



KORDEK™ LX5000

For Metalworking Fluid Concentrates and Tankside Additions

EPA Reg. No. 707-256

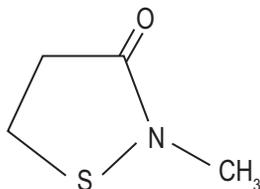
CAS Reg. No. 2682-20-4

EINECS No. 2202396

General

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

Structure



Physical Properties

The following are typical properties of KORDEK™ LX5000; **they are not to be considered product 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

Features and Benefits

- 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**
 Dow 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.
- 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

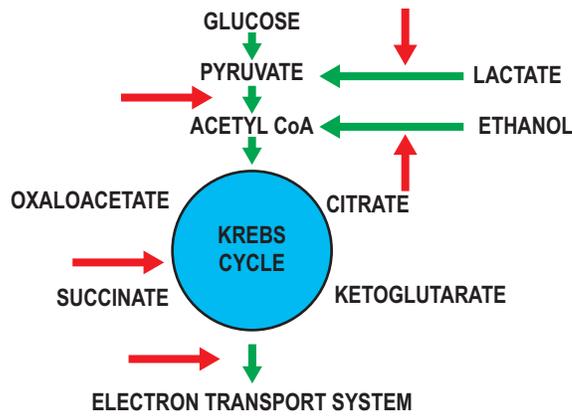
Dilution of Metalworking Fluid Concentrates	Dose Level	Lbs. KORDEK™ LX5000	Quarts KORDEK™ LX5000
		Per 100 Gal. Conc.	Per 100 Gal. Conc.
15:1	Minimum	1.8 lb	3/4 quarts
15:1	Maximum	3.6 lb.	1 1/2 quarts
20:1	Minimum	2.4 lb	1 quart
20:1	Maximum	4.8 lb.	2 quarts
25:1	Minimum	3.0 lb.	1 1/4 quarts
25:1	Maximum	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. Dow 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 on page 3) are associated with the Krebs cycle (pyruvate and succinate dehydrogenase), nutrient metabolism (lactate and alcohol dehydrogenase) and energy generation (NADH dehydrogenase).



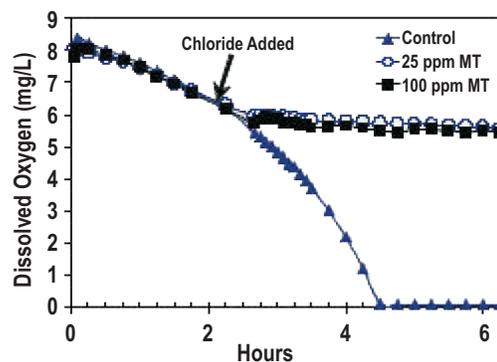
The key physiological activities that are rapidly inhibited in microbial cells are respiration (oxygen consumption), energy generation (ATP synthesis), and growth (reproduction). Many of these key enzymes are present in both aerobic and anaerobic microorganisms, which explains why KORDEK™ LX5000 biocide 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 (<10³/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 (<10³ 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

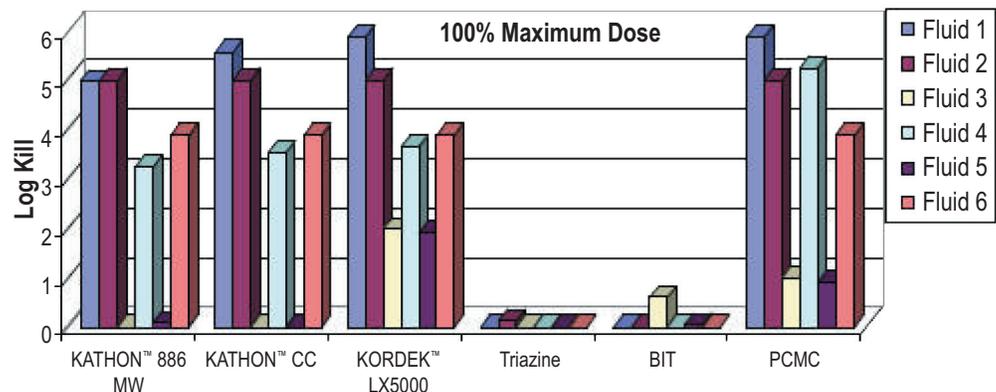
- KATHON™ 886 MW and KATHON CC showed a >99.9% kill (3-log reduction) in 4 fluids, but showed no significant kill in two fluids
- The triazine and BIT biocides were ineffective (no significant kill observed) in all of the six fluids

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

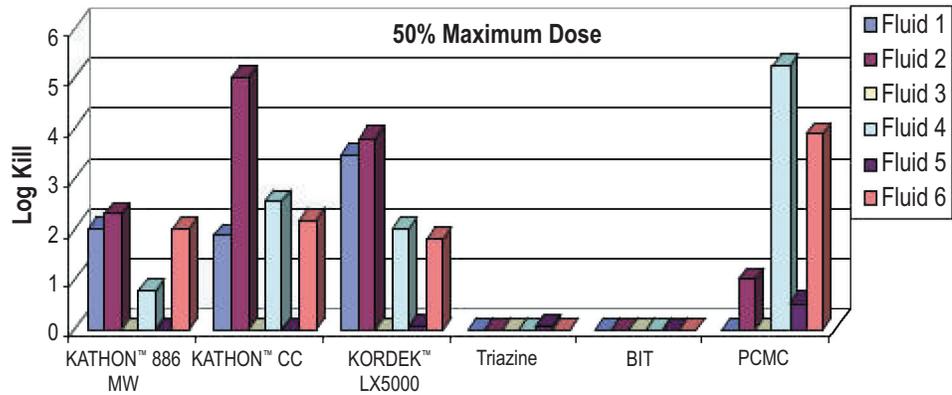
- KORDEK™ LX5000 biocide (methylisothiazolone) was the only biocide that provided at least a 90% kill (1-log reduction) in all 6 fluids
- PCMC showed good kill (>99.9%) in 4 fluids, but only a 90% kill in one other fluid
- KATHON 886 MW and KATHON CC showed a >99.9% kill (3-log reduction) in 4 fluids, 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

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 Safety Data Sheet (SDS) 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 Dow 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 Dow 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 Dow 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 Dow representative for a copy of the deactivation procedure.

Toxicology and Environmental Fate

For product safety information, refer to the Safety Data Sheet (SDS).

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

Safety Data Sheets (SDS)

Safety Data Sheets (SDS) are available for all Dow 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 SDS from your local Dow 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.

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).

Product Stewardship

When considering the use of any Dow product in a particular application, review the latest Safety Data Sheet (SDS) and country-specific product label to ensure the intended use is within the scope of approved uses. Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products – from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

Customer Notice

Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including Safety Data Sheets (SDS), should be consulted prior to use of Dow products. Current Safety Data Sheets are available from Dow.

For further information visit our website:
www.dowmicrobialcontrol.com
or call:

Central and Eastern Europe:
Turkey +90-216-571-16-00
Russia +7-495-663-78-20
Poland +48-22-543-18-00
Western Europe:
+800-3-694-6367 (toll-free)
+31-115-67-26-26 (phone)
+31-115-67-28-28 (fax)
North America:
+1-800-447-4369 (toll-free)
+1-989-832-1560 (phone)
+1-989-832-1465 (fax)
Middle East and Africa:
UAE +971-4-332-88-66
South Africa +800-99-5078 (toll-free)
Greater China:
Shanghai +86-21-3851-1000
Beijing +86-10-8527-9199
Guangzhou +86-20-3813-0600
Taiwan +886-227-718-000
Southeast Asia:
Philippines +63-2-867-3293
Indonesia +62-21-2995-6273
Singapore +65-6830-4575
+65-6796-6217
Thailand +66-2365-7371
Vietnam +84-8-3822-5808
Malaysia +603-7965-5200
Australia and New Zealand:
+613-9226-3500 (phone)
+61-3-9226-3562 (fax)
Japan and Korea:
Japan +81-3-5460-2261
Korea +82-2-3490-4348
Indian Subcontinent:
+91-22-6793-4953 (phone)
+91-22-6793-4924 (fax)
Latin America:
+55-11-5188-9555 (phone)
+55-11-5188-9400 (fax)
Other Global Areas:
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+1-989-832-1465 (fax)

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