ROHM AND HAAS

KORDEK™ LX5000

For Metalworking Fluid Concentrates and Tankside Additions

Description

KORDEK LX5000 biocide is a broad spectrum biocide for use in Metalworking Fluid Concentrates and as a Tankside Additive for dilute circulating systems.

Product Features and Performance

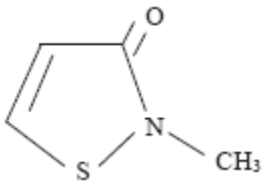
- **Broad Spectrum Efficacy (including Mycobacteria)**
  KORDEK LX5000 is efficacious against gram positive and gram negative bacteria, mold and yeast. Laboratory studies have also shown good efficacy versus natural populations of mycobacteria present in contaminated fluid samples from the field (laboratory-dosed biocide testing).

- **Formaldehyde-free**
  KORDEK LX5000 contains NO FORMALDEHYDE and is not a formaldehyde releaser. It is also halogen (chlorine) free, nitrate free, metal free (no hardness salts), and contains no organic solvents or volatile organic compounds (VOC).

- **Formulation in Metalworking Fluid Concentrates**
  Rohm and Haas has developed novel, stabilization technology which enables the effective use of KORDEK LX5000 in various concentrate formulations.

- **Compatibility**
  KORDEK LX5000 is chemically compatible with most metalworking fluid concentrate components in end use fluids. Formulated in water, it can be used in most concentrates (soluble oils, semi-synthetics, and true synthetics) and is compatible with KATHON™ 893MW Fungicide and many other commercially available biocides.

Composition



Active Ingredient: 2-methyl-4-isothiazolin-3-one
CAS Registry No. 2682-20-4/EINECS No. 2202396

Typical Properties

These properties are typical but do not constitute specifications.

Appearance	Clear, colorless to amber liquid
Active Ingredient	50% Methylisothiazolone (MIT)
Solvent	Water
Odor	Mild
pH (as is)	3-7
Specific Gravity	1.2 g/cc at 20°C
Solubility in water	Completely soluble in water

- **Enhanced Stability for Long–term Preservation**
  The active ingredient in KORDEK LX5000 provides excellent stability in dilute fluids at pH 10 and below and provides long-term microbial efficacy.

Directions for Use

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. To be used only by technically qualified persons.

Metalworking Fluid Preservation – Tankside Addition

KORDEK LX5000 biocide is recommended for the control of bacteria and fungi in water-extendible metalworking fluids (soluble oil, semi-synthetic and synthetic types). The preservative should be dispensed as a tankside additive into the circulating use-dilution of the metalworking fluid using a metering pump or by manual pouring, and uniformly dispersed throughout the system.

Dosing: Use KORDEK LX5000 at 1.0 to 2.0 pints (1.2 to 2.4 lb) per 1,000 gallons of metalworking fluid every 1-6 weeks. This will provide 150-300 ppm product and 75 to 150 ppm active ingredient. The frequency of treatment may vary depending upon the rate of dilution of the preservative with makeup fluid, the nature and severity of contamination, level of control required, filtration effectiveness and system design.

Metalworking Fluid Concentrates

KORDEK LX5000 is recommended for the control of bacteria and fungi in water-extendible metalworking fluids (soluble oil, semi-synthetic and synthetic types) when added to the metalworking fluid concentrates. KORDEK LX5000 should be added to the concentrate at a level to ensure that the final use–dilution metalworking fluid will contain 150-300 ppm KORDEK LX5000 (75 to 150 ppm active ingredient). Refer to the below listed table for dosing details.

Note: Regardless of the manner of incorporation, the total active ingredient level in the system should at no time exceed 150 ppm active ingredient in the final use dilution.

Metalworking Fluid Concentrations

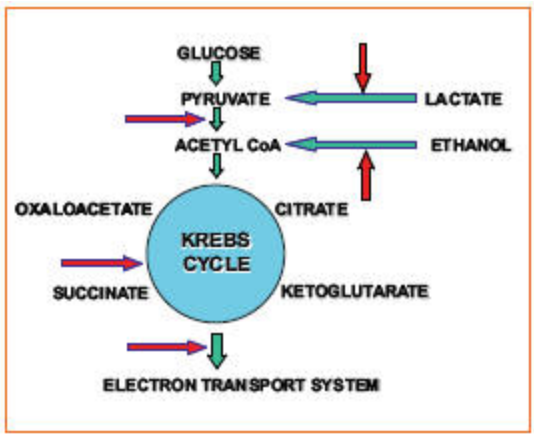
Dilution of Metalworking Fluid Concentrates	Dose Level	Lbs. KORDEK LX5000 Per 100 Gal. Conc.	Quarts KORDEK LX5000 Per 100 Gal. Conc.
15:1	Minimum	1.8 lb	3/4 quarts
15:1	Maximum	3.6 lb.	1 1/2 quarts
20:1	Minimum	2.4 lb	1 quart
20:1	Maximum	4.8 lb.	2 quarts
25:1	Minimum	3.0 lb.	1 1/4 quarts
25:1	Maximum	6.0 lb.	2 1/2 quarts

How Can I Improve KORDEK LX5000 Stability in Concentrates?

We recommend testing KORDEK LX5000 in concentrates prior to commercialization. Rohm and Haas technical staff can assist you in formulating products. We have years of experience and a range of recommended stabilizers to prolong the lifetime and improve the compatibility of KORDEK LX5000 in concentrates. Contact your sales representative for assistance.

How Does KORDEK LX5000 Work?

KORDEK LX5000 utilizes a two-step mechanism involving rapid growth inhibition leading to a loss of cell viability. Growth inhibition is the result of rapid disruption of the central metabolic pathways of the cell by inhibition of several specific dehydrogenase enzymes. The critical enzymes which are affected (see red arrows in the figure below) are associated with the Krebs cycle (pyruvate and succinate dehydrogenase), nutrient metabolism (lactate and alcohol dehydrogenase) and energy generation (NADH dehydrogenase).



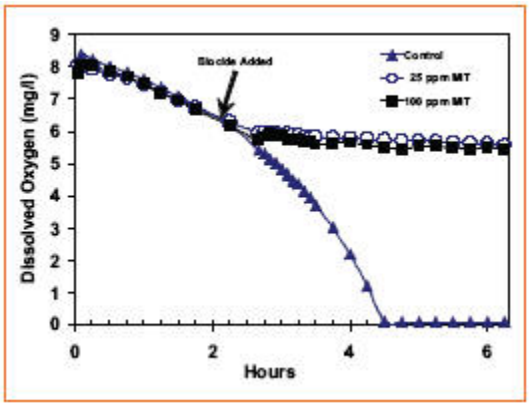
The key physiological activities that are rapidly inhibited in microbial cells are respiration (oxygen consumption), energy generation (ATP synthesis), and growth (reproduction). Many of these key enzymes are present in both aerobic and anaerobic microorganisms, which explains why KORDEK LX5000 biocide is such a broad spectrum biocide.

Inhibition of cellular activity and growth is rapid (within minutes), whereas cell death (cidal activity) is observed after hours of contact. In general, the higher the concentration of biocide, the shorter the contact time required for more complete kill.

Cell death results from the destruction of protein thiols in the cell from one of multiple pathways. As cell metabolism is disrupted, free radicals are produced within microbial cells, which also results in cell death. This unique mechanism results in the broad spectrum of activity of KORDEK LX5000, low use levels for microbial control, and difficulty in attaining resistance by mutation.

How Rapidly Does KORDEK LX5000 Work?

Within minutes after addition of KORDEK LX5000 to a fluid, the metabolic activity of the microorganisms in the system shuts down. This includes cellular respiration (oxygen uptake; see graph), growth, energy generation, and nutrient uptake. The microorganisms, although still alive, are no longer able to reproduce or metabolize. After 24 to 48 hours of contact with a lethal dose of the methylisothiazolone (MIT) microbicide, most of the microorganisms have been killed.



How Long Does KORDEK LX5000 Last?

KORDEK LX5000 is extremely stable in use diluted fluids and provides long term microbial control. Variables such as the degree of contamination/fouling and system dynamics can affect the life of the microbicide in a system.

Performance

Summary of Field Trials

- Excellent microbial control has been achieved for 4 to 6 months with concentrate dosing only
- Bacterial control achieved at 100-200 ppm KORDEK LX5000 for total bacteria and SRB's ($<10^3$/ml)
- Fungal control (<10/ml) achieved at 200-300 ppm KORDEK LX5000
- Excellent system operating performance (pH, alkalinity, tramp oil, rust control, tool life)
- Improved control over emulsion stability
- No odor or worker complaints
- Machine operators very satisfied

6-Week Use-Dilution Multiple Challenge Efficacy Tests

Results with KORDEK LX5000 + KATHON 893MW	
Treatment Level	**Fluids Preserved vs: Bacteria and Fungi**
50 ppm KORDEK LX5000 + 67 ppm KATHON 893MW	5 of 9
100-150 ppm KORDEK LX5000 + 67-110 ppm KATHON 893MW	9 of 9

6-Week Use-Dilution Multiple Challenge Efficacy Tests

Results with KORDEK LX5000 Biocide Alone	
Treatment Level	**# of Fluids Preserved**
50 ppm	5 of 10 vs Bacteria
150-300 ppm	10 of 10 vs Bacteria
150 ppm	1 of 10 vs Fungi
200->300 ppm	10 of 10 vs Fungi

Eradication and Challenge Tests in Dynamic System

Results in a Contaminated Soluble Oil

- Microbial control (eradication) achieved with 250 ppm KORDEK LX5000 + 67 ppm KATHON 893MW
- 6 weeks of preservative efficacy ($<10^3$ bacteria/ml and <10 fungi/ml) achieved following eradication

Comparative Efficacy of Six Biocides Versus Mycobacteria in Metalworking Fluids

A comparative study was conducted evaluating six metalworking fluid biocides versus natural populations of mycobacteria from in-use metalworking fluids. KATHON 886 MW, KATHON CC, KORDEK LX5000 biocides, benzisothiazolone (BIT), hexahydro-tris(hydroxyethyl)-s-triazine (triazine), and chlorophenol (parachlorometacresol; PCMC) microbicides were tested under controlled laboratory conditions to determine their efficacy at the maximum recommended dose rate and one-half of the maximum level. A total of six metalworking fluids, known to contain high levels of mycobacteria were used for the efficacy studies. The results for the maximum dose rate studies showed:

1. KORDEK LX5000 was the only biocide that provided at least a 90% kill (1-log reduction) in all 6 fluids

2. PCMC showed good kill (>99.9%) in 4 fluids, but only a one-log kill in one other fluids

3. KATHON 886 MW and KATHON CC showed a >99.9% kill (3-log reduction) in 4 fluids, but showed no significant kill in two fluids

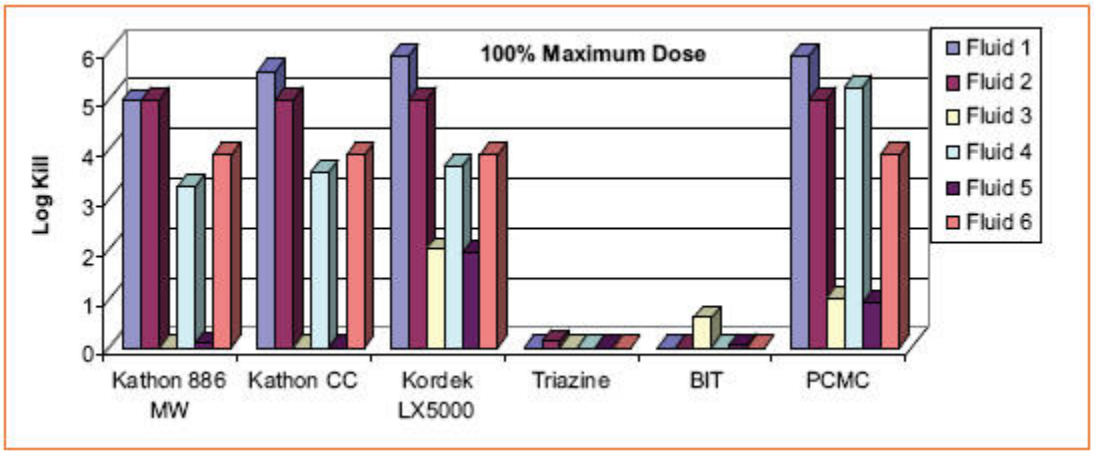
4. The triazine and BIT biocides were ineffective (no significant kill observed) in all of the six fluids

Biocides Tested

Biocide	50% Maximum Dose	Maximum Dose
KATHON 886 MW (14% methychloro-methylisothiazolone)	9 ppm active 63 ppm product	17.5 ppm active 125 ppm product
KATHON CC (1.5% methychloro-methylisothiazolone + monocopper citrate)	9 ppm active 583 ppm product	17.5 ppm active 1,667 ppm product
KORDEK LX5000 (50% methylisothiazolone)	75 ppm active 150 ppm product	150 ppm active 300 ppm product
Triazine (78% Hexahydro-tris(hydroxyethyl)-s-Triazine)	588 ppm active 750 ppm product	1,180 ppm active 1,500 ppm product
PCMC (46% Parachlorometacresol)	1,725 ppm active 3,750 ppm product	3,450 ppm active 7,500 ppm product
BIT (19% Benzisothiazolone)	171 ppm active 886 ppm product	342 ppm active 1,772 ppm product

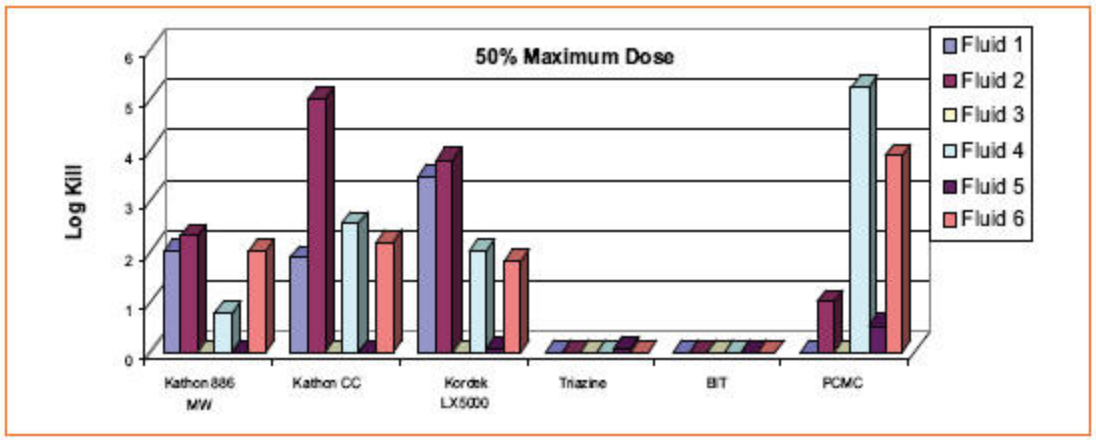
I. Biocide Efficacy vs Mycobacteria at Maximum Dose Rates

- KORDEK LX5000 biocide (methylisothiazolone) was the only biocide that provided at least a 90% kill (1-log reduction) in all 6 fluids
- PCMC showed good kill (>99.9%) in 4 fluids, but only a 90% kill in one other fluid
- KATHON 886 MW and KATHON CC showed a >99.9% kill (3-log reduction) in 4 fluids, but showed no kill in two fluids
- The triazine and BIT failed to achieve a 1-log kill in any of the 6 fluids



II. Biocide Efficacy vs Mycobacteria at 50% Maximum Dose Rates

- KORDEK LX5000 and KATHON CC biocides achieved at least a 90% kill (1-log reduction) in 4 fluids but no kill in the other 2 fluids.
- The chlorophenol, PCMC, showed good kill (>99.9%) in 2 fluids, but less than 90% kill in the 4 other fluids.
- KATHON 886 MW showed a 90-99% kill in 3 fluids, but no kill in the other 3 fluids.
- The triazine and BIT failed to achieve a 1-log kill in any of the 6 fluids tested.



Safe Handling Information

NOTE: Always Wear Protective Equipment When Handling Concentrated Biocide.

Like other industrial biocides, KORDEK LX5000 must be handled using proper safety procedures. As supplied, the product is corrosive to skin/eyes and is a potential sensitizer. Users should avoid any direct contact with KORDEK LX5000 as supplied. The Material Safety Data Sheet (MSDS) and the product label for KORDEK LX5000 contain specific recommendations for safe handling of the product. Additional safe handling training materials are available through your local Rohm and Haas representative.

The use of engineering controls (for example, a closed dosing system) can help minimize the chance of worker exposure to chemicals. If you need engineering advice regarding handling equipment for KORDEK LX5000, please contact your local Rohm and Haas representative.

After the shipping containers of KORDEK LX5000 have been emptied, they may still contain considerable amounts of concentrated preservative. To minimize the effect of accidental exposure, the containers should be rinsed at least three times with water before they are discarded. The best way to handle the rinse water (and the biocide it contains) is to charge it to the product to be preserved; otherwise, the rinse liquids and empty containers should be disposed of as specified by local regulations. It is recommended that any unused amounts of the preservative be deactivated prior to disposal. Please contact your local Rohm and Haas representative for a copy of the deactivation procedure.

Spill Cleanup Procedures

NOTE: Always Wear Protective Equipment When Handling Concentrated Biocide.

Spills should be absorbed with spill pillows or spongy inert solid materials such as vermiculite; the contaminated absorbent should then be transferred to closed containers and disposed of in accordance with local regulations.

After the supernatant biocide has been removed by absorption, the affected spill area should then be chemically decontaminated. In such cases, an aqueous solution of 5% sodium bicarbonate and 5% sodium hypochlorite should be applied to the site of the spill to deactivate the remaining KORDEK LX5000. The general rule is to apply 10 times the volume of deactivating solution for each estimated volume of residual KORDEK LX5000. After the deactivating solution has been applied, it should be allowed to stand for 30 minutes. The spill site should then be flushed with copious amounts of water. The aqueous residue from this flushing process should then be drained into a chemical sewer (provided that local and national regulations permit this). Please contact your local Rohm and Haas representative for a copy of the deactivation procedure.

Toxicology and Environmental Fate

Rohm and Haas Company takes every measure to ensure that its products are safe for both man and the environment.

Toxicology

KORDEK LX5000 is considered safe at recommended use levels. Based on assessment of extensive toxicological

data, experts conclude that the active ingredient in KORDEK LX5000 is:

- non-genotoxic
- not carcinogenic
- not teratogenic
- non-sensitizing at use levels

Like other biocides, KORDEK LX5000 must be handled properly. The product, as supplied, is corrosive to the skin/eyes and is a potential sensitizer. Please refer to the Material Safety Data Sheet for details on proper handling procedures.

Environmental Fate

There is no shortcut to environmental safety: Rohm and Haas has conducted extensive research into the environmental fate of the active ingredient of KORDEK LX5000. These studies demonstrate that, at normal use/dilution levels, KORDEK LX5000 has minimal environmental impact because of the following properties:

- KORDEK LX5000 is used at very low dose levels
- Rapid degradation to non-toxic, non-persistent substances
- Degradation does not produce chlorine or chlorinated organics
- KORDEK LX5000 is unlikely to adversely affect legally accepted routine disposal procedures of equipment rinses (white water) or the aqueous phases after splitting of the emulsion, respectively

This combination of properties makes KORDEK LX5000 an environmentally sound choice for a preservative.

More detailed information on the toxicological profile or environmental fate of KORDEK LX5000 biocide can be obtained from your local Rohm and Haas sales office.

Shipping Information

KORDEK LX5000 50% solution is available in 5-gallon pails (44 lbs), 30-gallon drums (242 lbs), 300-gallon intermediate bulk containers (2,204 lbs) and cartons (22 lbs) containing two 5-liter bottles.

Materials of Construction

The following materials have been tested in our corrosion laboratories for compatibility with KORDEK LX5000 (as supplied) at temperatures up to 40°C.

Materials of Construction for KORDEK LX5000

Metals	Plastics	Elastomers	Fiberglass Reinforced Plastic (FRP) / Coatings
Compatible:	**Compatible:**	**Compatible:**	**Compatible:**
304L SS	HDPE	EDPM-Nordel	Vinyl Ester (Plasite 4300)
316L SS	FI-HDPE	Kalrez	Vinyl Ester (Ceilcrete 6650)
904L SS	Polypropylene	Butyl Rubber	
Alloy 20	PTFE		
Hastelloy C276	Kynar (PVDF)		
Monel 400	Ryton		
NOT Compatible:	**NOT Compatible:**	**NOT Compatible:**	**NOT Compatible:**
Carbon Steel	LDPE	Viton	
Titanium		Buna N	
Naval Brass		Hypalon	

Material Safety Data Sheets

Material Safety Data Sheets (MSDS) are available for all Rohm and Haas products. These sheets contain pertinent information that you may need to protect your employees and customers against any known health or safety hazards associated with our products.

We recommend that you obtain copies of our MSDS from your local Rohm and Haas technical representative before using our products in your facilities. We also suggest that you contact your suppliers of other materials recommended for use with our products for appropriate health and safety precautions before using them.

EPA Registration

KORDEK LX5000 is registered with the U.S. EPA (Environmental Protection Agency). The EPA registration number is 707-256.

Biocidal Product Directive Compliance

KORDEK LX5000 is a biocidal product intended for use in accordance with Product Type 13 (Metalworking fluid preservatives) of the Biocidal Products Directive 98/8/EC (BPD).

Caution

Use biocides safely. Always read the label and product information before use.

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 use 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 patents or as permission or license to use any patent of the Rohm and Haas Company.

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