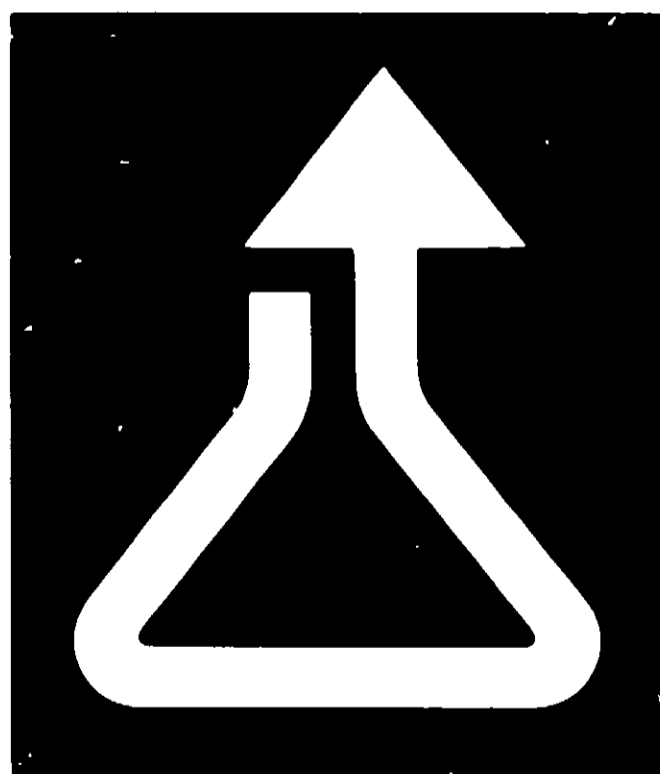


EP A. DER. NO. 707-123

8190-R2

KATHON 886

A PAPER MILL SLIMICIDE



**ROHM
AND
HAAS**
PHILADELPHIA, PA. 19105

DANGER!
KEEP OUT OF REACH OF CHILDREN

SEE FIRST AID STATEMENT AND OTHER
PRECAUTIONS ON SIDE PANEL.



ACTIVE INGREDIENTS

5-chloro-2-methyl-4-isothiazolin-3-one calcium chloride	55.0%
2-methyl-4-isothiazolin-3-one calcium chloride	15.0%

INERT INGREDIENTS

Total	30.0%
	<hr/>
	100.0%

EPA Reg. No. 707-123
EPA Est. No. 707-PA-1

NET CONTENTS

LBS.

DIRECTIONS FOR USE

Kathon 886 is useful in the control of bacteria and fungi. Kathon 886 should be used only in accordance with directions in the Technical Bulletin furnished by the manufacturer, and only in the production of paper not to be used in direct contact with foods as a wrapper or container.

This product is toxic to fish and wildlife; Treated effluent should not be discharged where it will drain into lakes, streams, ponds, or public water; Do not contaminate water by cleaning of equipment, or disposal of wastes; Apply this product only as specified on this label.

DANGER!

CORROSIVE

CAUSES EYE DAMAGE AND SKIN BURNS

MAY CAUSE ALLERGIC SKIN REACTION

HARMFUL IF INHALED

HARMFUL OR FATAL IF SWALLOWED OR

BROUGHT IN CONTACT WITH SKIN

Do not get in eyes, on skin, on clothing. Wear goggles or face shield and rubber gloves when handling. Avoid breathing vapor or dust. Avoid contamination of food. Do not take internally. Wash thoroughly after handling.

FIRST AID

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. For eyes, call a physician. Remove and wash contaminated clothing before re-use.

If swallowed, drink promptly a large quantity of milk, egg whites, gelatin solution or if these are not available, drink large quantities of water. Avoid alcohol. Call a physician immediately.

NOTE TO PHYSICIAN

Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsion may be needed.

NOTICE: Seller warrants that the product conforms to its chemical description and is reasonably fit for the purpose stated on the label when used in accordance with directions under normal conditions of use, but neither this warranty nor any other warranty of merchantability or fitness for a particular purpose, express or implied, extends to the use, storage or handling of this product contrary to label instructions, or under abnormal conditions, or under conditions not reasonably foreseeable to seller, and buyer assumes the risk of any such use.

ROHM AND HAAS COMPANY

INDEPENDENCE MALL WEST
PHILADELPHIA, PENNSYLVANIA 19106



TECHNICAL BULLETIN

KATHON 886

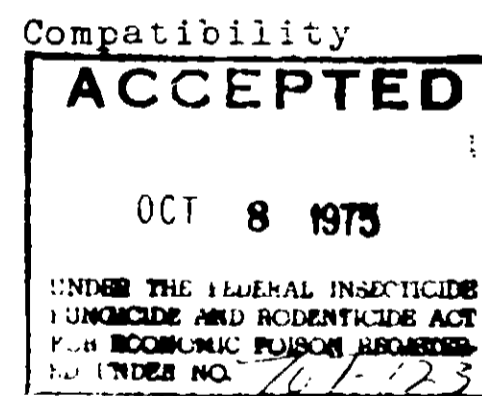
PAPER MILL SLIMICIDE

INTRODUCTION

Kathon 886 is a new broad spectrum antimicrobial product offered for use as a paper mill slimicide. It is effective at low concentrations and is highly resistant to the inhibitory effects of most organic and inorganic compounds.

PHYSICAL AND CHEMICAL PROPERTIES

Appearance	White to tan solid
Odor	Mild
Solubility	Highly soluble in water and the lower alcohols and glycols, insoluble in other organic solvents (e.g., ethers, esters, ketones, aliphatic and aromatic hydrocarbons).
Compatibility	Biologically and physically compatible with anionics, nonionics and cationic surfactants, proteins, halogens and in use solutions, and most organic and inorganic compounds normally used in chemical specialty products. The compound is inhibited by primary and secondary amines, mercaptans, and sulfides through a chemical reaction mechanism.
Stability	Darkens at 180°C. Decomposes at 250°C.
pH (50% aqueous)	3.5 to 5.0



Kathon 886, as supplied, is stable for at least one year.

These suggestions and data are based on information we believe to be reliable. They are offered in good faith but without warranty. We make no representation as to the suitability of our products and suggest that you test them on a commercial scale.

Suggest that you use our products on the inclusion of descriptive material in your report and the inclusion of a copy of this technical bulletin in your report. We will be glad to provide you with a copy of this technical bulletin.

ACCEPTED

OCT 8 1975

UNDER THE FEDERAL INSECTICIDE
FUNGICIDE AND RODENTICIDE ACT
FOR ECONOMIC POISON REGISTERED
ED UNDER NO. 707-123

with anionics, nonionics and cationic surfactants, proteins, halogens and in use solutions, and most organic and inorganic compounds normally used in chemical specialty products. The compound is inhibited by primary and secondary amines, mercaptans, and sulfides through a chemical reaction mechanism.

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Kathon 886, as supplied, is stable for at least one year.

These suggestions and data are based on information we believe to be reliable. They are offered in good faith, but without guarantee, as conditions and methods of use of our products are beyond our control. We recommend that the prospective user determine the suitability of our materials and suggestions before adopting them on a commercial scale.

Suggestions for uses of our products or the inclusion of descriptive material from patents and the citation of specific patents in this publication should not be understood as recommending the use of our products in violation of any patent or as permission or license to use any patents of the Rohm and Haas Company.

FORM 2890

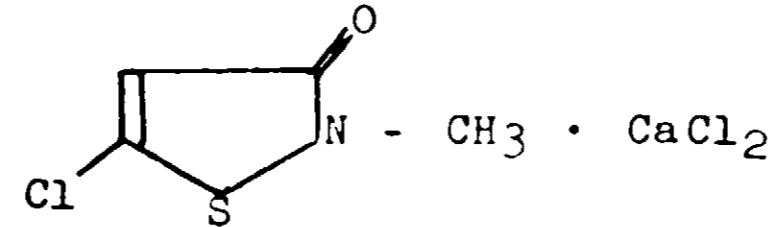
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CHEMICAL IDENTIFICATION

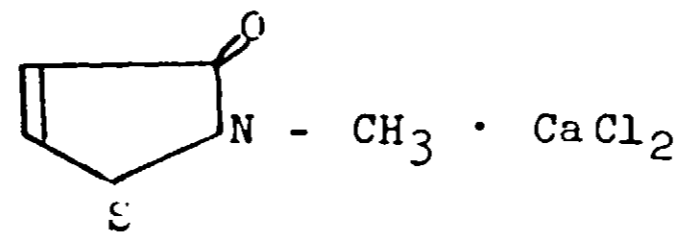
The active ingredients in Kathon 886 are the compounds identified according to Chemical Abstract Nomenclature as 5-Chloro-2-methyl-4-isothiazolin-3-one calcium chloride and 2-methyl-4-isothiazolin-3-one calcium chloride.

Structural Formulae:

5-Chloro-2-methyl-4-isothiazolin-3-one calcium chloride



2-methyl-4-isothiazolin-3-one calcium chloride



Chemical Composition:

The composition of Kathon 886 as supplied is:

5-Chloro-2-methyl-4-isothiazolin-3-one calcium chloride	...55.0%
2-methyl-4-isothiazolin-3-one calcium chloride15.0%
Inert Ingredients30.0%

Note: All of the following toxicological and microbiological data are based on Kathon 886 as supplied.

TOXICITY

The toxicity and sensitizing characteristics of Kathon 886 are as follows:

- 1) Acute Oral LD₅₀ of Kathon 886 administered as a 1.0 percent solution in water to rats.

Males - 105 mg/kg
Females - 112 mg/kg

- 2) Acute dermal LD₅₀ of a 10 percent W/V solution of Kathon 886 applied as a 24 hour occluded patch to rabbits.

Intact skin - 200 mg/kg
Abraded skin - 168 mg/kg

- 3) Acute dermal LD₅₀ of a 0.1 percent W/V solution of Kathon 886 applied as a 24 hour occluded patch to rabbits.

Intact skin - 800 mg/kg

- 4) Acute inhalation LD₅₀ of Kathon 886 applied to rats as an aqueous aerosol is 1.2 mg/liter.
- 5) Primary skin irritation on rabbits from a 24 hour, occluded patch test.

Concentrations (W/V) of Kathon 886 in Water	Irritation Index
1.0%	6.3 (severe)
0.5%	3.16 (moderate)
0.1%	0 (none)

At levels of 0.5 percent and greater Kathon 886 is considered a primary skin irritant.

- 6) Primary Eye Irritation in Rabbits. Treated eyes washed 2 seconds after instillation of 100 mg of solution - Draize Test.

Concentrations (W/V) of Kathon 886 in Water	Response
10%	Severe corneal, irridial and conjunctival effects
0.5%	Slight irritation
0.1%	No effect

- 7) Fish Toxicity - Dynamic Test on Bluegills

LC₅₀ (6 days) = 0.96 mg/L

- 8) Human Patch Test

Tests were conducted with formulations containing three levels of Kathon 886, 50 ppm, 100 ppm and 1000 ppm. The formulations were applied respectively to one site of the subject's arms every other day until completion of the studies. The sites were covered with plastic strips (water barrier) and allowed to remain for 24 hours. The sites were rated for irritation on a scale of 0 (no irritation) - 4 (severe irritation) after each 24 hour exposure.

The results show that, at the 100 ppm and 1000 ppm levels, repeated 24 hour exposure of Kathon 886 were required to product a response. The most rapid reaction was a 2 rating (0-4 scale) after 2 applications. Six of the remaining 7 subjects elicited a reaction after six 24 hour exposures.

All the subjects were rechallenged with the formulation containing Kathon 886 eight days later. At a concentration of 100 ppm, the Microbicide causes essentially the same reaction as before. These results indicated that Kathon 886 is a sensitizer at a concentration of 100 ppm in 6 of 10 subjects.

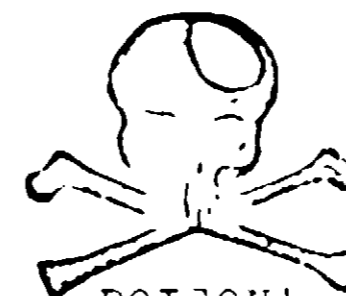
At the 50 ppm level repeated 24 hour exposures of Kathon 886 produced some irritation in 5 out of 10 individuals. In none of these subjects was the irritation of a sensitizing phenomena.

HANDLING PRECAUTIONS

The following handling precautions are included on the Kathon 886 label:

DANGER!

KEEP OUT OF REACH OF CHILDREN



POISON!

CORROSIVE

Causes severe eye damage and skin burns.

May cause allergic skin reaction.

Harmful if inhaled.

Harmful or fatal if swallowed or brought in contact with skin.

Do not get in eyes, on skin, on clothing. Wear goggles or face shield and rubber gloves when handling. Avoid breathing vapor or dust. Avoid contamination of food. Do not take internally.

Wash thoroughly after handling.

FIRST AID

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. For eyes, call a physician. Remove and wash contaminated clothing before reuse.

If swallowed, drink promptly a large quantity of milk, egg whites, gelatin solution or if these are not available, drink large quantities of water. Avoid alcohol. Call a physician immediately.

NOTE TO PHYSICIAN

Probably mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsion may be needed.

This product is toxic to fish and wildlife. Treated effluent should not be discharged where it will drain into lakes, streams, ponds, or public water. Do not contaminate water by cleaning of equipment, or disposal of wastes. Apply this product only as specified on this label.

DISSIPATION OF KATHON 886

Radiolabelled studies were conducted to follow the dissipation of Kathon 886 in natural river water, soil and in activated sludge. Results of these studies are given below.

Dissipation in One Type of River Water

Percent 5-Chloro-2-methyl-4-isothiazolin-3-one calcium chloride Remaining

Percent 2-methyl-4-isothiazolin-3-one calcium chloride Remaining

Concentration Tested

Concentration Tested

Days	0.01 ppm	0.1 ppm	1.0 ppm	1.0 ppm
1	15%	87%	96%	96%
2	0%	67%	92%	98%
4	-	24%	83%	52%
7	-	0%	72%	28%
14	-	-	61%	0%
35	-	-	25%	-

Dissipation in Activated Sludge Unit

The level of Kathon 886 in the standard soap and detergent activated sludge unit was increased gradually to 10 ppm. The recovery of the charged C14 activity during the seven week test is given below.

Percent of Total C14 Added

	<u>C14-5-Chloro-2-methyl-4-isothiazolin-3-one calcium chloride</u>	<u>C14-2-methyl-4-isothiazolin-3-one calcium chloride</u>
Effluent	55.1%	59.6%
Carbon Dioxide	23.6%	18.3%
Sludge	<u>22.5%</u>	<u>19.3%</u>
TOTAL	101.2%	97.2%

The effluent contained no detectable amount of either parent compound according to GLC analysis.

Dissipation in One Type of Soil

In biometry flask studies, 25 percent of the C14 activity applied as 1 ppm of C14 5-Chloro-2-methyl-4-isothiazolin-3-one calcium chloride was evolved as C14O₂ in 25 days from nonsterile Hagerstown silt loam. There was negligible evolution from sterilized soil.

ANTIMICROBIAL EFFICACY

Bacteriostatic and Fungistatic Effectiveness

Kathon 886 is an excellent candidate for antimicrobial applications where broad spectrum activity is required. The serial dilution data in Table I indicate this product exhibits microbiostatic effects at very low concentrations against a wide range of bacterial and fungal species. Preliminary studies on several bacterial and fungal types indicates the product has a biocidal effect at these low concentrations after several days exposure.

TABLE I
 MICROBIOSTATIC CONCENTRATIONS
 OF KATHON 836

BACTERIA	ATCC NO.	PPM
<u>Gram-Positive</u>		
<u>Bacillus cereus var mycoides</u>	(R&H #L5)	4
<u>Bacillus subtilis</u>	(R&H #B2)	4
<u>Brevibacterium ammoniagenes</u>	6871	4
<u>Sarcina lutea</u>	9341	8
<u>Staphylococcus aureus</u>	6538	4
<u>Staphylococcus epidermidis</u>	155	4
<u>Streptococcus pyogenes</u>	624	16
<u>Gram-Negative</u>		
<u>Achromobacter parvulus</u>	4335	4
<u>Alcaligenes faecalis</u>	8750	4
<u>Enterobacter aerogenes</u>	3906	8
<u>Escherichia coli</u>	11229	8
<u>Flavobacterium suavis</u>	958	16
<u>Proteus vulgaris</u>	8427	8
<u>Pseudomonas aeruginosa</u>	15442	8
<u>Pseudomonas fluorescens</u>	13525	4
<u>Pseudomonas chlororans</u>	8062	8
<u>Salmonella typhosa</u>	6539	8
<u>Shigella sonnei</u>	9292	4
FUNGI	ATCC NO.	PPM
<u>Aspergillus niger</u>	9642	16
<u>Aspergillus nysse</u>	10196	8
<u>Candida albicans (yeast)</u>	11651	8
<u>Chaetomium album</u>	6205	16
<u>Gliocladium fibriatum</u>	(QM 7638)	16
<u>Mucor rouxii</u>	(R&H L5-83)	8
<u>Penicillium funiculosum</u>	9644	8
<u>Penicillium variable (glaucum)</u>	(U.S.D.A.)	4
<u>Phoma pigmentaria</u>	12569	4
<u>Pullularia americana pullulans</u>	9348	8
<u>Rhizopus stolonifer</u>	10404	8
<u>Rhodotorula rubra (yeast)</u>	9449	4
<u>Saccharomyces cerevisiae (yeast)</u>	2601	4
<u>Trichophyton mentenophytes (interdigitale)</u>	9533	8

Algistatic Effectiveness

The broad spectrum antimicrobial activity of Kathon 886 has been further demonstrated in biostatic tests against a number of algae species. The data in Table II indicate the biostatic efficiency of the compound as determined by the Fitzgerald Test method.

TABLE II
ALGAESTATIC CONCENTRATIONS OF
KATHON 886 (1)

Algae Test Organism	Product Concentration (ppm)
<u>Chlorophyta (Green Algae)</u>	
<u>Ankistrodesmus flaccatus</u>	1.5
<u>Chlamydomonas eurynetes</u>	0.8
<u>Chlorella pyrenoidosa</u> (2)	0.4
<u>Cocconeis elongata</u>	3.0
<u>Cosmarium</u> sp.	0.4
<u>Eudorina elegans</u>	0.2
<u>Mougeotia</u> sp.(2)	0.2
<u>Pandorina morum</u>	0.4
<u>Pediastrum tetras</u>	0.4
<u>Scenedesmus blicus</u>	1.5
<u>Spirogyra varians</u>	0.8
<u>Ulothrix subtilissima</u> (2)	0.2
<u>Cyanophyta (Blue-green Algae)</u>	
<u>Anabaena cylindrica</u> (2)	0.2
<u>Nostoc</u> sp.	0.2
<u>Oscillatoria prolifera</u> (2)	1.5
<u>Phormidium</u> sp.	0.4
<u>Phormidium retzii</u>	0.4
<u>Chrysophyta (Diatoms)</u>	
<u>Navicula radiolosa</u>	0.2
<u>Nitzschia</u> sp.(2)	0.2

(1) Modified Fitzgerald Test, two-fold serial dilutions with proper growth media. Minimum inhibitory concentrations determined visually after 10-30 days incubation at 21-28°C (depending on growth requirements) and with 16 hours of fluorescent illumination per day.

(2) Test modified by using shake flasks to promote growth.

EVALUATION AS A PAPER MILL SLIMICIDE

Kathon 886 was evaluated as a potential paper mill slimicide agent using the following laboratory test procedure.

A series of Erlenmeyer flasks were fitted with plastic foam stoppers, through which wood tongue depressors were inserted to act as slime receptors in the culture medium. Fifty milliliters of an artificial "white water" medium consisting of 0.3% mono-potassium phosphate, 0.1% clay, 0.1% soluble starch and 0.1% groundwood was added to each flask. The flasks were then treated with the desired dosage level of the test compound. A pooled, pure culture inoculum consisting of the following organisms was used to evaluate the effectiveness of the microbiocide treatment:

Pseudomonas fluorescens

Pseudomonas oleovorans

Flavobacterium suaveolans

Alcaligenes caecalis

Bacillus cereus var. mycoides

Aerobacter aerogenes

Pullularia (Aureococcidium) pullulans

Aspergillus niger

The test flasks were inoculated once per week with the pooled inoculum and incubated in a rotary shaker at room temperature. This procedure was used to evaluate various concentrations of Kathon 886, to compare this product with proprietary compounds, and to determine the compatibility of Kathon 886 with paper chemical additives. Efficacy was determined by reduction in microbial populations on the surface of the wood tongue depressor and in the white water medium compared to an untreated control. The results of these studies are summarized in Tables III, IV, V and VI.

DIRECTIONS FOR USE

To ensure uniform mixing, Kathon 886 should be added to the beater or hydropulper section of the paper making system at a level of 2.5 to 10 ppm active ingredients based on total water flow at maximum dilution. The amount to be used will depend on the extent of slime present and the paper mill system. For a dose of 2.5 ppm, the amount of Kathon 886 will range from 0.75 to 2.5 pounds active ingredient per ton of paper produced based on a pulp consistency ranging from 1% to 0.1% and a reuse of water ranging from 90% to 50%.

TABLE III

Effect of Kathon 886 on Pooled Bacterial and Fungal Pure Cultures
In Paper Mill Slimicide Application Test^(a)

Concentration of Kathon 886	Sample	Bacteria				Fungi			
		1 Week	2 Weeks	3 Weeks	% Reduc- tion After 3 Weeks	1 Week	2 Weeks	3 Weeks	% Reduc- tion After 3 Weeks
2.5 ppm	White water, #/ml	<100	<100	<100	>99.9	200	250	320	98
	Surface, #/stick	<10,000	<10,000	<10,000	>99.99	<10,000	120,000	3.4x10 ⁶	54
5 ppm	White water, #/ml	<100	<100	<100	>99.99	650	<100	25	>99.99
	Surface, #/stick	<10,000	<10,000	<10,000	>99.99	<10,000	7.0x10 ⁵	9,200	>99
10 ppm	White water, #/ml	<100	<100	<100	>99.99	<100	<100	0	100
	Surface, #/stick	<10,000	<10,000	<10,000	>99.9	<10,000	<10,000	<100	>99.99
None (Control)	White water, #/ml	3.4x10 ⁶	4.0x10 ⁶	7.5x10 ⁶	- - -	2.0x10 ⁴	1.8x10 ⁴	5.3x10 ⁴	- - -
	Surface, #/stick	9.0x10 ⁸	1.5x10 ⁹	1.3x10 ⁹	- - -	3.4x10 ⁶	6.2x10 ⁶	7.4x10 ⁶	- - -

(a) Flask inoculated each week for three weeks with 14,900,000 total microorganisms/ml white water.

TABLE IV

Comparison of Kathon 886 with Commercial A (1) and Commercial B (2)
in Pooled Pure Culture Inoculated Paper Mill Slimicide Application Test

Biocide Treatment	ppm Product	No. Microorganisms (3)							
		Bacteria				Fungi			
		White Water		Surface		White Water		Surface	
		#/ml	Reduction %	#/Stick	Reduction %	#/ml	Reduction %	#/Stick	Reduction %
Kathon 886	2.5	100	>99.99	1.0×10^4	>99.99	410	97	1.9×10^4	99
	5	<100	>99.99	< 1.0×10^4	>99.99	300	98	9.0×10^3	>99
	10	<100	>99.99	< 1.0×10^4	>99.99	<10	>99.99	<100	>99.99
Commercial A	50	3.7×10^4	>99	< 1.0×10^4	>99.99	60	99.9	4.0×10^3	>99
	100	250	>99.99	< 1.0×10^4	>99.99	5	>99.99	1×10^3	99.9
	200	<100	>99.99	< 1.0×10^4	>99.99	<10	>99.99	500	>99.9
Commercial B	50	7.9×10^6	0	1.3×10^8	0	140	99	3.0×10^3	99.9
	100	7.8×10^6	0	4.3×10^8	0	<10	>99.99	<100	>99.99
	200	<100	>99.99	1.0×10^8	>99.99	<10	>99.99	<100	>99.99
None	---	4.4×10^6	---	4.3×10^8	---	1.3×10^4	---	2.7×10^6	---

- (1) Commercial A contains 10% methylene bisisocyanate.
(2) Commercial B contains 10% chloroethylene bisisocyanate.
(3) Counts made 7 days after single inoculation.

TABLE V

Comparison of Kathon 886 with Other Commercial Biocides in Pooled Pure Culture
Inoculated Paper Mill Slimicide Application Test

Product	Active Ingredient	PPM Active Ingredient	No. Microorganisms/ml White Water ^(a)			
			Bacteria	% Reduction	Fungi	% Reduction
Kathon 886	(See Text)	10	<100	>99.999	<10	>99.99
Commercial A	bis (trimethyl) sulfone & methyl bithiocyanate	50	<100	>99.999	800	99.8
		25	1.1x10 ⁷	53	1.2x10 ³	99.8
Commercial B	dimethyl tetrahydrothia- diazine thione	50	100	>99.999	2.4x10 ⁴	92
		25	3.1x10 ⁷	0	3.0x10 ⁴	90
Commercial C	sodium ethylene bisdi- thiocarbamate	50	1.1x10 ⁷	63	<10	>99.99
		25	2.0x10 ⁷	33	<10	>99.90
Commercial D	sodium monomethyl dithio- carbamate	50	1.3x10 ⁷	57	<10	>99.99
		25	3.3x10 ⁷	0	70	>99.9
Commercial E	bis (bromacetoxy) butene	50	2.2x10 ⁷	27	90	>99.9
		25	1.3x10 ⁷	57	20	>99.99
Commercial F	disodium cyanothioimido- carbamate	50	3.5x10 ⁷	0	1.0x10 ⁴	97
		25	4.3x10 ⁷	0	4.3x10 ⁴	86

(a) Compared to control, 7 days after single inoculation.

TABLE VI

Compatibility of Kathon 886 with Standard Paper Chemical Additives in Pooled Pure Culture Inoculated Paper Mill White Water

<u>Treatment of White Water</u>	<u>No. Microorganisms per Liter of White Water</u>	
	<u>Bacteria</u>	<u>Fungi</u>
10 ppm Kathon 886 + AB ₁ CD (pH 7-9)	100	10
10 ppm Kathon 886 + AE ₂ CD (pH 7-9) ⁽¹⁾	100	10
10 ppm Kathon 886 + AB ₃ CD (pH 4-5) ⁽¹⁾	100	10
10 ppm Kathon 886 (pH 7-9)	100	10
10 ppm Kathon 886 (pH 4-5)	100	10
Control (No additive or Kathon 886)	2,700,000	24,000

The above data indicate Kathon 886 is a very effective slimicide under control laboratory conditions against the test organisms employed. Moreover, the product is biologically compatible with several other chemical compounds used in paper processing and is, therefore, a worthy candidate for this particular application.

CORROSION CHARACTERISTICS

At use levels Kathon 886 does not exhibit corrosive properties on mild steel in aqueous solutions. Equally important, the product does not interfere with the corrosion inhibiting effects of most types of commercial corrosion inhibitors. The corrosion data in Table VII illustrates this fact.

- (1) Percent in white water based on weight of pulp:
A = Alum, 3% (coupling agent)
B₁ = ZRN-112, 0.5% (Wet strength resin).
B₂ = Kymene, 0.5% (Wet strength resin).
B₃ = Parex, 0.5% (Wet strength resin).
C = Tamol, 0.5% (Pitch control agent).
D = Pexol, Resin Size, 0.5% (Sizing agent).
- (2) One week after single inoculation.