

Technical Information

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® = Registered trademark of
BASF Aktiengesellschaft

Protectol® GA Myacide® GA

Protectol® GA 50
Protectol® GA 24

Products for North America

Myacide® GA 50
Myacide® GA 45
Myacide® GA 25
Myacide® GA 15
Myacide® GDA Technical

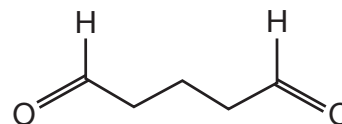
For use in disinfectants, pulp and paper production,
water treatment and oil and gas production

Properties

Chemical nature

Common name	Glutaraldehyde
Chemical name	1,5-pentanedial
Synonyms	Glutaral (CTFA/INCI) Glutardialdehyde Glutaric dialdehyde

Structural Formula



Molecular formula	C ₅ H ₈ O ₂
Molar Mass	100.1 g/mol
CAS No.	111-30-8
EINECS No.	203-856-3

	Concentration (% w/w in water) BASF Method – Titration	Methanol Content (% w/w) BASF Method – GC	Specific Gravity (20°C)	Viscosity (cSt @ 25°C)
Protectol® GA 50 Myacide® GA 50 Myacide® GDA Technical	50.0-51.0	≤0.5	approx. 1.13	approx. 12.75
Protectol® GA 24	23.5–24.5	≤0.3	approx. 1.06	approx. 2.26
Myacide® GA 45	43.7–46.4	≤0.3	approx. 1.12	approx. 8.62
Myacide GA 25	24.3–25.8	≤0.3	approx. 1.06	approx. 2.26
Myacide® GA 15	14.3–15.8	≤0.2	approx. 1.04	approx. 1.54

All products have a pH within the range 3.2 – 4.2. (DIN 19268)
All products are colourless to slightly yellow liquids.

The above information does not necessarily form part of the product specification. A detailed specification is available from your local sales office.

Data are expressed as active ingredient (a.i.) throughout this brochure except where stated.

Solubility and Miscibility

Miscible in all proportions with water and a range of polar solvents such as Methanol, Ethanol and Propanol.

Storage Stability

Bulk

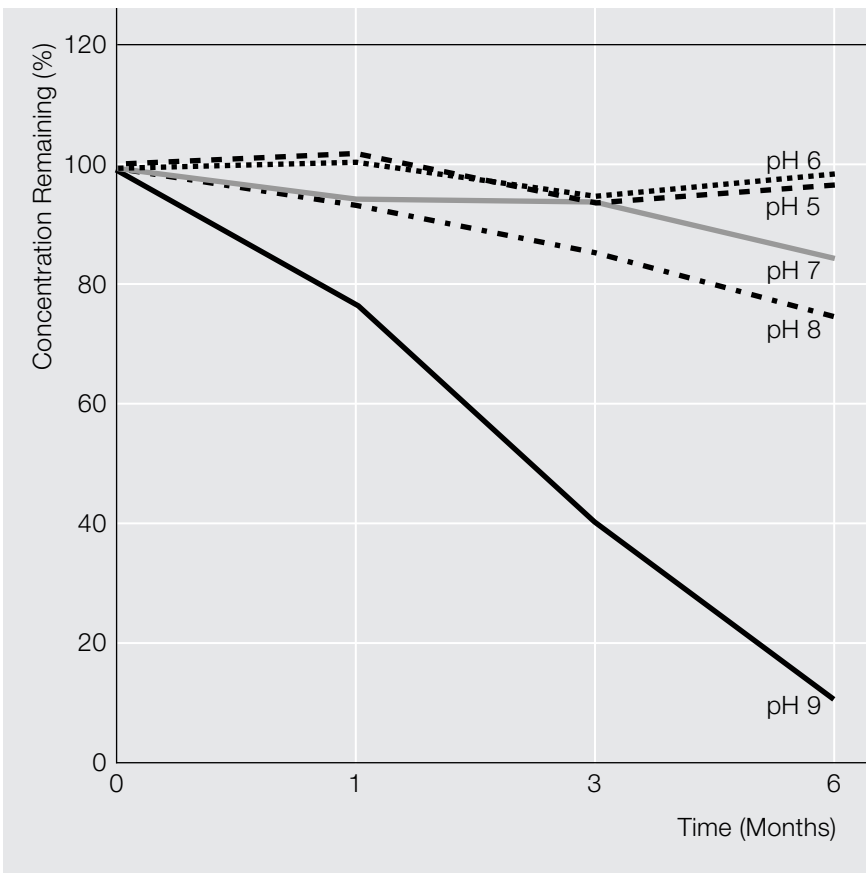
Shelf life of up to 12 months when stored in sealed containers at 20 – 22°C, or preferably below.

Dilute solution

Studies have been carried out to determine the effect of pH on the stability of dilute solutions of glutaraldehyde.

The example in Figure 1 shows the degradation profiles of 125 ppm glutaraldehyde stored in buffered solutions of different pH at 20 – 22°C.

Figure 1 – The Effect of pH on the stability of a 125ppm aqueous solution of Glutaraldehyde (~22 °C)



This study shows that the stored solutions are most stable at acid pH. With increasing alkalinity, biocidal effect steadily decreases.

A similar trial carried out at 40 °C shows that the degradation of solutions stored at pH 7 and above is rapid, with the rate increasing as the pH increases. At acid pH, however, the solutions remained stable throughout the duration of the test, this indicates that for preservative applications and for applications where glutaraldehyde is used as a biocidal product, e.g. disinfection, it is most stable in formulations with a pH between 4 and 7.

In some applications the rapid disappearance of active glutaraldehyde caused by high pH values and/or temperatures may be advantageous in reducing impact on the environment.

Materials Compatibility

Glutaraldehyde aqueous products have a comparable corrosivity to water at the same pH. These products are acidic (pH 3.2 to 4.2) and therefore only materials which are sufficiently resistant towards acids should be used to avoid damage to equipment and products.

Compatible

Baked Phenolics
 Fibreglass-reinforced plastics
 Glass
 Nickel
 Nickel-Chromium-Molybdenum Alloys
 Polyethylene
 Polypropylene
 PVC
 Stainless Steel types 304, 304L, 316 and 316L
 Titanium

Incompatible

Aluminium
 Carbon Steel
 Copper
 Copper-Nickel Alloy
 Iron

Natural and synthetic rubber materials (e.g. Viton) can swell when in contact with glutaraldehyde products and should therefore not be used.

Special care should be taken when choosing gasket materials. The use of incompatible materials may lead to product leakage or material failure. Polytetrafluoroethylene (PTFE) is recommended for all gaskets.

Stainless steel, glass and high density polyethylene (HDPE) should be considered where appropriate for storage containers.

Trace Metal Content

Analysis of a representative number of batches has shown that the trace metal contamination is less than 10 ppm in the product.

Antimicrobial Mode of Action

The activity of Glutaraldehyde is reported to be due to its reaction with nucleophilic cell components, where it forms irreversible cross-links with proteins and enzymes, ultimately resulting in cell death.

Glutaraldehyde exhibits excellent antimicrobial activity as measured by kill tests, demonstrating a rapid speed of kill, even in the presence of protein. In the presence of protein higher concentrations of glutaraldehyde are usually required.

Contact Time	Minimum effective concentration (% a.i.)		
	S. aureus	P. aeruginosa	C. albicans
Without protein			
5 min.	0.050	0.050	0.050
30 min.	0.0175	0.075	0.375
60 min.	0.00625	0.0125	0.375
With protein			
5 min.	0.050	0.050	0.75
30 min.	0.025	0.025	0.50
60 min.	0.0125	0.0125	0.375

Antimicrobial Activity

BASF glutaraldehyde products are highly effective antimicrobial agents, being active against a broad range of microorganisms including Gram positive and Gram negative bacteria, fungal and bacterial spores, algae and viruses.

MIC Values for Glutaraldehyde

The Minimum Inhibitory Concentrations (MIC) for glutaraldehyde (ppm of active ingredient) against a range of test organisms are shown below: MIC data was generated using in-house methodology.

	Organism	Strain	ppm a.i
Gram positive bacteria	<i>Staphylococcus aureus</i>	NCIB 9518	25
	<i>Bacillus subtilis</i>	NCTC 10073	625
	<i>Bacillus cereus</i>	NC00 2599	625
Gram negative bacteria	<i>Legionella pneumophila</i>	(Industrial isolate)	625
	<i>Klebsiella aerogenes</i>	NCTC 418	250
	<i>Klebsiella pneumoniae</i>	PC 1602	250
	<i>Pseudomonas aeruginosa</i>	NCIMB 8626	125
	<i>Pseudomonas fluorescens</i>	NCIB 9046	75
Sulphate reducing bacteria	<i>Desulphovibrio desulphuricans</i>	NCIB 8301	30
Yeasts	<i>Candida albicans</i>	NCPF 3179	625
	<i>Saccharomyces cerevisiae</i>	NCTC 87	625
Moulds	<i>Stachybotrys atra</i>	IMI 82021	80
	<i>Penicillium funiculosum</i>	IMI 87160	125
	<i>Aspergillus niger</i>	ATCC 16404	315
	<i>Trichoderma viridae</i>	(Industrial isolate)	250
Algae	<i>Scenedesmus obliquus</i>	CCAP 276/3A	50
	<i>Euglena gracillis</i>	CCAP 1224/5Z	1000
	<i>Chlorella pyrenoidosa</i>	ATCC 53170	50

It should be noted that glutaraldehyde can react with the media components used in the M.I.C. tests. As a result, the figures obtained are generally higher than the effective doses required in-use.

Application

BASF glutaraldehyde products are suitable for use in a wide variety of application areas. These are described below.

Further information concerning the use of the Glutaraldehyde products in these application areas is available on request from your local sales office.

The examples and case studies in this publication may not necessarily comply with national registrations. Please refer to the approved label. The relevant dose rates for individual products should be calculated on a pro rata basis related to the glutaraldehyde content.

Water Treatment

Treatment of cooling water systems, heat transfer systems, process water systems and other industrial water applications.

Recirculating Cooling Water and Air Washer Systems

BASF glutaraldehyde products offer an ideal treatment strategy for such systems, being easy to handle and dose. Efficacy has been demonstrated using the ASTM E645-91 test procedure. In this test, 25 ppm of Protectol® GA 50 gave greater than 99% control of a mixed bacterial inoculum after a contact time of 2 hours, while 50 ppm controlled the inoculum after a contact time of 1 hour.

The biocide should be added to the recirculating system at a convenient point to ensure rapid and uniform mixing, such as the water sump close to the outlet pipe.

Protectol® GA 50 may be used as part of an intermittent or slug dosing regime or as a continuous dose. Heavily fouled systems should always be cleaned before treatment begins. An initial addition of 100-600 ppm is recommended and if necessary the blowdown should be discontinued for up to 24 hours. Once control is achieved, dosing can be continued on an intermittent basis at 40-600 ppm per day. Alternatively, continuous dosing in the range of 40-200 ppm can be recommended.

Representative dose rates are provided in the table below.

Application	Glutaraldehyde (ppm a.i.)	Protectol® GA 50 (ppm)	Myacide® GA 50 fl.oz/1000 gallons (US)
Recirculating cooling water, Air washer.	20 – 300	40 – 600	5.1 – 76.3

Other heat transfer systems

The above dosing recommendations apply generally to the use of Protectol® GA 50 in other heat transfer systems.

Legionella

In tests, 20ppm of Protectol® GA 50 demonstrated >99.99% control of two strains of *Legionella pneumophila* after a 1 hour contact time.

When used for the treatment of Legionella contamination, Protectol® GA 50 should only be used as part of an integrated management programme involving the use of appropriate scale and corrosion control additives.

Paper Industry Biocides

Treatment of process water and preservation of mill additives.

Paper Mill Process Water

Protectol® GA 50 can be dosed at a convenient point early in the process, but experience has shown that the best results are achieved by adding it to the wet end of the machine, where good dispersion can take place. Convenient locations for this are the machine chest, head box, machine wire pit or backwater loop system.

The levels of Protectol® GA 50 required depend on the cleanliness of the system, the quality of the raw materials and the degree of microbial control required. A typical regime may involve initially dosing at a level of 200 – 400g of Protectol® GA 50 per tonne of finished paper.

Bulk Paper

Protectol® GA 50 can be used to preserve bulk pulp and control both foul odours and general biodeterioration of stock. It may be dosed directly into the hydropulper, machine chest or stock chest. A single slug dose of between 100 ppm and 500 ppm is sufficient to provide control in the stock. In situations where contamination is high, repeat dosing every 1 – 7 days may be required.

Paper Mill Additives

To inhibit the growth of spoilage organisms during the manufacture of water-based solutions, suspension concentrates and emulsions, Protectol® GA 50 may be dosed at 100-500 ppm based on final formulation volume.

Oil and Gas

Treatment of water and products for use in oil exploration, production and recovery.

Glutaraldehyde is probably the most widely used biocide in this application, particularly in seawater injection systems, although care has to be taken to avoid incompatibility with oxygen scavengers and inactivation by organic matter. It has also been used effectively in drilling, completion and frac fluids. glutaraldehyde can be readily deactivated by ammonium bisulphite. As this is the most widely used oxygen scavenger, it is usual to apply glutaraldehyde to water injection systems following scavenging to avoid incompatibility problems.

Kill test results demonstrating the efficacy and rapid speed of kill against 3 common spoilage organisms for the water and oilfield industries, are shown below.

Time (hrs) to achieve $\geq 10^4$ log reduction

	10 ppm	25 ppm	50 ppm	100 ppm
<i>P. fluorescens</i>	<6	<1	<0.5	<0.5
<i>B. cereus</i>	<6	<1	<0.5	<0.5
<i>D. desulfuricans</i>	<2	<2	<1	<0.5

Preservation of Formulations

For the preservation of drilling muds, workover and completion fluids and other products susceptible to contamination, Protectol® GA 50 should be added initially at between 50 and 1000 ppm depending on the severity of contamination.

Produced Water, Flooding and Injection Water

For Water Flooding operations Protectol® GA 50 should be added initially at 100 to 200 ppm and repeated until control is achieved. Subsequent treatment may be continued on a weekly basis, or as required at levels of 20 to 500 ppm.

Injection wells associated with gas storage systems should be treated with sufficient product to give a concentration of 500 to 5000 ppm when diluted in the formation water. Further top-up water should be treated at 200 to 2000 ppm.

For hydrostatic systems, the water should be dosed with 100 to 4000 ppm depending on the water quality and the duration of the shut-in.

The relevant dose rates for individual products should be calculated on a pro rata basis related to the glutaraldehyde content of the product in question. Representative dose rates are provided in the table below.

Application	Glutaraldehyde (ppm a.i)	Protectol® GA 50 (ppm)	Myacide® GA 50 gallons (US)/100 barrels	Myacide® GA 50 gallons/100 gallons(US)
Preservation of Formulations	25–500	50–1000	0.21–4.2	–
Flooding Water Injection Water Produced Water	50–250	100–500	–	0.1–0.5
Gas Injection Wells	100–2500	200–5000	–	0.2–5
Hydrostatic Systems	50–2000	100–4000	–	0.1–4

Industrial Product Preservation

BASF glutaraldehyde products can be used for the preservation of technical products e.g. polymer dispersions, adhesives, industrial additives.

To inhibit the growth of spoilage bacteria during the manufacture of water-based solutions, suspension concentrates and emulsions, BASF glutaraldehyde products should be dosed at 100–500 ppm of active ingredient based on final formulation volume.

BASF glutaraldehyde products may also be used in heavily contaminated alkaline systems to provide quick knockdown of the contaminating organisms in preparation for the addition of a long term preservative.

Surface and Instrument Disinfection

As a biocidal active component of disinfectant formulations for animal houses, hard surfaces, laundry disinfectant cleaners and surgical instruments.

Glutaraldehyde is commonly used as the active component in formulated Sterilants (sporicidal disinfectants) for use on endoscopes.

It is typically used within a dilution range of between 2.5 – 3.5 % where it has demonstrated proven efficacy against bacteria, yeasts, moulds, mycobacteria, viruses and bacterial spores.

A key criterion for use in endoscope applications is how the formulation performs against bacterial spores. Formulations based on 2.5 – 3.5 % typically achieve effective performance within 10 hours at ambient temperature.

High Level Disinfectants (HLD) do not have to meet such strict efficacy requirements against bacterial spores but do have to demonstrate activity against other microbes especially Mycobacteria. A glutaraldehyde based sterilant formulated as above will typically achieve the requirements for a HLD within 20-40 minutes contact time at ambient temperature.

Stability in Formulations

The high quality of BASF glutaraldehyde products leads to improved stability, particularly in formulated alkaline activated solutions commonly used as instrument disinfectants.

Clear, dilute solutions can be formulated from Protectol® GA 50 which, following activation, remain clear for at least 4 weeks.

The results of in-house studies prove the high quality of Protectol® GA 50. When stored for extended time periods or at raised temperatures, the quality was found to be superior to that of alternative market product as clear solutions could still be produced following activation.

Where 50% glutaraldehyde solutions from any source are exposed to elevated temperatures, problems may be encountered with the formulation of stable instrument disinfectants. Glutaraldehyde supplied for use in these types of products should be stored at a maximum temperature of 20°C, but, more ideally, at 6°C. The general shelf life of six months at a maximum temperature of 30°C only guarantees that the specified parameters are still fulfilled at the end of this time.

Odour Control and Chemical Toilet Sanitisation

For incorporation into chemical toilet formulations.

It is important that the appropriate levels of BASF glutaraldehyde products are incorporated into each treatment concentrate formulation to achieve a final dose level of 100 – 500 ppm (100–500g/m³) based on the toilet final volume.

Registrations and Approvals**Europe**

Listed in Annex VI of the EC Cosmetics Directive for use up to 0.1% a.i. in rinse-off products.

Germany

BgVV recommendations for food contact applications:
XXXVI, B VII – paper and board, slimicides.
XXXV1/2, IIG – paper and board for bakeries, slimicides.
German Kosmetikverordnung Part A, no. 48 for rinse-off products.

France

Positive list for use in sugar processing.

Finland

Protectol® GA 50 and GA 24 are approved for use as paper slimicides.

UK

Listed in the British Pharmacopoeia (1998).

Sweden

Protectol® GA 50 and Protectol® GA 24 are approved for use as a paper slimicide.

Spain

Protectol® GA 50 is registered for use in disinfection formulations in health and veterinary applications and in the food industries.

Ireland

Protectol® GA 50 is approved for use in disinfectant formulations for animal husbandry uses.

North America

Canada

Glutaraldehyde is registered as a technical product for use in manufacturing registered microbiocides.

USA

The Environmental Protection Agency (EPA) has registered the following products:

Myacide® GDA Technical for use by manufacturers in formulating biocides only.

Myacide® GA 50, Myacide® GA 45, Myacide® GA 25 and Myacide® GA 15 are approved for one or more of the following applications:

For controlling slime-forming bacteria, sulphate-reducing bacteria, fungi, yeast and algae in paper mills and paper mill process water systems, pigments and filler slurries for food contact paper and paperboard, non-food contact water based coatings for paper and paperboard, air washers, recirculating cool water systems, heat transfer systems and oil well drilling and oil field processing applications.

These end use products are also registered in California for most of the above applications.

FDA 21, CFR – Code of Federal Regulations include:

172.230 – as a cross-linking agent in microcapsules for flavouring substances.

173.320 – chemicals for controlling microorganisms in beet-sugar mills.

173.105 – indirect food contact use in adhesives.

176.170 – components of paper and paperboard in contact with aqueous and fatty foods.

176.180 – components of paper and paperboard in contact with dry food.

176.300 – paper slimicide use.

Other regions

Australia

Approved by the National Registration Authorities for Agricultural and Veterinary Chemicals as a technical grade active constituent

Japan

MITI listed

Safety

Toxicological Data

Acute toxicity studies with 50 % glutaraldehyde in rats gave an oral LD₅₀ of 320mg/kg and a dermal LD₅₀ of >2000mg/kg.

Glutaraldehyde should not be used in aerosols unless measures are taken to protect the user. Rat inhalation studies gave a 4-hour LC₅₀ value of 1.1 mg/l. Studies have shown that glutaraldehyde is not carcinogenic or teratogenic and is not mutagenic in animals.

Environmental Data

Glutaraldehyde has a low potential to bioaccumulate and has been shown to be readily biodegradable. Glutaraldehyde (50 %) is harmful to fish and daphnia (LC₅₀ is 10–100 mg/l) but is very toxic to algae (LC₅₀ 0.1–1 mg/l). However, under normal use conditions, glutaraldehyde is not expected to cause adverse effects on either effluent treatment plants or to the environment following discharge into wastewater.

Safety Notes

According to the experience gained over many years and to other information at our disposal, the glutaraldehyde products supplied by BASF Performance Chemicals should not exert any harmful effects on health. This is provided that they are used properly, that due attention is given to safety and industrial hygiene precautions necessary for handling chemicals and that the information and advice given in our Safety Data Sheets are observed.

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

Handling and Storage

Contact with eyes and skin should be avoided. Safety goggles must be worn when handling the concentrated product. Take care to avoid the generation of aerosols. Glutaraldehyde should be stored at ambient temperature in sealed containers as supplied, in dry conditions.

Labelling

Refer to the latest Safety Data Sheet for detailed information on product safety

Classification according to UN criteria

Protectol® GA 50, GA 24

UN Number	3265
Proper technical name	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S (contains GLUTARALDEHYDE)
Class	8
Packing group	III

Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out their own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.

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Registration of the Protectol® trademark is pending in the United States

Label recommendations supersede any claims made in this brochure.

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