alkoxy, aryloxy, alkylthio, arylthio, haloalkoxy, cycloalkylamino, carbamoxy ou isothiazolonyle; un radical alkényle ou alkynyle en C_2-C_8 non substitué ou substitué par de l'halogène; un groupe aralkyle en C_7-C_{10} éventuellement substitué par un ou plusieurs des groupes halogène, alkyle en C_1-C_4 ou alkoxy en C_1-C_4; ou un groupe aryle substitué éventuellement par un ou plusieurs des groupes halogène, nitro, alkyle en C_1-C_4, alkyl (en C_1-C_4) acylamino , carbalkoxy en C_1-C_4 ou sulfamyle;
R et R^1 sont chacun indépendamment de l'hydrogène, un groupe halo ou un groupe alkyle; et une quantité efficace d'un anhydride choisi parmi :

$$R^2\text{-}C(O)\text{-}O\text{-}(O)C\text{-}R^3$$

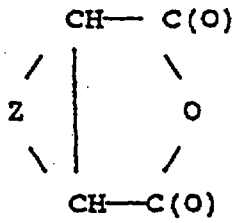
I

où R^2 et R^3 sont chacun indépendamment un groupe alkyle, cycloalkyle, aryle, alkylaryle, arylalkyle, ou -C(O)-OR^4, où R^4 est de l'hydrogène, un groupe alkyle, cycloalkyle, aryle, alkylaryle ou arylalkyle;



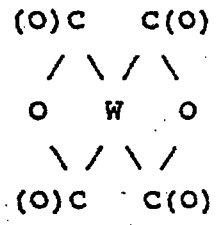
II

où X est $CR^5=CR^6$, $CR^5R^6-CR^5=CR^6$ ou $(CR^5R^6)_n$ où n est égal à 2 ou à 3 et où R^5 et R^6 sont chacun indépendamment un des groupes R^2, R^3, H ou Cl;



III

où Z complète un noyau saturé ou insaturé à 4, 5, 6 ou 7 chaînons qui peut être hétérocyclique, Z pouvant être substitué par un ou plusieurs groupes R^5 ou R^6;



où W est un noyau aromatique, de préférence un noyau de benzène.

2. Composition selon la revendication 1, comprenant 0,1 à 99,9, de préférence 1 à 50 parties en poids de l'isothiazolone ou de chaque isothiazolone, 0,1 à 99,9, de préférence 1 à 25 parties en poids d'anhydride et 0 à 99,8, de préférence de 25 à 98 parties en poids d'un solvant.

3. Composition selon la revendication 2, comprenant 1 à 25 parties de l'isothiazolone ou de chaque isothiazolone, 1 à 10 parties de l'anhydride et 65 à 98 parties d'un solvant.

4. Composition selon l'une quelconque des revendications précédentes, dans laquelle Y est un groupe alkyle en C_1-C_{18} ou cycloalkyle en C_3-C_{12}, R et R^1 sont chacun indépendamment de l'hydrogène ou un halogène, R^2, R^3, R^5 sont chacun un groupe alkyle inférieur et X est de l'hydrogène, un groupe alkyle ou un groupe aryle.

5. Composition selon la revendication 4, comprenant 14 parties de 5-chloro-2-méthyl-3- isothiazolone, de 2-méthyl-3-isothiazolone, de 2-octyl-3-isothiazolone ou de 4,5-dichloro-2-octyl-3- isothiazolone.

6. Composition selon la revendication 4, comprenant 1,5 partie de 5-chloro-2-méthyl-3- isothiazolone, de 2-méthyl-3-isothiazolone, de 2-octyl-3-isothiazolone ou de 4,5-dichloro-2-octyl-3- isothiazolone.

7. Composition selon l'une quelconque des revendications précédentes, dans laquelle l'anhydride est l'an-

* C L M S *

hydride acétique, anhydride pivalique, l'anhydride succinique, l'anhydride maléique, l'anhydride monochloromaléique, l'anhydride glutarique, l'anhydride phtalique ou l'anhydride pyromellitique.

8. Procédé d'inhibition de la croissance de bactéries, de fungi ou d'algues dans un endroit sujet ou susceptible de contamination par des bactéries, des fungi ou des algues, ce procédé consistant à incorporer sur ou dans cet endroit en quantité efficace pour affecter désavantageusement la croissance des bactéries, des fungi ou des algues, une composition selon l'une quelconque des revendications précédentes.

9. Procédé selon la revendication 8, dans lequel ledit endroit est un milieu aqueux, une formulation d'huile de coupe, un système de refroidissement à l'eau, un film protecteur ou décoratif solide, des tissus, du cuir, du papier, du bois, de l'eau de lessivage, une formulation cosmétique, un système de carburant, une matière plastique ou une émulsion.