

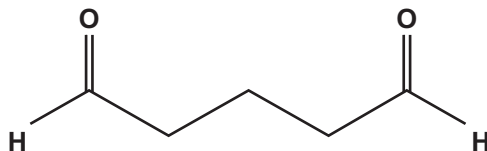


AQUCAR™ GA 15 Water Treatment Microbiocide

General

AQUCAR™ GA 15 Water Treatment Microbiocide is an aqueous solution of glutaraldehyde (CAS Reg. No. 111-30-8) containing varying levels of active ingredient. It is especially effective in controlling slime-forming bacteria, sulfate-reducing bacteria and algae in water cooling towers, air washers, pasteurizers, and other recirculating water systems.

Structure



Physical Properties

The following are typical properties of AQUCAR™ GA 15 Water Treatment Microbiocide; they are not to be considered product specifications.

Active, % Glutaraldehyde (w/w):.....	15
pH at 25°C:.....	3.1 to 4.5
Solubility in Water, 20°C:	Miscible
Boiling Point:.....	100.5°C/213°F
Freezing Point:	-6.5°C/20°F
Specific Gravity, at 20/20°C:	1.042
Vapor Pressure at 20°C:	0.2 mm Hg based on glutaraldehyde (0.27 hPa)

Applications/ Directions for Use

AQUCAR™ GA 15 Water Treatment Microbiocide is extremely effective in controlling biological fouling and microorganism populations in a variety of water systems. It can be used in both heating and cooling processes, and in open and closed recirculating systems. Some of the application areas in which it has been found to be effective are as follows:

Cooling Towers

AQUCAR™ GA 15 Water Treatment Microbiocide has been shown to reduce microorganism levels which lead to biofilm formation and loss of heat exchange efficiency. It will also remove slime and biofilm which can harbor disease-causing bacteria.

Auxillary Water and Waste Water Systems

AQUCAR™ GA 15 Water Treatment Microbiocide controls odor-forming and slime-forming bacteria, fungi and algae in service and auxillary water systems such as fire protection systems; pumps or screen bays; waste water and waste material disposal; holding or recovery systems such as storage tanks, storage piles, associated piping, settling ponds or lagoons; transport spillways or canals; and disposal wells.

Air Washers

AQUCAR™ GA 15 Water Treatment Microbiocide will break up slime and sludge found on mist eliminators and, because of its low vapor pressure, will not create odor problems.

Pasteurizers/Bottle Warmers

AQUCAR™ GA 15 Water Treatment Microbiocide has the ability to strip off corrosion-causing biofilm, as well as eliminate odor-causing bacteria. Since it is non-corrosive, overall system corrosion rates may be substantially reduced.

Treatment Recommendations

Slug doses at a point of uniform mixing are preferred, although continuous addition can be employed. Determine the size of the system in gallons or liters and add the appropriate amount of AQUICAR™ GA 15 Water Treatment Microbiocide. The frequency of addition will depend on the condition of the system and the precise treatment regimen should be adjusted according to the response of each individual system.

	Slug Dose Method*	Continuous Feed Method*
Initial Dose: When the system is noticeably fouled	50-100 ppm	50-100 ppm
Subsequent Dose: Once microbial control becomes evident	20-50 ppm	10-50 ppm

*Concentration of active ingredient

Food Additive Regulations

The product meets the requirements of the Food Additive Regulations listed below. Uses are subject to good manufacturing practices and any limitations which are part of the regulations. The information given here is for use as a general guideline. The regulations should be consulted for complete details. In some cases a product formulation may meet an FDA clearance and the use is not on the product label.

21 CFR 172.230(a)(3) Cleared for use as a cross-linking agent

21 CFR 173.320(b)(6) Chemicals for Controlling Microorganisms in Beet-Sugar Mills (max. 250 ppm active)

21 CFR 173.357(a)(2) Fixing agent in the immobilization of glucose isomerase enzyme preparations for use in manufacture of high fructose corn syrup.

21 CFR 175.105 (c)(5) Adhesives

21 CFR 176.170 (a)(5) Cleared for use as antimicrobial agent in pigment and filler slurries used in manufacture of paper and paperboard (max. 300 ppm active)

21 CFR 176.180 (b)(1) Components of Paper and Paperboard in Contact with Dry Food (max. 300 ppm active)

21 CFR 176.300 Slimicides

Special Features and Benefits

AQUICAR™ GA 15 Water Treatment Microbiocide, which controls microorganisms by reacting with the cell wall, has many important features:

- Ability to remove established biofilm and to inhibit regrowth
- Broad spectrum of activity - controls aerobic and anaerobic microorganisms and algae
- Chemically compatible with most common scale and corrosion inhibitors and dispersants
- Reduce populations of sessile microorganisms known to cause corrosion and reduce heat exchange efficiency
- Effective over a broad pH and temperature range
- Non-foaming
- Water-soluble; therefore, easy to mix into your water-based formulation
- Effective against organisms that produce H₂S, which causes corrosion and foul odors
- Active concentrations as low as 1 ppm can be measured using the Alden, Glutitect field test kit

- Can be transported and stored in bulk
- Compatible with chlorine
- Non-corrosive at end use concentrations
- Non-halogenated material

Product Performance

The evaluation of antimicrobial compounds has traditionally relied on measurements of efficacy against free-floating (planktonic) microorganisms. However, attention in recent years has begun to focus on the effects of microorganisms which adhere to surfaces, giving rise to types of deposits known as biofouling. These deposits contain not only colonies of microorganisms, but also a combination of cellular by-products, entrained debris, and inorganic materials. Biofilms can cause significant energy losses in water distribution systems as a result of increased fluid frictional resistance. In heat transfer equipment, biofilms can decrease heat transfer efficiency. Microbial fouling can occur under both aerobic and anaerobic conditions and can accelerate corrosion of metals and deterioration processes in wood.

AQUCAR™ GA 15 Water Treatment Microbiocide has shown substantial effectiveness in controlling microorganisms in water-handling systems where fouling and/or microbially influenced corrosion present problems. This utility has been demonstrated in both aerobic systems, such as recirculating cooling towers, and anaerobic systems, where sulfate-reducing bacteria cause corrosion. Combined field and laboratory data have substantiated the ability of AQUCAR GA 15 to both penetrate biofilms and destroy “protected” microbial cells. In addition to controlling microorganisms, AQUCAR GA 15 appears to accelerate the erosion rate of cells from the biofilm. When fouled systems are effectively treated with AQUCAR GA 15, biofilms are removed from the system. As a result, the systems operate more efficiently and corrosion rates are significantly reduced.

In preliminary laboratory tests, glutaraldehyde has been shown to inactivate pure cultures of LDB (Legionnaires’ Disease Bacteria). However, the ability of these formulations to control the growth or inactivate LDB in operating cooling towers exposed to ultraviolet light, organic material, other microbial contamination and aeration, has not been studied. These findings also do not address the problem of long-term preventative maintenance of water cooling towers. Even in the absence of complete knowledge about LDB levels and the disease outbreak, it is prudent to minimize slime growth and excessive bacterial contamination in cooling towers. This precaution is supported by limited ecological studies on LDB that have shown the presence of the organism is usually associated with heavy fouling of the cooling systems.

Compatibility with Water Treatment Chemicals

AQUCAR™ GA 15 Water Treatment Microbiocide has been used successfully to treat systems containing phosphonate, phosphate, chromate, nitrite, molybdate and many other scale and corrosion inhibitors. Because of glutaraldehyde’s non-ionic nature, it is also compatible with dispersants, surfactants and most other water treatment chemicals. In addition, glutaraldehyde is fully compatible with halogens and may be used to treat chlorinated systems.

Compatibility with Ammonia

Concentrated solutions of glutaraldehyde are known to react very quickly with concentrated solutions of ammonia. In cooling water applications, AQUCAR™ GA 15 Water Treatment Microbiocide is typically added at relatively low concentrations, usually <100 ppm active ingredient. Cooling systems heavily contaminated with ammonia rarely contain more than 100 ppm ammonia and frequently contain 25-50 ppm. Because of the low concentration of these two potential reactants, the rate of reaction is slowed dramatically. In addition, because

of their relatively quick biocidal action, AQUICAR™ GA 15 Water Treatment Microbiocide only requires chemical stability of approximately six hours to be effective. The data in Table 1 is representative of the effect of ammonia and pH on the stability of use-level concentrations of AQUICAR GA 15.

As expected, as the pH and/or ammonia concentrations of the solutions increased, the stability of the AQUICAR GA 15 decreased. However, if a 20 percent loss in eight hours is acceptable, the following can be concluded: at pH 7 or 8, 50 or 100 ppm active concentration of AQUICAR GA 15 could be used to treat a cooling water system that contains up to 100 ppm ammonia. At pH 9, 50-100 ppm AQUICAR GA 15 could be used in the presence of up to 50 ppm ammonia.

These data indicate that AQUICAR GA 15 is useful in treating cooling systems containing appreciable concentrations of ammonia. It should be noted that their stability may vary under actual field conditions and should be monitored to confirm chemical compatibility.

**Table 1
Effect of Ammonia
Concentration and
pH on AQUICAR™
GA 15 Water
Treatment
Microbiocide
Stability**

pH	Ammonia, ppm	Initial Concentration AQUICAR™ GA 15 Water Treatment Microbiocide, ppm active ingredient	% remaining after 8 hours
7.0	25	50	100
7.0	50	50	100
7.0	100	50	99
7.0	25	100	98
7.0	50	100	94
7.0	100	100	92
8.0	25	50	100
8.0	50	50	100
8.0	100	50	96
8.0	25	100	98
8.0	50	100	90
9.0	25	50	88
9.0	50	50	80
9.0	100	50	65
9.0	25	100	80
9.0	50	100	75
9.0	100	100	50

All stability experiments were conducted at 30°C/86°F

**Effectiveness
on Materials of
Construction**

AQUICAR™ GA 15 Water Treatment Microbiocide is compatible with the following materials of construction:

Stainless steel, nickel, and polyethylene.

AQUICAR GA 15 Water Treatment Microbiocide is compatible with the following gasketing materials:

Silicone, Kalrez¹, Teflon², and Grafoil³.

Additional information on this topic can be found in *Glutaraldehyde Safe Handling and Storage Guide* (Form No. 253-01338).

¹Kalrez is a Registered Trademark of Du Pont Performance Elastomers L.L.C. (DPE)

²Teflon is a Registered Trademark of E. I. du Pont de Nemours and Company

³Grafoil is a Registered trademark of GrafTech International Holdings, Inc.

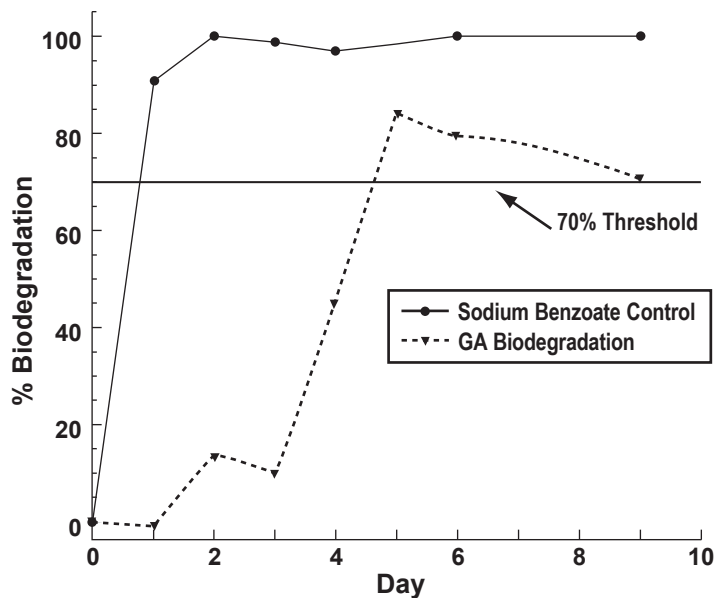
Table 2
AQUCAR™ GA 15
Water Treatment
Microbiocide
Dosage Guide
for Dose
Concentrations
Between 20 and
100 ppm

When applying...	Glutaraldehyde Concentrations (wt%)	Sp. Gravity (g/cc)	To produce a concentration of...	Use		
				Fl oz of AQUCAR™ GA 15 per 100 gal of water	Gal of AQUCAR™ GA 15 per 10,000 gal of water	mL of AQUCAR™ GA 15 per m ³ of water
AQUCAR GA 15 Water Treatment Microbiocide	15.0%	1.042	20 ppm a.i.	1.6	1.3	128
	15.0%	1.042	50 ppm a.i.	4.1	3.2	320
	15.0%	1.042	100 ppm a.i.	8.2	6.4	640

Glutaraldehyde and the Environment

The OECD (Organization for Economic Cooperation and Development) 301 series of biodegradation protocols are designed to determine the biodegradation potential of substances under stringent conditions. In one such biodegradation test, glutaraldehyde met and exceeded the OECD ready biodegradability classification criteria and was found to be readily biodegradable.

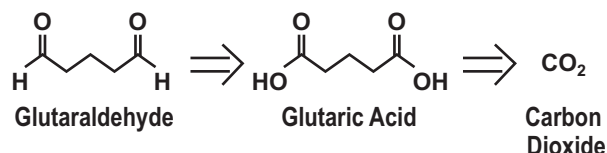
% Biodegradation of Glutaraldehyde in OECD 301A Test



A study of the aquatic metabolism of glutaraldehyde in river water sediment under aerobic and anaerobic conditions was performed. The result indicate that the metabolism of glutaraldehyde is rapid. Under aerobic conditions, the metabolism proceeds to complete mineralization with carbon dioxide as the principal metabolite. Under anaerobic conditions, only primary degradation is observed with the production of 1,5-pentenediol as the major metabolite. Both pathways of degradation are shown on the following page.

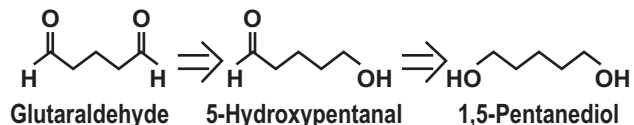
Aerobic Aquatic Metabolism

$T_{1/2}$ in river water – 10.6 hr. Carbon dioxide was the major metabolite, with glutaric acid as intermediate



Anaerobic Aquatic Metabolism

$T_{1/2}$ in river water – 7.7 hr. 1,5-Pentanediol was the major metabolite



The compiled ecotoxicology data indicates that glutaraldehyde is a readily biodegradable compound which has little environmental impact when handled and used properly. Due to its rapid metabolism and biodegradation under both aerobic and anaerobic conditions, it has a favorable ecotoxicology profile. Complete details on the biodegradation tests mentioned above, as well as many other environmental fate and ecotoxicology tests performed on glutaraldehyde, are summarized in a Dow publication entitled “*Ecotoxicology of Glutaraldehyde*” (Form No. 253-01418).

Toxicology

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

Storage, Handling and Disposal

When applying AQUCAR™ GA 15 Water Treatment Microbiocide, it is important to wear the appropriate protective equipment. This equipment includes proper gloves, splash-proof monogoggles or both safety glasses with side shields and a wrap-around full-face shield, coveralls, and when necessary, respiratory equipment. **In the U.S., please refer to the product label for specific precautions and use directions.** Further information and precautions regarding the handling, storage, and disposal of AQUCAR GA 15 can be obtained by consulting the latest Safety Data Sheet (SDS) and the *Glutaraldehyde Safe Handling and Storage Guide*, (Form No. 253-01338), available from your Dow representative.

Product Stewardship

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.

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