



## BIOBAN DXN

Preservative for Water-Containing Systems and Emulsions

EPA Reg. No. 464-682

CAS Reg. No. 828-00-2

EINECS 212-579-9

### General

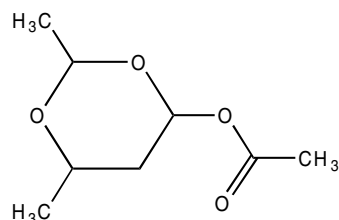
BIOBAN™ DXN (2,6-Dimethyl-1,3-Dioxan-4-yl Acetate) is an EPA-registered biocide for the protection of water-based industrial products, processes and systems against microbiological growth and spoilage. It is a broad-spectrum biocide with efficacy against both bacteria and fungi.

BIOBAN DXN is EPA registered for use in emulsions, paints, coatings, specialty industrial products, textile chemicals and finishes, industrial adhesives, leather processing liquors and distillate fuels.

The advantages of using BIOBAN DXN are:

- Broad spectrum efficacy
- Non-formaldehyde release and non-formaldehyde containing
- Soluble in water and in oil (hydrocarbons)
- Effective over a wide pH range (3-8)
- Non-halogenated, non-phenolic and non-metallic
- Compatible with anionic, cationic and non-ionic compounds

### Structure



### Physical Properties

The following are typical properties of BIOBAN DXN. They are not to be considered product specifications.

Active, %	85.0-95.0
Specific Gravity @ 25/25°C	1.060-1.075
Refractive Index @ 20°C	1.430-1.437
Freezing Point	Below 25°C/77°F
Flash Point (Tag Closed Cup)	87°C/189°F
Vapor Pressure @ 20°C	0.218 mm Hg
pH @ 25°C	5
Appearance	Amber-yellow liquid
Solubility	100% soluble in water with agitation. Soluble in organic solvents.

## Antimicrobial Activity

Upon addition to aqueous systems, BIOBAN DXN undergoes hydrolysis to its microbiologically active components acetaldehyde, aldol, and acetic acid.

The ability of BIOBAN DXN to inhibit growth of microorganisms is shown in the table of minimum inhibitory concentrations (MIC) for representative spoilage bacteria and fungi. The MIC values indicate the concentration of preservative needed (in ppm) to control a particular organism. The lower the number, the greater the effectiveness of the biocide. Although values shown do not necessarily indicate dosage levels required in the formulated product, they are indicative of the spectrum of antibacterial activity of the preservative.

Bacteria	MIC (ppm product)	Fungi	MIC (ppm product)
<i>Escherichia coli</i>	625	<i>Aspergillus flavus</i>	1250
<i>Enterobacter aerogenes</i>	625	<i>Aspergillus niger</i>	1250
<i>Pseudomonas aeruginosa</i>	625	<i>Aspergillus oryzae</i>	1250
<i>Pseudomonas fluorescens</i>	625	<i>Aspergillus terreus</i>	1250
<i>Salmonella choleraesuis</i>	312	<i>Penicillium piscarium</i>	625
<i>Salmonella typhosa</i>	625	<i>Penicillium sp.</i>	1250
<i>Shigella sonnei</i>	625	<i>Candida albicans</i>	1250
<i>Bacillus subtilis</i>	625	<i>Pityrosporum ovale</i>	625
<i>Brevibacterium ammoniagenes</i>	625	<i>Saccharomyces cerevisiae</i>	2500
<i>Staphylococcus aureus</i>	1250		

## Formulating Considerations

BIOBAN DXN functions over a wide pH range of 3-8. The product is not effective in systems with a pH over 9. Limited efficacy is seen between pH 8 and 9.

BIOBAN DXN should not be used in systems containing high levels of ammonia and/or amines. Yellowing and inactivation of BIOBAN DXN occurs under these conditions.

Due to the hydrolysis of BIOBAN DXN to acetic acid, acetaldehyde and aldol, the released acetic acid may cause the pH of the system to drop slightly. If pH drift is of concern, the pH can be adjusted by adding 30g of sodium carbonate for every 100g of BIOBAN DXN. Avoid the use of sodium or potassium hydroxide to adjust the pH as these compounds may result in color formation. Ammonium hydroxide should not be used because it will inactivate the biocide. A neutralized solution of 10% BIOBAN DXN in water resulting in a pH of 7.0-7.1 can also be prepared. Call DOW Chemical Company Technical Service for details.

## Uses

BIOBAN DXN is a microbial growth inhibitor for use only in industrial water-based products. The dosage rate for all label applications is 0.1%-0.2% by weight (1000-2000 ppm).

### Adhesives

BIOBAN DXN is an effective preservative for industrial adhesive formulations. BIOBAN DXN is compatible with most adhesive formulations, including starch and polyvinyl acetate. BIOBAN DXN has clearance for use in food contact adhesives (CFR 175.105).

### Textile Chemicals and Finishes

Microbial contamination of textile chemical specialties causes breakdown of the working properties of these chemicals as well as foul odors, rancidity, acidity, discoloration, and deterioration of the fibers and fabric. BIOBAN DXN is an especially effective preservative for controlling microbial contamination in various textile chemical specialties. BIOBAN DXN has been used effectively in dye levelers, fiber lubricants, spinning emulsions, softeners, antistats, sizings, dyes, dye dispersions, dye pastes and textile adhesives.

### **Specialty Industrial Products**

BIOBAN DXN is an effective antimicrobial for use in specialty industrial products such as pigment slurries, thickeners and gums, dyestuffs, inks and lignosulfonates. These products often contain raw materials that are heavily contaminated with various microorganisms or contain ingredients that are excellent nutrients for microbial growth.

### **Silicone Emulsions**

BIOBAN DXN is particularly effective for the preservation of bulk silicone emulsions. It is also effective for the preservation of silicone and oil-based emulsions that are used in antifoam emulsion systems.

### **Paints, Coatings and Polymer Emulsions**

BIOBAN DXN inhibits microbiological growth during shelf-life storage of PVC, PVA, acrylic, polyethylene and other latex emulsion concentrates and latex emulsion-based paints.

## **Toxicity**

BIOBAN DXN is only slightly toxic based upon acute tests in animals. The LD<sub>50</sub> in rats is >2000 mg/kg body weight by both the oral and dermal routes. The inhalation LC<sub>50</sub> in rats is 4.0 mg/L. When tested in rabbits for irritation potential, BIOBAN DXN was mildly irritating to the eye and only slightly irritating to the skin; however, it was a strong sensitizer in the Magnusson Kligman guinea pig maximization test. BIOBAN DXN should be considered a potential human sensitizer.

In a 90-day dermal study in rats, the no-observed-effect-level (NOEL) was 100 mg/kg/day. Effects observed at the next dose level (300 mg/kg/day) included weight gain reduction in males and liver necrosis, inflammation, and hemorrhage in females.

The National Toxicology Program (NTP) conducted carcinogenicity studies with BIOBAN DXN. Male rats were given 0, 62.5, or 125 mg/kg/day and the females were given 0, 125, or 250 mg/kg/day by gavage for two years. Acanthosis and hyperkeratosis were increased in the forestomach of high-dose rats. With mice, the males and females were given 0, 250, or 500 mg/kg/day by gavage for two years. Acanthosis, hyperkeratosis, focal hyperplasia, and chronic inflammation were increased in the forestomach of dosed mice. Because of an increased incidence of squamous cell papillomas of the forestomach in high dose male mice, NTP concluded that there was equivocal evidence of carcinogenicity for male mice. However, there was no evidence of carcinogenicity in female mice or in male or female rats. BIOBAN DXN has not been classified as a potential human carcinogen by NTP, IARC - International Agency for Research on Cancer or OSHA.

In a teratology study, rats were given doses of 0, 60, 300, or 900 mg/kg/day of BIOBAN DXN by gavage on gestation days 6-15. The NOEL for maternal toxicity was 300 mg/kg/day. The NOEL was 900 mg/kg/day based on reduced body weight gain and reduced food consumption. The NOEL for developmental toxicity was 900 mg/kg/day, the highest dose tested.

BIOBAN DXN is not mutagenic in the standard Ames battery of bacterial strains with or without activation. Neither did it cause DNA damage nor induce repair in the rat hepatocyte unscheduled DNA synthesis assay. However, the chemical was clastogenic in Chinese hamster ovary cells with activation but was negative without activation.

## **Environmental Effects**

A series of avian toxicity studies was conducted with BIOBAN DXN. It was slightly toxic to the bobwhite quail ( $LD_{50} = 1585$  mg/kg) and was practically nontoxic to both quail and mallard duck based upon the 8-day dietary  $LC_{50}$  of greater than 5620 ppm in the diet of both species. In the rainbow trout, the 96-hour  $LC_{50}$  was >370 ppm of active ingredient in water. Similarly, the 48-hour  $LC_{50}$  in *Daphnia magna* was >24 ppm. Though an exact  $LC_{50}$  was not determined in either study, the results indicate that BIOBAN DXN is "not more than slightly toxic."

The major route of degradation of BIOBAN DXN is abiotic hydrolysis. Available data indicate that 50% of it is hydrolyzed in two hours and complete breakdown occurs in 14 hours. The breakdown products are acetic acid and dioxinol. Dioxinol then degrades into acetaldehyde and aldol.

## **First Aid**

**If swallowed**, drink a large quantity of water. Do not induce vomiting. Immediately contact a physician or Poison Control Center.

**If inhaled**, remove to fresh air and call physician immediately.

**If on skin**, wash thoroughly with soap and water. Flush with large quantities of water.

**If in eyes**, flush eyes immediately with plenty of clear water for at least 15 minutes. Immediately contact physician.

**If on clothing**, remove contaminated clothing and wash before reuse.

## **Precautionary Labeling**

Labels for BIOBAN DXN bear these caution statements:

CAUTION!

Harmful if swallowed or absorbed through the skin.

Causes moderate eye irritation.

Avoid contact with eyes, skin or clothing.

Prolonged or frequently repeated skin contact may cause allergic reaction in some individuals.

Wash thoroughly with soap and water after handling.

## **Handling and Storage**

Workers handling BIOBAN DXN should wear impervious gloves, chemical goggles, and an impervious apron. In case of contact, wash exposed skin with plenty of water. If in the eyes, flush the eyes with plenty of water for at least 15 minutes. Hold eyelid open and move eye from side to side to assure complete rinsing. See a physician.

Product should be stored in its original container under normal ambient conditions. Do not store in locations near sources of heat. If spilled, use dikes to prevent the spill from entering bodies of water or sewers. Absorb with appropriate material and send to an approved incinerator.

## Shipping and Packaging

BIOBAN DXN does not meet any of the hazard class criteria in the *UN Recommendations for the Transport of Dangerous Goods* and is therefore not subject to the regulations of the U.S. Department of Transportation (DOT), the International Civil Aviation Organization (ICAO), or the International Maritime Organization (IMO). The bill of lading description used by DOW is:

DISINFECTANT NOI, OTHER THAN MEDICINAL OR TOILET PREPARATIONS. NO HAZARD CLASS LABEL OR PLACARDS REQUIRED. NMFC ITEM 57100 SUB 3 CLASS 60. TRADE NAME = BIOBAN DXN

Shipping Container	Gross Wt.
5-gallon drum	35 lb
55-gallon drum	476 lb

**For further information visit our website:  
[www.dowbiocides.com](http://www.dowbiocides.com) or call...**

United States 1-800-447-4369 (phone)  
and Canada: 1-989-832-1560 (phone)  
1-989-832-1465 (fax)  
Europe: 800-3-694-6367 (phone)  
32-3-450-2240 (phone)  
32-3-450-2815 (fax)  
Pacific: 603-7958-3392 (phone)  
603-7958-5598 (fax)  
Latin America: 55-11-5188-9555 (phone)  
55-11-5188-9937 (fax)  
Other Global 1-989-832-1560 (phone)  
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