

643718

COMMONWEALTH of AUSTRALIA  
Patents Act 1952

**APPLICATION FOR A STANDARD PATENT**

I/We

Rohm and Haas Company

of

Independence Mall West, Philadelphia, Pennsylvania, 19105, United States of America

hereby apply for the grant of a Standard Patent for an invention entitled:

**Carbonyl stabilizers for 3-isothiazolones**

••••• which is described in the accompanying complete specification.

•••••

••••• Details of basic application(s):-

<u>Number</u>	<u>Convention Country</u>	<u>Date</u>
••••• 438816	United States of America	17 November 1989
••••• 601964	United States of America	22 October 1990

The address for service is care of DAVIES & COLLISON, Patent Attorneys, of 1 Little Collins Street, Melbourne, in the State of Victoria, Commonwealth of Australia.

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DATED this THIRTEENTH day of NOVEMBER 1990

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To: THE COMMISSIONER OF PATENTS

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.....  
a member of the firm of  
DAVIES & COLLISON for  
and on behalf of the  
applicant(s)

Davies & Collison, Melbourne



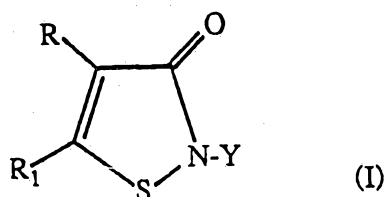


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CARBONYL STABILIZERS FOR 3-ISOTHIAZOLONES
- International Patent Classification(s)  
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- (71) Applicant(s)  
ROHM AND HAAS COMPANY
- (72) Inventor(s)  
GARY LEWIS WILLINGHAM
- (74) Attorney or Agent  
DAVIES COLLISON CAVE , 1 Little Collins Street, MELBOURNE VIC 3000
- (56) Prior Art Documents  
AU 64523/90 A01N 43/80
- (57) Claim

1. Composition comprising
  - a) at least one 3-isothiazolone of the formula (I)



wherein

Y is (C<sub>1</sub>-C<sub>18</sub>)alkyl or (C<sub>3</sub>-C<sub>12</sub>)cycloalkyl each optionally substituted with one or more of hydroxy, halo, cyano, alkylamino, dialkylamine, arylamino, carboxy, carbalkoxy, alkoxy, aryloxy, alkylthio, arylthio, haloalkoxy, cycloalkylamino, carbamoxy, or isothiazolonyl; an unsubstituted or halo-substituted (C<sub>2</sub>-C<sub>8</sub>) alkenyl or alkynyl; a (C<sub>7</sub>-C<sub>10</sub>)aralkyl optionally substituted with one or more of halogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl or (C<sub>1</sub>-C<sub>4</sub>)alkoxy; and an aryl optionally substituted with one or more of halogen, nitro, (C<sub>1</sub>-C<sub>4</sub>)alkyl, (C<sub>1</sub>-C<sub>4</sub>)alkyl-acylamino, carb(C<sub>1</sub>-C<sub>4</sub>)alkoxy or sulfamyl; and

R and R<sup>1</sup> is each independently H, halogen or (C<sub>1</sub>-C<sub>4</sub>) alkyl; and

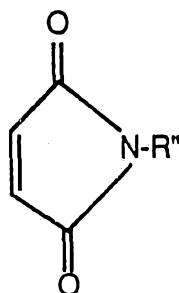
- b) a carbonyl compound comprising (C<sub>2</sub>-C<sub>6</sub>) aldehydes, (C<sub>7</sub>-C<sub>10</sub>) aromatic

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aldehydes, (C<sub>2</sub>-C<sub>4</sub>) dialdehydes and maleimides of the formula



wherein R'' is H, (C<sub>1</sub>-C<sub>4</sub>) alkyl or aryl;

provided that when (b) comprises an aldehyde or dialdehyde the ratio (b):(a)

is less than 10:1.

3. Composition according to claim 1 wherein the carbonyl compound comprises crotonaldehyde, glyoxal, maleimide, (methyl-1-naphthyl) maleimide, N-ethyl maleimide, N-phenyl maleimide, cinnamaldehyde, benzaldehyde, acetaldehyde, salicylaldehyde, methacrolein, or acrolein.

9. A method of stabilizing a 3-isothiazolone of the formula (I) as defined in claims 1 or 4, comprising incorporating with said 3-isothiazolone an effective amount of a carbonyl compound as defined in any of claims 1 to 3.

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COMMONWEALTH OF AUSTRALIA  
PATENTS ACT 1952  
COMPLETE SPECIFICATION

NAME & ADDRESS  
OF APPLICANT:

Rohm and Haas Company  
Independence Mall West  
Philadelphia Pennsylvania 19105  
United States of America

NAME(S) OF INVENTOR(S):

Gary Lewis WILLINGHAM

ADDRESS FOR SERVICE:

DAVIES & COLLISON  
Patent Attorneys  
1 Little Collins Street, Melbourne, 3000.

COMPLETE SPECIFICATION FOR THE INVENTION ENTITLED:

Carbonyl stabilizers for 3-isothiazolones

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

This invention concerns the stabilization of 3-isothiazolone compounds by the incorporation with those compounds of certain carbonyl compounds.

Isothiazolones have generated high commercial interest as microbicides to prevent spoilage of certain aqueous and non-aqueous products caused by microorganisms. Isothiazolones are highly effective microbicides (as used herein, "microbicides" includes bactericides, fungicides and algicides and microbicidal activity is intended to include both the elimination of and the inhibition or

prevention of growth of microbial organisms such as bacteria, fungi and algae); by suitable choice of functional groups, they are useful in a broad range of applications. However, it has been long recognized that either in storage prior to addition to the substrate to be treated or after addition, their efficacy may be decreased because they are not stable under practical conditions of long-term storage. Means have thus been sought for some time to improve the stability of isothiazolones.

US-A-3,870,795 and 4,067,878 teach the stabilization of isothiazolones against chemical decomposition by addition of a metal nitrite or metal nitrate, but teach that other common metal salts, including carbonates, sulfates, chlorates, perchlorates, and chlorides are ineffective in stabilizing solutions of isothiazolones, such solutions usually being in water or in an hydroxylic solvent.

US-A-4,150,026 and 4,241,214 teach that metal salt complexes of isothiazolones are useful because they have enhanced thermal stability, while retaining biological activity.

It is known to use certain organic stabilizers for isothiazolones, generally for use situations where metal salts may create problems, such as corrosion, coagulation of latices, insolubility in non-aqueous media, interaction with the substrate to be stabilized, and the like. Formaldehyde or formaldehyde-releasing chemicals are known as stabilizers, (see US-A-4,165,318 and 4,129,448), as are certain organic chemicals such as orthoesters (EP-A-315464) and epoxides (EP-A-342852).

Grove, US-A-4,783,221 teaches blends of isothiazolones with at least one

metal salt of an organic carboxylic acid having at least six carbon atoms, wherein the metal is a transition metal, zinc, mercury, antimony, or lead; and also with a solvent diluent.

In certain applications, however, it is desirable to avoid addition of organic stabilizers by virtue of their volatility, decomposition under high heat, higher cost, difficulty in handling, potential toxicity, and the like. Formaldehyde is a suspected carcinogen, and it is desirable not to use formaldehyde in applications where contact with human skin or lungs may occur.

In actual use, copper salts, such as copper sulfate, have proved efficacious in the stabilization of isothiazolones. However, copper salts may be undesirable in effluent streams in such operations as in the manufacture of stabilized isothiazolones or in their blending into a product or the use of that product. Copper salts, especially the chlorides, may contribute to possible corrosion, or in the presence of polymers in aqueous dispersion may lead to coagulation of the dispersion.

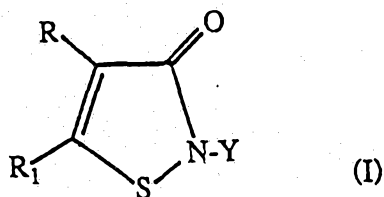
DE-A-3144137 discloses the use of isothiazolone derivatives to provide bacteriostatic activity in disinfectant compositions containing aldehydes. The minimum ratio of aldehyde to isothiazolone disclosed is 10:1, and there is nothing in the disclosure relating to the stability or otherwise of the isothiazolone.

US-A-4,539,071 discloses a combination of an isothiazolone and glutaraldehyde as a biocide, but there is no discussion in this disclosure relating to the stability of the composition. Commercial formulations of isothiazolones and N,N-methylolchloroacetamide are also known, being sold under the trademark Parmetol, but the carbonyl compound is not being employed as a stabilizer.

The present invention aims to provide a stabilization system for isothiazolones which overcomes some or all of the disadvantages outlined above, and which enables an isothiazolone to be stabilized by only low levels of stabilizer so as to avoid interference with other components in systems in which isothiazolones are used as microbicides.

Accordingly the invention provides in one aspect composition comprising

- a) at least one 3-isothiazolone of the formula (I)



wherein

Y is (C<sub>1</sub>-C<sub>18</sub>)alkyl or (C<sub>3</sub>-C<sub>12</sub>)cycloalkyl each optionally substituted with one or more of hydroxy, halo, cyano, alkylamino, dialkylamine, arylamino, carboxy, carbalkoxy, alkoxy, aryloxy, alkylthio, arylthio, haloalkoxy, cycloalkylamino, carbamoxy, or isothiazolonyl; an unsubstituted or halo-substituted (C<sub>2</sub>-C<sub>8</sub>) alkenyl or alkynyl; a (C<sub>7</sub>-C<sub>10</sub>)aralkyl optionally substituted with one or more of halogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl or (C<sub>1</sub>-C<sub>4</sub>)alkoxy; and an aryl optionally substituted with one or more of halogen, nitro, (C<sub>1</sub>-C<sub>4</sub>)alkyl, (C<sub>1</sub>-C<sub>4</sub>)alkyl-acylamino, carb(C<sub>1</sub>-C<sub>4</sub>)alkoxy or sulfamyl; and

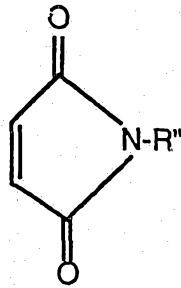
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R and R<sup>1</sup> is each independently H, halogen or (C<sub>1</sub>-C<sub>4</sub>) alkyl; and

- b) a carbonyl compound comprising (C<sub>2</sub>-C<sub>6</sub>) aldehydes, (C<sub>7</sub>-C<sub>10</sub>) aromatic aldehydes, (C<sub>2</sub>-C<sub>4</sub>) dialdehydes and maleimides of the formula





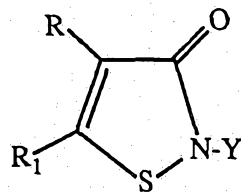
where R'' is H, (C<sub>1</sub>-C<sub>4</sub>) alkyl or aryl;

provided that when (b) comprises an aldehyde or dialdehyde the ratio (b):(a) is less than 10:1.

In another aspect, the invention provides a method for inhibiting or preventing the growth of bacteria, fungi, yeast or algae in a locus subject or susceptible to contamination by bacteria, fungi, yeast or algae, which comprises incorporating onto or into the locus, in an amount which is effective to adversely affect the growth of bacteria, fungi, yeast, or algae, the aforementioned composition.

A further aspect of the invention provides a method for stabilising said 3-isothiazolones which comprises incorporating therewith an effective amount of a carbonyl compound as defined above; a different aspect of the invention is the use of said carbonyl compounds as stabilisers for said isothiazolones.

The isothiazolones which are stabilized include those disclosed in US-A-3,523,121 and 3,761,488 and represented by the formula



as defined above.

Preferred substituents for Y are substituted or unsubstituted (C<sub>1</sub>-C<sub>18</sub>) alkyl or (C<sub>3</sub>-C<sub>12</sub>) cycloalkyl; R is preferred to be H, Me or Cl; and R<sub>1</sub> is preferred to be H or Cl. Representative of such preferred Y substituents are methyl, ethyl, propyl, isopropyl, butyl, hexyl, octyl, cyclohexyl, benzyl, 3,4-dichlorobenzyl, 4-methoxybenzyl, 4-chlorobenzyl, 3,4-dichlorophenyl, 4-methoxyphenyl, hydroxymethyl,

chloromethyl, chloropropyl, hydrogen, and the like.

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

5 Most preferred is 5-chloro-2-methyl-3-isothiazolone, either as a sole compound or in admixture with 2-methyl-3-isothiazolone. When in admixture, the preferred ratio of monochlorinated/unchlorinated isothiazolone is from about 70:30 to about 85:15, and an especially preferred ratio is from about 70:30 to about 80:20. A second especially preferred isothiazolone is 2-methyl-3-isothiazolone in  
10 combination with low levels of 5-chloro-2-methyl-3-isothiazolone, a preferred ratio being from about 98:2 to about 96:4, and an especially preferred ratio being about 97:3.

The carbonyl compounds may possess other functionality such as a halogen substituent in addition to the carbonyl group: in particular, aromatic aldehydes may  
15 have other substituents on the aromatic ring. It will also be appreciated that carbonyl compounds may exist in the form of salts which can be equally active as stabilizers, and accordingly the present invention is intended to cover the claimed compounds when they exist as salts. Preferred carbonyl compounds are (C<sub>2</sub>-C<sub>4</sub>) aldehydes, (C<sub>2</sub>-C<sub>4</sub>) dialdehydes and maleimides including (methyl naphthyl)  
20 maleimide, N-ethyl maleimide and N-phenyl maleimide. Particularly preferred specific compounds include crotonaldehyde, glyoxal, maleimide, cinnamaldehyde, benzaldehyde, acetaldehyde, salicylaldehyde, methacrolein and acrolein. Additional preferred compounds including citral and vanillin.

Some carbonyl compounds are known to have microbicidal activity, although  
25 their efficacy as stabilizers of isothiazolones has not previously been appreciated. Such compounds will be particularly desirable to use as stabilizers; examples are acrolein, benzoic acid, sorbic acid, dehydroacetic acid, glycolic acid and citric acid.

The composition may contain from about 0.01 to about 99.9999 parts of the



one or more isothiazolones, and from about 0.0001 to about 99.9 parts of the carbonyl compound.

Generally, the composition of the invention will be in the form of a solution. 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.

FORMULATIONS TABLE

••••• Isothiazolone	Carbonyl Compound	Solvent
••••• (I, Supra)		
••••• 0.01 -99.9999%	0.0001- 99.99%	0 - 99.9899%
••••• Preferred		
••••• 0.1-50%	0.01-50%	30-99.89%

Solvents 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 carbonyl compound to eliminate its stabilizing action.

Hydroxylic solvents, for example, polyols, such as glycols, alcohols and the like, may be used. Under conditions of high dilution and high ratios of stabilizer to isothiazolone, glycols may be successfully used. In certain formulations, hydrocarbons, either aliphatic or aromatic, are useful solvents.

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

Water is a solvent for certain of the preferred isothiazolones and the carbonyl compound may be employed in aqueous formulations.

The amounts of carbonyl compound employed will vary depending on use



conditions and concentrations of the isothiazolone in the mixture: effective amounts of carbonyl compounds based on isothiazolone may be ratios in the range of from about 1:100 to about 1000:1 stabilizer to isothiazolone. In concentrated solutions, ratios are generally from about 1:50 to about 50:1. Obviously higher amounts may be used, but at additional cost. At high levels of dilution of the isothiazolone (such as from 1 to 10,000 ppm isothiazolone in the solvent), the ratio of stabilizer to isothiazolone can range from about 1:10 to about 20:1. The preferred range is from 1:1 to 20:1.

The stabilization advantages of the carbonyl compounds of the present invention are noted even when the isothiazolone contains other salt stabilizers such as are recorded in US-A-3,870,795, 4,067,878, 4,150,026 and 4,241,214.

It is known in the art that the performance of microbicides may be enhanced by combination with one or more other microbicides. Thus, other known microbicides may be combined advantageously with the composition of this invention.

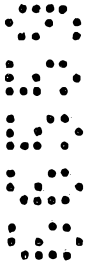
Uses of these new organically stabilized microbicides are typically at any locus subject to contamination by bacteria, fungi, yeast or algae. Typical loci are in aqueous systems such as water cooling, laundry wash water, oil systems such as cutting oils, oil fields and the like where microorganisms need to be killed or where their growth needs to be controlled. However these stabilized microbicides may also be used in all applications for which known microbicidal compositions are useful; preferred utilities of the compositions are to protect wood paint, adhesive, glue, paper, textile, leather, plastics, cardboard, lubricants, cosmetics, food, caulking, feed and industrial cooling water from microorganisms.

The following lists typical industries and applications of compositions:

<u>Industry</u>	<u>Application</u>
Adhesives, Sealants	adhesives caulks sealants

Agriculture/food chain

adjuvant preservation  
agricultural active ingredient  
agricultural chemical preservative  
agricultural formulations preservation  
animal feed preservation  
dairy chemicals  
fertilizer preservation  
food preservation  
food processing chemicals  
grain preservation  
post-harvest produce protection  
sugar processing  
tobacco

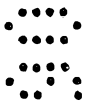


Construction products

asphalt / concrete  
cement modifiers  
construction products  
roof mastics  
synthetic stucco  
wall mastics  
joint cement

Cosmetics and toiletries

cosmetics  
raw materials for cosmetics, toiletries  
toiletries



Disinfectants, antiseptics

antiseptic  
disinfectant



Emulsions, dispersions

aqueous dispersions  
dispersed pigments  
latex  
photographic emulsions  
pigment slurries  
polymer latices



Formulated household products

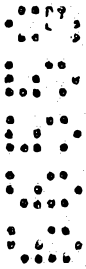
fabric softeners  
polishes  
waxes  
hand dish detergents  
raw materials  
liquid detergents  
hand soaps

Industrial processing, misc

electrodeposition paint, baths, rinses.  
electrodeposition pre-treatment, post  
rinses  
industrial fluids preservation  
pasteurization baths  
process aid preservation

Industrial water treatment

air washers  
cooling towers  
cooling water  
water cooling  
preservation/treatment of wooden  
cooling tower slats and structural  
members  
can warmers  
brewery pasteurization  
closed loop water cooling systems



Laundry

household laundry products  
laundered goods  
laundry wash water  
sanitizers-laundry

Leather, leather products

leather and hide  
leather and hide products

Lubricants, hydraulic aids

automotive lubricants and fluids  
conveyor lubricants  
greases  
hydraulic fluids  
lubricants

Medical devices

diagnostic enzymes  
diagnostic kits  
medical devices

Metalworking & related app's

cutting fluids  
metal cleaning  
metalworking fluids

Odor control (active ingredient) air conditioning  
animal bedding  
cat litter

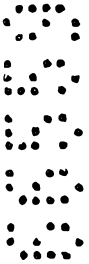
chemical toilet prep'ns  
deodorizers  
humidifiers  
industrial deodorants  
sanitary formulations  
toilet bowls

Paints and coatings

emulsions  
paints

Paper and wood pulp,  
their products

absorbent materials of paper and wood  
pulp  
packaging materials of paper and wood  
pulp  
paper  
paper products  
paper treatment  
soap wrap  
wood pulp  
wood pulp products

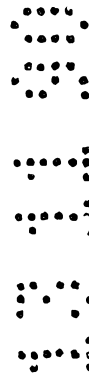


Paper mill

paper mill slimicides  
pulp and paper slurries

Petroleum refining, fuels

aviation fuels (jet fuel, aviation gas)  
crude oils  
burner, diesel and turbine fuel oils  
coal slurries  
diesel fuel additives  
diesel fuels  
fuels  
gasoline  
heating oils  
hydrocarbons  
kerosene  
liquified petroleum gas  
petrochemical feedstocks  
petroleum products, storage,  
transportation and production  
recycled petroleum products  
residual fuel oils  
turbine oils



Photographic Chemicals

photographic processing - wash water,

and process

rinses  
photoprocessing  
photoplate processing chemicals  
developers, stabilizers etc)

Printing

fountain solutions (printing)  
ink components (pigments, resins,  
solvents, etc)  
inks

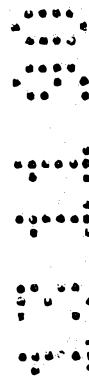
Sanitizers (active)

sanitizers  
sanitizers-dairy  
sanitizers-dental  
sanitizers-fermentation  
sanitizers-food preparation  
sanitizers-food processing  
sanitizers-medical  
sanitizers-rendering  
sanitizers-veterinary



Soaps, detergents, cleaners

cleaners  
detergents  
household cleaners  
industrial cleaners  
liquid soaps  
oil and grease remover  
powdered soaps  
raw materials for cleaning products  
soaps  
surfactants



Textiles, textile products

bonded fabrics  
burlap  
canvas  
canvas goods  
carpet backing  
carpets  
clothing  
coated fabrics  
curtains  
draperies  
engineering textiles  
fibers  
geotextiles



goods made of textiles  
knitted fabrics  
nets  
nonwoven fabrics  
rope  
rugs  
textile accessories  
textile products  
textiles  
upholstery  
woven fabrics  
yarn

Textile processing

dye fixatives  
dyes  
fiber lubricants  
hand modifiers  
sizes  
textile processing fluids

Therapeutic (active or preservative)

animal health/veterinary  
aquaculture  
dental  
human health  
pharmaceutical /therapeutic

Water purification

charcoal beds  
deionization resins  
filters  
membranes  
reverse osmosis membranes  
ultrafilters  
water purification  
water purification pipes, tubing

Wood applications

lazes (wood stains)  
wood  
wood products

Miscellaneous

alcohols  
bedding incorporating water or gels  
ceramic  
contact lens cases-leaching  
electronic circuitry

electronics chemicals  
enzymes-food production  
enzymes  
enzymes-industrial  
gel cushions  
marine antifoulants  
mildewcides  
wood  
plastics  
laundry  
mining  
natural rubber latex  
oil field injection waters including  
enhanced recover injection fluids,  
drilling, fracturing and completion fluids  
pipes  
plastics  
polymer systems  
polymers and resins (synthetic and  
natural)  
reagent preservation  
rubber  
rubber products  
skin remover  
solid protective/decorative films  
stains  
swimming pools  
waste treatment  
water beds

Because isothiazolones are so active as microbicides and only low levels of carbonyl compounds are required to achieve stabilization, the amount of carbonyl compound in systems being treated will be very small, and therefore it is not likely to interfere with other components in systems requiring protection or with systems to which the protected systems will be applied. Potential areas of general application include metal-working fluids, cooling water, and air washers.

One significant area of application for the compositions of the invention is as microbicides in metal working fluids. Metal working fluids are proprietary combinations of chemicals, which may contain, inter alia, ingredients such as

alkanolamines, petroleum sulfonate surfactants, oils (naphthenic, paraffinic, etc.), chlorinated paraffins and fatty esters, sulfurized fatty compounds, phosphate esters, fatty acids and their amine salts, glycols, polyglycols, boric acid esters and amides. They are utilized in the milling, machining, drilling, and other processing technologies for fabricating metal for the purposes of lubricating, cooling, preventing surface corrosion, and the like. They are sold in the form of active metal working fluid (MWF) concentrates, and are diluted in use to 1-10% active ingredients in water.

Because metal working fluids are recycled and stored, the growth of microorganisms is favored. Isothiazolones have been found effective in preventing the growth of such organisms. Certain of the components in the metal working fluids will tend to destroy the isothiazolone and so remove its microbicidal protective activity, so that stabilizers for the isothiazolone against such degradation are desirable.

The following examples are intended to illustrate the present invention and not to limit it except as it is limited by the claims. All percentages are by weight unless otherwise specified, and all reagents are of good commercial quality unless otherwise specified. Methods for quantitative determination of the isothiazolones in the following examples in metal-working fluids are described in detail in "Kathon® 886 MW Microbicide and Kathon® 893 MW Fungicide: Analysis in Metalworking Fluids by High-Performance Liquid Chromatography", 1988, Rohm and Haas Company.

EXAMPLES  
EXAMPLES 1 TO 4

These examples demonstrate the stabilizing effect of carbonyl compounds for isothiazolones added to several different metal working fluids (MWF). MWF concentrates A and B were "semi-synthetic" types having about 10 to 15 percent naphthenic/paraffinic oil, about 50 percent water, emulsifying agents, pH adjusting amines, anticorrosive agents, and EP (extreme pressure) agents.

Into a glass vial in the following order were placed: a) 5 parts by weight of the MWF concentrate solution, b) 5 parts of the stabilizer in solution or dispersion, c) 5 parts water, d) 5 parts of an aqueous solution containing 80 ppm active ingredient (AI), prepared by dilution of a 14.4% aqueous solution of an approximately 75/25 mixture of 5-chloro-2-methyl-3-isothiazolone and 2-methyl-3-isothiazolone, the former being considered the active ingredient for these purposes; also present was 9.2 % magnesium chloride and 15.7% magnesium nitrate. Thus the final mixture contained 3-5% of the MWF concentrate, 15 ppm active ingredient of the isothiazolone, and C (control) to 1,000 ppm of the stabilizer.

The vials were then capped, stored at ambient room temperature in a closed cabinet for a designated time, filtered through a 0.45 micron filter into another vial and analyzed the same day. The relative concentration of the active ingredient was determined by reverse phase high pressure liquid chromatography, utilizing a Varian model 5500 chromatograph and an ultraviolet detector.

TABLE 1  
STABILIZATION OF 5-CHLORO-2-METHYL-3-ISOTHIAZOLONE IN MWF  
CONCENTRATE A AFTER FIVE DAYS

Original system contained 15 ppm 5-chloro-2-methylisothiazolone (AI) with 3% MWF Concentrate A in water. All stabilizers were added at 1000 ppm

<u>Stabilizer</u>	<u>% AI remaining</u>
None, (comparative)	3
crotonic acid	87
trans-cinnamic acid	56
fumaric acid	100
maleic acid	100
N-phenylmaleimide	35
••••• 4-acetylbutyric acid	73
••••• 2-oxoadipic acid	65
••••• 3-oxoadipic acid	38
••••• 3-oxoglutaric acid	37
••••• 4-ketopimelic acid	66
••••• succinic acid	100
••••• 3-bromopropionic acid	91
••••• 4-hydrazinobenzoic acid	34
<u>Comparative</u>	
••••• benzalacetophenone	11
••••• 2-oxooctanenitrile	0
••••• pyruvonnitrile	0
••••• 2,4-hexanedione	0
••••• acetoacetanilide	0
••••• 4-chlorocinnamonnitrile	5
••••• 2-acetoxy-3-butene nitrile	0
••••• N-(2-hydroxyethyl)acetoacetamide	1
•••••	
•••••	

EXAMPLE 2

This example demonstrates the stabilizing effect of several carbonyl compounds on a commercial MWF after 4 days at room temperature. Testing was as in Example 1. In the absence of the MWF, the relative concentration of the AI remained at 100%.

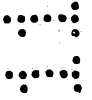
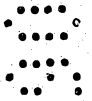
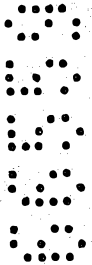


TABLE 2  
MWF A STABILIZED WITH CARBONYL COMPOUNDS  
AGED 4 DAYS

Original system contained 15 ppm 5-chloro-2-methyl-3-isothiazolone (AI) with 3% MWF concentrate A in water. All stabilizers were added at 1000 ppm.

<u>Stabilizer</u>	<u>% AI remaining</u>
None	3
acrylic acid	79
propionic acid	88
crotonic acid	70
trans-2-pentenoic acid	65
trans-2-hexenoic acid	39
butyric acid	72
vinyl acetic acid	59
crotonaldehyde	63
succinic acid	78
phthalic acid	22
maleic acid	91
fumaric acid	68
maleimide	67
isophthalic acid	67
malonic acid	91
succinic acid	79
glutaric acid	73
3-oxoglutaric acid	28
<u>Comparative</u>	
methyl crotonate	9
crotononitrile	6
3-penten-2-one	4
succinamide	6
succinonitrile	4

### EXAMPLE 3

This example demonstrates the stabilizing effect of further carbonyl compounds on a commercial MWF after 3 days at room temperature.

The original system contained 15 ppm of 5-chloro-2-methyl-3-isothiazolone (AI) with 3% MWF concentrate A in water. All stabilizers were added at 1000 ppm.

TABLE 3

<u>Stabilizer</u>	<u>% AI remaining</u>
None	19
adipic acid	55
citric acid	79
lactic acid	43
(D)(L) malic acid	69
(D)(L) mandelic acid	37
oxalic acid	76
propionic acid	63
sorbic acid	52
tartaric acid	65

### EXAMPLE 4

In this experiment, further results are shown for a variety of carbonyl compounds in two different MWFs. The carbonyl compounds tested were readily soluble in the test system; there was no colour development with the systems on mixing.



TABLE 4  
COMPARISON OF SEVERAL CARBONYL COMPOUNDS  
IN TWO MWF SYSTEMS AFTER 11 DAYS

Original system contained 15 ppm 5-chloro-2-methyl-3-isothiazolone (AI) with 3% MWF concentrate A in water. All stabilizers were added at 1000 ppm.

<u>Stabilizer</u>	<u>Stabilizer level (ppm)</u>	<u>MWF Conc. A % AI Remaining</u>	<u>MWF Conc. B % AI Remaining</u>
None, (comparative)	0	43	3
N-ethylmaleimide	1000	77	3
N-phenylmaleimide	1000	72	19
t-cinnamaldehyde	1000	61	50
iodoacetamide	1000	83	31

EXAMPLE 5

This example illustrates the ability of carbonyl compounds to stabilize isothiazolone in the presence of typical formulations used for water treatment in cooling towers.

A synthetic cooling tower water was prepared by adding 466.4 mg sodium carbonate into a liter of deionized water. The pH was adjusted to 9.0 using concentrated hydrochloric acid. Into the solution was added 10.7 ml scale/corrosion inhibitor stock solution (Acrysol QR 1086, Bahibit AM, and Cobratec TT-50-S), then 160 mg  $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$  and 122 mg  $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ . The final solution was adjusted to pH 9.0 with hydrochloric acid.

The synthetic water contained 170 ppm hardness as  $\text{CaCO}_3$ , 440 ppm alkalinity as  $\text{CaCO}_3$ , 5 ppm Acrysol® QR 1086, 5 ppm Bahibit™ AM (Phosphonate), and 2 ppm Cobratec® TT-50-S (Tolyltriazole). The hardness was 160 ppm  $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$  and 122 ppm  $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ .

Isothiazolone was added at 5 ppm AI and incubated for 10 days at room temperature. AI analysis was done as described in Example 1. Results are given in Table 5.

TABLE 5  
COMPARISON OF CARBONYL STABILIZERS IN COOLING  
TOWER WATER AFTER 10 DAYS AT ROOM TEMPERATURE

<u>Stabilizer</u>	<u>Stabilizer Level (ppm)</u>	<u>% AI Remaining</u>
None	0	40
crotonaldehyde	50	40
crotonaldehyde	25	40
glyoxal	50	74
glyoxal	25	60
maleimide	50	71
maleimide	25	57
t-cinnamaldehyde	50	43
t-cinnamaldehyde	25	40

EXAMPLES 6-9

These examples illustrate the stabilizing effect of carbonyl compounds for isothiazolones in metalworking fluids. Tests were run as described for Examples 1-4. Results are given in Tables 6-10.



TABLE 6

11.25 ppm AI, 300 ppm stabilizer, 2 days at room temperature, a synthetic metalworking fluid (MWF-A)

<u>Stabilizer</u>	<u>% AI remaining</u>
None	50
Benzaldehyde	56
Salicylaldehyde	66
Acetaldehyde	67
Methacrolein	69

TABLE 7

15 ppm AI, 1000 ppm stabilizer, 3 days at room temperature, MWF-A

<u>Stabilizer</u>	<u>% AI remaining</u>
None	23
Furfuraldehyde	55
4-Methoxysalicylaldehyde	66
Methyl glyoxal	77
Glycollic acid	77

TABLE 8

15 ppm AI, 2000 ppm stabilizer, 3 days at room temperature, MWF-A

<u>Stabilizer</u>	<u>% AI remaining</u>
None	14
Acrolein	67

TABLE 9

11.25 ppm AI, 300 ppm stabilizer, 2 days at room temperature, a synthetic metalworking fluid (MWF-A).

<u>Stabilizer</u>	<u>% AI remaining</u>
None	32
Metolachlor	44
Diethatyl Ethyl	72
Alachlor	46
Butachlor	42

The four stabilizers were added as the commercially available emulsifiable concentrates (stabilizer in an aromatic or aliphatic solvent plus a mixture of nonionic and anionic emulsifiers). The products and suppliers were metolachlor (Dual EC - Ciba-Geigy); diethatyl ethyl (Antor EC-BFC Chemicals); alachlor (Lasso EC-Monsanto); and butachlor (Machete EC-Monsanto).

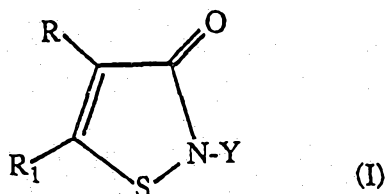
While the invention has been described with reference to specific examples and applications, other modifications and uses for the invention will be apparent to those skilled in the art.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. Composition comprising

a) at least one 3-isothiazolone of the formula (I)

5



10

wherein

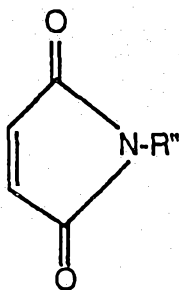
Y is (C<sub>1</sub>-C<sub>18</sub>)alkyl or (C<sub>3</sub>-C<sub>12</sub>)cycloalkyl each optionally substituted with one or more of hydroxy, halo, cyano, alkylamino, dialkylamine, arylamino, carboxy, carbalkoxy, alkoxy, aryloxy, alkylthio, arylthio, haloalkoxy, cycloalkylamino, carbamoxy, or isothiazolonyl; an unsubstituted or halo-substituted (C<sub>2</sub>-C<sub>8</sub>) alkenyl or alkyne; a (C<sub>7</sub>-C<sub>10</sub>)aralkyl optionally substituted with one or more of halogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl or (C<sub>1</sub>-C<sub>4</sub>)alkoxy; and an aryl optionally substituted with one or more of halogen, nitro, (C<sub>1</sub>-C<sub>4</sub>)alkyl, (C<sub>1</sub>-C<sub>4</sub>)alkyl-acylamino, carb(C<sub>1</sub>-C<sub>4</sub>)alkoxy or sulfamyl; and

20

R and R<sup>1</sup> is each independently H, halogen or (C<sub>1</sub>-C<sub>4</sub>) alkyl; and

b) a carbonyl compound comprising (C<sub>2</sub>-C<sub>6</sub>) aldehydes, (C<sub>7</sub>-C<sub>10</sub>) aromatic aldehydes, (C<sub>2</sub>-C<sub>4</sub>) dialdehydes and maleimides of the formula

25



30

wherein R'' is H, (C<sub>1</sub>-C<sub>4</sub>) alkyl or aryl;

provided that when (b) comprises an aldehyde or dialdehyde the ratio (b):(a) is less than 10:1.

2. Composition according to claim 1 wherein the carbonyl compound comprises a (C<sub>2</sub>-C<sub>4</sub>)aldehyde, (C<sub>2</sub>-C<sub>3</sub>)dialdehyde, or maleimide.
3. Composition according to claim 1 wherein the carbonyl compound comprises  
5 crotonaldehyde, glyoxal, maleimide, (methyl-1-naphthyl) maleimide, N-ethyl maleimide, N-phenyl maleimide, cinnamaldehyde, benzaldehyde, acetaldehyde, salicylaldehyde, methacrolein, or acrolein.
4. Composition according to any preceding claim wherein said at least one 3-  
10 isothiazolone is 5-chloro-2-methyl-3-isothiazolone, 2-methyl-3-isothiazolone, 2-n-octyl-3-isothiazolone, 4,5-dichloro-2-cyclohexyl-3-isothiazolone, or 4,5-dichloro-2-octyl-3-isothiazolone; preferably a mixture of 5-chloro-2-methyl-3-isothiazolone and 2-methyl-3-isothiazolone.
- 15 5. Composition according to any preceding claim, additionally comprising a polyol solvent.
6. Composition according to any preceding claim wherein the total amount of 3-isothiazolone is from 0.01 to 99.9999%, preferably from 0.1 to about 50% by  
20 weight, and the carbonyl compound is present in an amount from 0.0001 to 99.99%, preferably from 0.01 to about 50% by weight, based on the total weight of the composition.
7. Composition according to any preceding claim wherein the ratio of carbonyl  
25 compound to total 3-isothiazolone present is from 1:100 to 1000:1, preferably from 1:50 to 20:1, and more preferably from 1:1 to 20:1, subject to the proviso of claim 1.
8. Use of a carbonyl compound as defined in any of claims 1 to 4 to stabilise a  
30 3-isothiazolone as defined in claims 1 or 4.
9. A method of stabilizing a 3-isothiazolone of the formula (I) as defined in

claims 1 or 4, comprising incorporating with said 3-isothiazolone an effective amount of a carbonyl compound as defined in any of claims 1 to 3.

10. Method of inhibiting or preventing the growth of bacteria, fungi or algae in  
5 a locus subject or susceptible to contamination thereby, comprising incorporating into  
o<sub>i</sub> onto the locus a composition according to any of claims 1 to 7 in an amount  
effective to adversely affect the growth of said bacteria, fungi or algae.

11. Method according to claim 10 wherein the locus is a metal-working fluid, a  
10 cutting oil, a water-cooling system, a cosmetic formulation, a paint, or a film-forming  
agent.

12. A composition according to claim 1, or a method of use thereof substantially  
as hereinbefore described with reference to the Examples.

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DATED this 16th day of September, 1993.

ROHM AND HAAS COMPANY

20 By Its Patent Attorneys

DAVIES COLLISON CAVE

