



Glutaraldehyde:

A Safe and Effective Biocide

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Glutaraldehyde

A safe and effective biocide

1. General Perspectives



Glutaraldehyde is marketed by The Dow Chemical Company under several trade names in a wide range of applications from leather tanning, photography, paper, water treatment, oil field, food manufacture, cosmetics, cleaners and high level disinfection of medical instrumentation to animal husbandry. The hazards of glutaraldehyde are well documented in safety data sheets, trade literature and public databases. Clear guidance on the risks to users of glutaraldehyde based products is given in the literature to eliminate or reduce and control exposure. Without exposure there can be no risk.

No carcinogenic properties

Glutaraldehyde belongs to the aldehydes chemical class whose properties clearly differ. Unlike formaldehyde, all available long term animal data clearly show that glutaraldehyde is not carcinogenic. Several regulatory and advisory agencies have set occupational exposure limits for glutaraldehyde. Users must ensure that any exposure does not exceed the limit applicable. However, a limit per se does not prevent the use of glutaraldehyde based products in any application. Use as a high level disinfectant on medical devices has led to cases of eye, nasal, respiratory and skin irritation and dermal sensitisation, primarily due to poor control of exposure following spills. In some cases, occupational asthma has been reported, although the available data do not suggest that exposure up to the limit value induces such effects. Products based on glutaraldehyde are effective against Gram positive and Gram negative bacteria, fungi, and a variety of viruses (including infectious bursal disease, porcine reproductive and respiratory syndrome virus, hog cholera virus, human corona virus, Newcastle disease virus, avian reovirus, avian rotavirus and strains of avian influenza virus). This wide spectrum of biocidal activity supports the many diverse applications.

In animal husbandry, glutaraldehyde products should be applied for a five minute contact time. Such uses may have wide and variable temperature fluctuations, and any biocide will function less effectively

at low temperatures. However, glutaraldehyde retains wide spectrum efficacy even at low temperatures, although contact times may need to be extended slightly. Glutaraldehyde is readily biodegradable. Products containing <50% glutaraldehyde are not classified as dangerous to the environment and at the concentrations likely to be discharged (5ppm or less), are not detrimental to the performance of municipal sewage treatment plants. The wide applications of glutaraldehyde have received many regulatory agency approvals following detailed review of the available data. These agencies include the USEPA and FDA, German BGVV, EU Commission, French Repression des Fraudes, and several country specific regulatory schemes by application. Glutaraldehyde is also notified for the EU Biocidal Products Directive. Such approvals for Dow products only reflect the markets into which it sells glutaraldehyde. Other agencies may not list glutaraldehyde for certain applications, but this may simply reflect the fact that no application has been made by Dow for these various listings.

Suitable for approval

A recent very detailed review (www.vyh.fi/eng/environ/risk/biocid/pilot.htm) of all available data by the Finnish Environment Institute for the EU Commission has concluded that glutaraldehyde is a suitable biocide for approval via the EUBiocidal Products Directive. The final project report is publicly available. Glutaraldehyde and products based upon it are, therefore, very effective, have widespread regulatory approvals, and a wealth of data to support them. Further information on these applications can be found at www.dowbiocides.com or via Dow's sales organisation.

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2. Protective Equipment



Glutaraldehyde is used in animal husbandry and a variety of agricultural settings for sanitisation and disinfection purposes. The hazards of glutaraldehyde are well known and are readily available from safety data sheets, trade literature and public databases. The risks of exposure to these hazards can be minimised by both correct application and if proper protective equipment is utilised. When using glutaraldehyde solutions in animal housing facilities, vapour and/or aerosol may cause skin, eye, and respiratory tract irritation and the possibility of asthma like respiratory reactions. Skin sensitisation may also occur in some sensitive individuals. The correct choice and use of protective equipment will therefore decrease the risk of exposure thereby protecting the skin, eyes, and respiratory tract.

Respiratory protection

To prevent exposure to the respiratory tract, a full face respirator should be worn during sanitisation/disinfection activities which could create aerosol or vapour. The full face respirator not only protects the respiratory tract, but provides protection for the eyes and facial skin as well.

Skin protection

Glutaraldehyde in contact with skin, especially that which is trapped against the skin by clothing or gloves, is more likely to cause irritation. Thus glutaraldehyde should be kept off the skin by wearing protective clothing.

Such preferred clothing should include:

- Shirts with long sleeves and high necks.
- Long trousers made of nitrile or butyl rubber.
- Boots made of a rubber-type material and not from leather to prevent soaking of the feet in glutaraldehyde solution.
- Gloves that are long enough to extend up the arm

to protect the forearm or clothing from splashes and seepage. Gloves must be inspected for tears or holes prior to use and should never be reused. Nitrile rubber and butyl rubber are suitable. Polyethylene gloves may only be used after dilution of the glutaraldehyde solution. Latex gloves are not recommended. Neoprene and poly-vinyl chloride (PVC) gloves are not acceptable because they absorb and retain glutaraldehyde. All clothing must be removed immediately if glutaraldehyde begins to soak through the material.

Eye and face protection

Glutaraldehyde solutions with concentrations of 2% and greater will produce severe, irreversible eye injury. Lower concentrations may also cause severe irritation. The following are recommended:

- Chemical splash goggles if not using a full face respirator. Safety glasses, even with sideshields, do not provide adequate protection of the eyes.
- A full face shield should be worn over the splash goggles if not using a full face respirator.

Additional information on protective equipment and precautions for safe use of glutaraldehyde can be found at: www.dowbiocides.com, via your service provider, or The Dow Chemical Company Customer Service Center (+800-3694-6367, or +32-3-450-2240).

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3. Misconceptions



Glutaraldehyde and formaldehyde based products are used in animal husbandry and a variety of agricultural settings for sanitisation and disinfection purposes. The active biocide, glutaraldehyde, is frequently confused with the chemical formaldehyde. Although glutaraldehyde and formaldehyde belong to the same chemical class 'aldehyde', their chemical and toxicological properties are significantly different. Formaldehyde has recently been confirmed as a carcinogen (International Agency for Research on Cancer (IARC), class1). Glutaraldehyde does not contain formaldehyde, nor does it release formaldehyde, even after prolonged storage under adverse conditions. All current data show that glutaraldehyde is not a carcinogen.

Not a carcinogen

Glutaraldehyde is not classified as a carcinogen by the European Union or the United States Environmental Protection Agency classification systems and has not been evaluated by IARC. Although glutaraldehyde and formaldehyde belong to the same class of chemicals (aldehydes) they are not the same, nor does glutaraldehyde ever release or become formaldehyde. This concept of similar chemical class with significant chemical differences can best be illustrated by the common alcohols, ethanol and methanol. Both chemicals belong to the chemical class of 'alcohols'. Ethanol, the form of alcohol in alcoholic drinks, is safe for consumption. Methanol, however, when similarly consumed causes blindness. Thus, any similarity in chemical structure or name does not necessarily equate to similarity of health effects. This concept is discussed in greater detail below for glutaraldehyde and formaldehyde.

Different toxicological profile

Allergic contact dermatitis in susceptible individuals can be caused by exposure to formaldehyde and glutaraldehyde. However, when such individuals are exposed to glutaraldehyde, no cross sensitisation to formaldehyde occurs. Glutaraldehyde is not covered by any governmental formaldehyde release standards or restrictions,

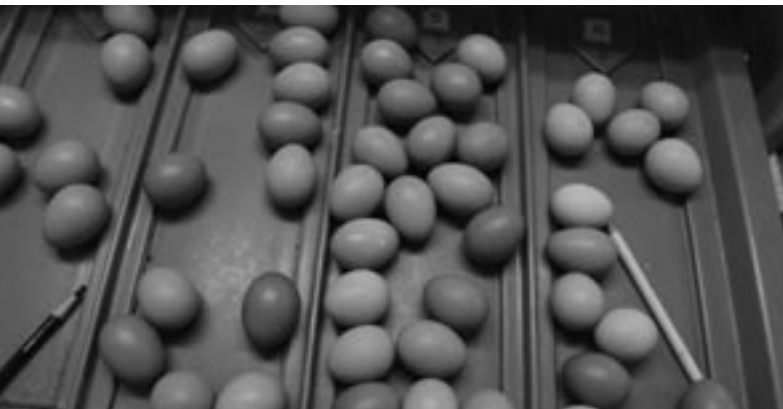
thus formaldehyde-related requirements are not applicable to glutaraldehyde users. Since governmental requirements are subject to change, it is advised that the user be familiar with all applicable governmental requirements. The table compares the major hazard effects of glutaraldehyde and formaldehyde. The concentrations of glutaraldehyde required to cause these effects are well above the in-use concentrations (typically 0.1-0.25% active) applied in animal housing. Additional information on glutaraldehyde and its use in animal housing can be found via your service provider.

	Formaldehyde	Glutaraldehyde
Physical form	Gas	Liquid
Carcinogen	Yes	No
Skin sensitiser	Yes	Yes
Corrosive:		
To skin	Yes at >25%	Yes at >40%
To metal	No	No
Precautions:		
Inhalation	Harmful if inhaled	Harmful if inhaled
Eye contact	Causes eye damage	Causes eye damage
Dermal contact	Dilute solutions cause skin irritation. Higher levels cause skin burns.	5-44% causes cause skin irritation. >45% causes skin burns.

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4. Efficacy of sanitisers on the farm



Glutaraldehyde is a potent and broad spectrum antimicrobial agent which can be used in many animal housing applications. Glutaraldehyde is a non-oxidiser; unlike oxidising agents, such as household bleach, non-oxidisers do not corrode metal surfaces. Glutaraldehyde remains active longer than a typical oxidising biocide, although, as with any chemical reaction, the rate of kill slows as the temperature drops. However, during normal use and application rates (1,000-2,500ppm active for five minutes), sanitisers based upon glutaraldehyde remain effective as long as the treated surfaces remain wet.

A clean environment

In farms, sanitisers are applied to surfaces that can harbour pathogenic micro-organisms to maintain a microbiologically 'clean' environment. Sanitation of a facility (99.9%kill) is performed when the animals are absent and the dirt has been removed from surfaces to be treated, usually with high pressure water sprays. Surface efficacy tests (1) have shown that the application of sanitisers at an active glutaraldehyde concentration of 1000ppm (0.1%) kills almost all of the tested bacteria species shown in Table 1 (>1,000,000 living cells/mL) within five minutes at T = 25°C. 1000ppm of glutaraldehyde is efficacious against all of the tested bacteria under the representative conditions of this test. Glutaraldehyde based sanitisers are also effective against the viruses that are shown in Table 2 (1000ppm active, five or 10 minute contact time at 25°C) (2). Complete elimination of the virus (>99.99% reduction) is required to pass the test. Glutaraldehyde based sanitisers at 1000ppm exceed this requirement and are virucidal against all of the viruses tested. Sanitation treatment required to kill the foot and mouth disease Virus Type A has also been investigated according to the US Environmental Protection Agency guidelines for determining virucidal efficacy. At 37°C and a 10 minute contact time with 500ppm active, glutaraldehyde based sanitisers are virucidal. At lower temperatures (25°C), a longer contact time of 30 minutes is required for complete inactivation of the virus.

Table 1. Efficacy data against bacteria.

Tested Bacteria Species	ATCC# Reference	Control CFU/carrier	1000ppm GA CFU/carrier	Reduction (%)
1. Clostridium perfringens	13124	5.3 X 10 ⁵	ND*	>99.99
2. Enterobacter aerogenes	13048	6.1 X 10 ⁴	ND	>99.99
3. Haemophilus parasuis	19417	4.6 X 10 ⁴	ND	>99.99
4. Mycoplasma gallisepticum	15302	5.1 X 10 ⁴	ND	>99.99
5. Mycoplasma synoviae	25204	1.7 X 10 ⁵	ND	>99.99
6. Pasteurella multocida	8747	2.0 X 10 ⁵	ND	>99.99
7. Salmonella enteritidis	13076	5.9 X 10 ⁵	66	>99.98
8. Streptococcus suis	43765	9.1 X 10 ⁴	ND	>99.99
9. Escherichia coli	8739	2.3 X 10 ⁵	ND	>99.99
10. Salmonella pullorum	10398	4.7 X 10 ⁶	ND	>99.99
11. Salmonella typhi	6539	3.0 X 10 ⁵	ND	>99.99
12. Pseudomonas aeruginosa	15442	3.5 X 10 ⁶	ND	>99.99
13. Staphylococcus aureus	6538	2.7 X 10 ⁶	ND	>99.99
14. Klebsiella pneumoniae	4352	3.2 X 10 ⁶	ND	>99.99

Glutaraldehyde, in combination with other actives, is also employed for sanitation. Glutaraldehyde and its blends are efficacious against all microbes including fungus (yeast and moulds). Testing with spores and hyphae of *Aspergillus fumigatus* has shown reduction in fungal counts by more than 99.99% (3). Farm sanitisers based on glutaraldehyde, therefore, remain the best choice for animal housing hygiene.

Table 2. Efficacy data against viruses.

Tested Virus Species	ATCC# Reference	Control titre	Reduction (%)
1. Avian Reovirus	Strain Uconn 11333	4.0X10 ⁵	>99.99
2. Avian Rotavirus	Strain AVR-1 (Nagareja)	4.0X10 ⁶	>99.99
3. Canine parvovirus	Strain CPV MLV (Cornell)	1.0X10 ⁶	>99.95
4. Infectious bronchitis	Baudette Strain, ATCC VR-135	1.6X10 ⁶	>99.999
5. Pseudorabies virus	Aujesky Strain, ATCC, VR-135	1.6X10 ⁵	>99.99
6. Transmissible gastroenteritis virus, Purdue strain	ATCC VR-763	1.6X10 ⁵	>99.99
7. Infectious bursal disease	Lukert Strain	1.0X10 ⁶	>99.95
8. Avian Influenza	ATCC VR-799	1.0X10 ⁶	>99.999
9. Avian Influenza	ATCC VR-740 (H6N2)	5.9X10 ⁶	>99.999
10. Newcastle disease	ATCC VR-109	1.0X10 ⁶	>99.999
11. Porcine Reproductive Respiratory Syndrome	TN-Strain	1.0X10 ⁶	>99.999
12. Hog Cholera = HC	NTU-076	3.1X10 ⁶	>99.999
13. Avian laryngotracheitis	SPAFAS # 490701	3.1X10 ⁵	>99.99
14. Marek's disease virus	ATCC VR-2175	1.6X10 ⁵	>99.99
15. Human Corona virus	ATCC VR-740	3.1X10 ⁵	>99.99

For more information on the appropriate products for each type of application, please contact your sanitiser supplier.

(1) EPA sanitiser Test for Non-Food Contact Surfaces with hard water on wood carrier. DIS/TSS-10 USEPA, Office of Pesticide Programs, 1976.

(2) EPA Guidelines for determining the virucidal efficacy of disinfectants intended for use on dry inanimate surfaces: USEPA Pesticide Assessment Guidelines, Subdivision G: Product Performance, 1982, Sect. 91-30, pp 72-76.

(3) EPA sanitiser Test for Non-Food Contact Surfaces with hard water on carriers. DIS/TSS-10 USEPA, Office of Pesticide Programs, 1976.

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5. Biocidal Products Directive



The European Biocidal Products Directive (BPD) aims to harmonise the authorisation of products designed to destroy, deter, render harmless, prevent the action of or otherwise exert a controlling effect on any harmful organism by chemical or biological means. It was published in April 1998 and became effective in Member States in May 2000. Since then several Review Regulations have been published providing guidance and tools.

Pilot project set up

To help stakeholders understand the complexities and workability of the BPD and to enable areas of conflict to be resolved, the European Commission set up a Pilot Project which took two biocides through the full registration process. The biocides selected were glutaraldehyde (Union Carbide (Europe) SA, a subsidiary of The Dow Chemical Company) and tebuconazole (Bayer AG). The final Commission report was published in December 2001. Only select market applications were evaluated. Glutaraldehyde was assessed as a biocide in recirculating cooling water systems and paper slimicide applications and the Finnish Environmental Institute (FEI) acted as the European Competent Authority. All data on glutaraldehyde were reviewed which took over two years. In some cases, new data were generated either to replace non-GLP (Good Laboratory Practice) compliant data, or to improve and support the risk assessment models required by the BPD. A major conclusion of this extensive review was that: "there was no convincing evidence showing glutaraldehyde to be a respiratory sensitiser and, therefore, the classification should be modified and R42 removed". This conclusion was drawn from review of three extensive published human cohort studies on the production of glutaraldehyde and on its use as a cold instrument sterilant in hospitals. The review also included other published but anecdotal case reports alleging occupational asthma from glutaraldehyde exposure, and unpublished and unconfirmed reports submitted to the UK SWORD (Surveillance of Work Related and Occupational Respiratory Disease) voluntary surveillance scheme of respiratory disease.

The case reports and SWORD reports were not included in the overall conclusion assessment as the studies were considered by the FEI to be of poor study quality, thereby having poor reliability scores; a high reliability score is required for data to be considered relevant for compliance with the BPD. The review of the human cohort studies and the FEI view on classification and labelling does not, in the short term, impact current classification of either glutaraldehyde or glutaraldehyde based products. However, the review does show that current products formulated with glutaraldehyde can be used safely and effectively together with the support and guidance from formulators.

Clear support

Whilst the Pilot Project did not directly assess the application of glutaraldehyde as a sanitiser in animal husbandry the data gathered allow clear extrapolation to support this use. A dossier submission for this application is not expected until sometime in 2007. Based upon these data, the Pilot Project Review and the experience of formulators of glutaraldehyde based animal sanitation products, users can be confident that such products are both efficacious and safe for their intended use when used as directed. For further information on the safety and efficacy of sanitation products please contact your service provider.

References are available from the authors upon request.

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6. Potential Corrosivity



Glutaraldehyde is supplied in a range of concentrations in aqueous solution. The classification and labelling of these solutions is dictated by Annex I of the European Dangerous Substances Directive (DSD¹). This classification, as it relates only to corrosivity and irritancy is shown in Table 1. Corrosive substances cause burns to skin and can cause blindness. Irritant substances cause less severe and reversible effects. A substance corrosive to skin is not necessarily corrosive to metals (see below for the classification criteria). Animal housing sanitation products containing glutaraldehyde are currently classified and labelled under the EU Dangerous Preparations Directive (DPD²). Thus, they must be classified and labelled as corrosive if they contain at least 10% active glutaraldehyde. In the future, they will be classified via the regulatory compliance process of the EU Biocidal Products Directive, (BPD³).

Classification based on data

Industry data on the corrosivity of aqueous solutions of glutaraldehyde clearly show that the criteria for classification as R34 are not met in the standard animal model method (OECD 404⁴) at concentrations at or below approximately 40% (Table 2). These data were submitted to the European Commission Working Party on Classification, Packaging and Labelling in 1998. Although receipt of the data was acknowledged, no changes to the official classification of glutaraldehyde in Annex I of the DSD have been made. Consequently, suppliers and formulators are not at liberty to use these available data.

Table 2. Classification as supported by animal data.

Glutaraldehyde (% active)	Effect after four hours	Corrosivity criteria* met? (Y/N)* Annex VI DSD	Classification
50%	Full depth necrosis (also at one hour)	Y	R34 – Corrosive
45%	Multiple foci of necrosis.	Y	R34 – Corrosive
25%	Moderate erythema and oedema. No full depth necrosis.	N	R38 – Irritant
10%	Moderate erythema and minor oedema.	N	R38 – Irritant
2%	Minor erythema and oedema	N	R38 – Irritant
1%	Minor erythema	N	Not classified as irritant to skin

Corrosive effects on metals

Transport classification of products⁵ also takes into account the corrosivity of substances to aluminium and steel; a corrosion rate of 6.25mm per year must occur for the substance/preparation to be considered corrosive for transport.

Table 1. Corrosivity and irritancy classification.

Glutaraldehyde concentration	Classification symbol and risk	Risk phrase numbers and text
≥ 10	C, (corrosive), R34	R34 – Causes burns
≥ 2-<10	Xn, (harmful) R37/38, R41	R37/38 – Irritating to respiratory system and skin R41 – Risk of serious damage to eyes
≥0.5-<2	Xi, (irritant) R36/37/38	R36/37/38 – Irritating to eyes, respiratory system and skin

Tests performed in the late 1970s on the standard steel and aluminium grades required for classification clearly showed that even 50% glutaraldehyde caused only minimal corrosion of aluminium (0.022-0.18mm/year), negligible corrosion to copper (0.005mm/year) and no detectable corrosion of steel. In view of these differences, aluminium is not recommended for containers intended for long-term storage of concentrated glutaraldehyde. Dilute solutions of glutaraldehyde based products are often used to sanitise the wheels, wheel arches and chassis of vehicles upon leaving a farm, particularly in cases where transport restrictions are in place (for example due to foot and mouth disease outbreaks).⁶ The data above indicate that the use of these glutaraldehyde solutions neither contributes to the corrosion of metallic vehicle parts nor shortens the life expectancy of such vehicles. Data also show high concentrations of aqueous glutaraldehyde do not corrode 'plastic' components that might also be found under vehicles. When handling glutaraldehyde based sanitation products, formulators and end users must wear personal protective safety equipment and take appropriate precautions to prevent unnecessary and potentially harmful skin, eye, and respiratory exposures. Glutaraldehyde, however, has negligible effect on metal and non-metal vehicle parts and can be readily used for vehicle sanitation.

For further information please consult your service provider.

References

¹Directive 92/32/EEC. EU Official Journal L154, 5th June 1992, 1-29.

²Directive 1999/45/EC. EU Official Journal L 200, vol 42,30th July 1999, 1-68.

³Directive 98/8 EC. EU Official Journal L123 vol 41, 24th April 1998, 1-63.

⁴OECD Guidelines for Testing of Chemicals. Organisation for Economic Cooperation and Development. Method no 404. Acute dermal irritation/corrosion.

⁵Recommendations on the transport of dangerous goods. Model Regulations. Thirteenth revision edition. Volume I. United Nations New York and Geneva.

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7. The Environment



Since micro-organisms are important to many aspects of human life (for example in waste water treatment plants, in digestion, in food production), wholesale elimination of them does not, at first glance, appear to be beneficial to the environment.

However, many micro-organisms also cause disease, infection and food spoilage. Biocides are therefore necessary to control or kill harmful micro-organisms. One such biocide, glutaraldehyde, is widely used in products for disinfection, sanitisation, preservation and slimicidal application in industry, hospitals and on farms. In addition to having a large spectrum of biocidal activity, glutaraldehyde has a very good environmental profile. Glutaraldehyde does not impact the environment because:

- It is readily biodegradable⁽¹⁾ in fresh water (below 5mg/L).
- It is biodegradable in marine environments⁽²⁾ (sea water).
- Biodegradation results in the mineralisation of the compound to water and carbon dioxide⁽³⁾.
- The octanol/water partition coefficient value is very low⁽⁴⁾, showing that glutaraldehyde is very water soluble and highly unlikely to bio-accumulate in the fatty tissues of aquatic organisms.
- It has little tendency to adsorb to soils and sediments due to its high water solubility and low soil adsorption coefficient⁽⁵⁾.
- It is removed in waste water treatment plants by more than 95% by biodegradation and other degradation processes.
- It does not inhibit reproductive success in fish⁽⁶⁾ or crustacea⁽⁷⁾.
- It is degraded in the atmosphere by reaction with UV light and oxidation by hydroxyl radicals⁽⁸⁾.
- There are no available data indicating that glutaraldehyde acts as an endocrine modulating chemical to wildlife species.

Like many chemicals, high concentrations of glutaraldehyde can be moderately toxic to fish⁽⁹⁾, crustacea⁽¹⁰⁾ and green planktonic algae⁽¹¹⁾. However, such potential adverse environmental effects are readily

mitigated by supply of dilute solutions for final use, clear instructions not to empty product into drains etc and the degradation and deactivation during its normal mode of action by reaction with amines and other proteinaceous material producing non-toxic and biodegradable substances. Since, particularly in farm sanitation applications, products are not discharged into drains or water courses, any waste streams that might contain residual amounts of glutaraldehyde will have little impact on wastewater treatment bacteria due to dilution and deactivation etc prior to reaching the treatment works⁽¹²⁾. In farm sanitation applications, spent glutaraldehyde solutions will not, therefore, impact surface waters. When glutaraldehyde based disinfectants, sanitisers, preservatives or slimicides are used at the recommended concentrations and disposed of in accordance with the supplier's instructions, these formulations should not adversely impact the environment.

For further information on the biological properties of glutaraldehyde or products based upon this biocide please consult your service provider.

References

- ⁽¹⁾74% in nine days: OECD 301-A (biodegradation).
- ⁽²⁾73% in 28 days: OECD 306(biodegradation).
- ⁽³⁾67.7% 14CO₂ in 30 days, sediments and river water test FIFRA162-4.
- ⁽⁴⁾log P_{o/w} = -0.33: OECD 107 (Octanol/water partition coefficient).
- ⁽⁵⁾K_{oc} between 120 and 500: FIFRA163/1 (soil partition coefficient).
- ⁽⁶⁾MATC = 2mg/l (OECD 210) (Early life stage study).
- ⁽⁷⁾NOEC for reproduction = 0.9mg/l (OECD 211) (21 day reproduction study).
- ⁽⁸⁾Analogy to the homologous dialdehyde, Glyoxal (IUCALD).
- ⁽⁹⁾LC₅₀ from 5.4 to 11.0mg/l: FIFRA 72/1 (acute fish toxicity)
- ⁽¹⁰⁾LC₅₀ = 5.0ppm (Daphniamagna) (acute toxicity).
- ⁽¹¹⁾LC₅₀ = 0.97mg/l (OECD 201) (acute toxicity).
- ⁽¹²⁾NOEC = 16mg/l (OECD 209) (acute bacteria respiratory inhibition).

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8. Global Approvals



Glutaraldehyde is marketed globally as the active biocide in many products formulated for medical, industrial and animal biosecurity applications. Regulatory and governmental agencies across the globe have undertaken extensive and in-depth reviews of the data available for glutaraldehyde and glutaraldehyde based sanitisers and disinfectants. Based on these evaluations, glutaraldehyde and products based upon it have been found to be efficacious. Additionally, glutaraldehyde has received specific regulatory approvals as an active substance/biocide from many national authorities. Glutaraldehyde based products are used in, and in some cases have authorised approvals for use in, food processing, cosmetics, paper manufacture, cooling water, oil field and in biosecurity applications for control of micro-organisms in animal production facilities and farm equipment. Examples of the latter include poultry and turkey houses, swine housing and farrowing areas, barns and large animal buildings, hatcheries, setters and chick processing facilities, cages and transport vehicles. Data submissions for animal biosecurity applications have been scrutinised by regulatory authorities around the world.

Table 1 below summarises by geography those countries which have issued approvals to glutaraldehyde based sanitisers/disinfectants for use in farm biosecurity.

Table 1. Global registrations for glutaraldehyde based products in animal biosecurity.

Asia	Australia, China, Indonesia, Japan, Malaysia, Philippines, South Korea, Taiwan, Thailand and Vietnam
Africa	Algeria, Egypt, Morocco, Israel, Jordan, Nigeria, South Africa, Sudan, Syria and Tunisia
Europe	Austria, Belgium, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Spain, Switzerland and UK
Latin America	Argentina, Bolivia, Brazil, Bolivia, Chile, Colombia, Cuba, Dominican Republic, Ecuador, Jamaica, Peru, Trinidad, Tobago and Venezuela
North America	Canada, Mexico and United States

*Regulatory clearances are granted to the registrant of the sanitiser/disinfectant product. Contact your supplier for its specific approvals.

For a complete listing of approvals, contact your glutaraldehyde supplier. Due to a wealth of supporting data, glutaraldehyde based sanitisers and disinfectants have a history of detailed and wide-spread regulatory review and approval in animal biosecurity and other applications. For more information on glutaraldehyde based products, please contact your sanitiser or disinfectant supplier.

For further information

Visit our website: www.biocidesfirst.com or call:

United States: and Canada	1-800-447-4369 1-989-832-1560 1-989-832-1465	(toll-free) (phone) (fax)
Europe:	800-3-694-6367 32-3-450-2240 32-3-450-2815	(toll-free) (phone) (fax)
Pacific:	800-7776-7776† 800-7779-7779	(toll-free) (fax)
China:	10-800-600-0015 10-800-600-0017	(phone) (fax)
Latin America:	55-11-5188-9555 55-11-5188-9937	(phone) (fax)
Other Global Areas:	1-989-832-1560 1-989-832-1465	(phone) (fax)

†except Indonesia and Vietnam

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