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(54) Titre : COMPOSITION EN POUDRE POUR LA PRODUCTION D'ACIDE PEROXYACETIQUE ET UTILISATION
CONNEXE POUR LA DESINFECTION DES SURFACES

(54) Title: POWDERED COMPOSITION FOR THE GENERATION OF PERACETIC ACID AND USE THEREOF TO
SANITIZE SURFACES

(57) **Abrégé/Abstract:**

A powdered composition for the generation of peracetic acid in an aqueous solution at neutral pH level, said powdered composition comprising in combination a peroxygen source which generates hydrogen peroxide when contacted by water; and tetraacetylenediamine. A use of said powdered composition to sanitize surfaces in contact with food, reservoirs, C.I.P. evaporators, fillers, aseptic equipment and pasteurisers found in dairies, wineries, breweries, and food, beverage and meat processing and packaging plants, or to sanitize water tanks, boilers, cooling towers and other equipments related to water and wastewater treatment, or as a chemical sterilant for instruments in hospitals, dental and medical clinics.



ABSTRACT

A powdered composition for the generation of peracetic acid in an aqueous solution at neutral pH level, said powdered composition comprising in combination a peroxygen source which generates hydrogen peroxide when contacted by water; and tetraacetythylenediamine. A use of said powdered composition to sanitize surfaces in contact with food, reservoirs, C.I.P. evaporators, fillers, aseptic equipment and pasteurisers found in dairies, wineries, breweries, and food, beverage and meat processing and packaging plants, or to sanitize water tanks, boilers, cooling towers and other equipments related to water and wastewater treatment, or as a chemical sterilant for instruments in hospitals, dental and medical clinics.

POWDERED COMPOSITION FOR THE GENERATION OF PERACETIC ACID AND USE THEREOF TO SANITIZE SURFACES

The invention relates to a powdered composition for the generation of peracetic acid in an aqueous solution at neutral pH level, and use thereof to sanitize surfaces.

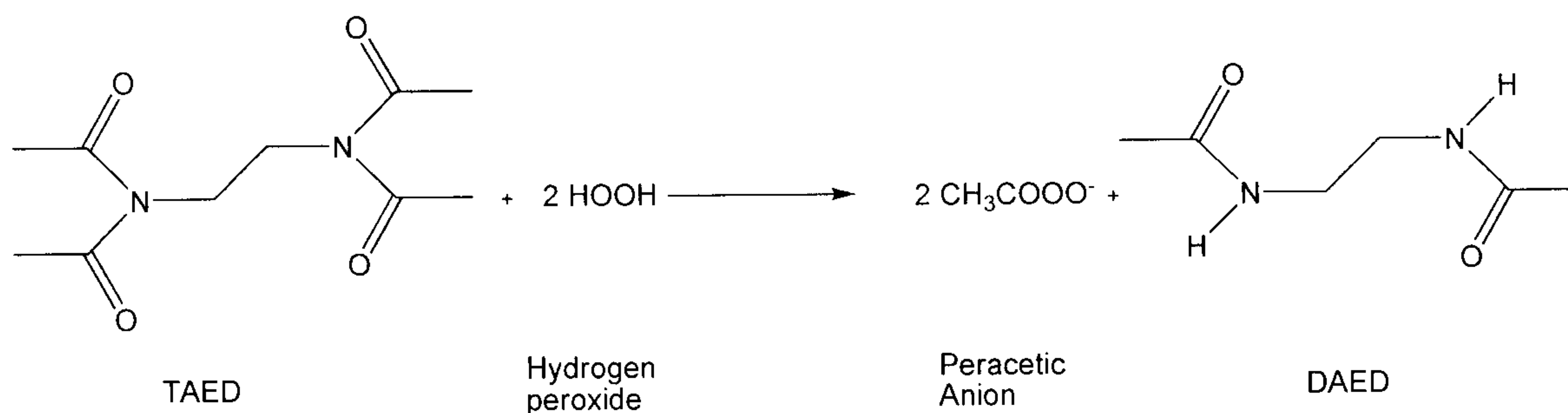
Introduction

Effective microbial growth control requires the use of broad spectrum biocides which are both safe to use and environmentally benign. These demands, and the prohibitive cost of developing new biocidal actives, combine to promote the use of highly effective agents with a proven history of environmental acceptance and safety. In this context, the peracid precursor, TAED (Tetra Acetyl Ethylene Diamine) is used extensively to activate peroxide and deliver broad spectrum microbiocidal activity across a range of domestic, clinical and industrial applications.

Of the many classes of antimicrobial agents currently in use those based on peroxygen are potentially the most environmentally acceptable. However, existing peroxygen actives either lack rapid efficacy (e.g. hydrogen peroxide) or are potentially hazardous to use (e.g. preformed peracetic acid).

The Applicants have now discovered how to overcome these problems enabling the promise of peroxygen based biocides to be realised. More particularly, the Applicant have surprisingly found that reacting TAED with a peroxygen source at near neutral pH provides a non-hazardous means of generating peracetic acid, especially *in situ* in an aqueous solution, according to the following reaction scheme:

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A preferred embodiment of the invention relates to a powdered composition for the generation of peracetic acid in an aqueous solution at neutral pH level, said powdered composition comprising in combination:

- a) a peroxygen source which generates hydrogen peroxide when contacted by water; and
- b) tetraacetylenediamine.

Another preferred embodiment of the invention relates to a powdered composition as defined hereinbefore, wherein the peroxygen source is a persalt whose the anion is a percarbonate, a perborate or a persulfate. More preferably, the peroxygen source may be sodium carbonate peroxyhydrate.

Another preferred embodiment of the invention relates to a powdered composition as defined hereinbefore, wherein it further comprises a sequestering agent for the stabilization of the peracetic acid in the aqueous solution. More preferably, the sequestering agent may be a phosphonic acid based sequestrant, or the sequestering agent may be nitriloacetic acid or phosphonic acid.

Another preferred embodiment of the invention relates to a powdered composition as defined hereinbefore, wherein it further comprises a pH adjuster

for the adjustment of the pH of the aqueous solution between 6.5 and 8. More preferably, the pH adjuster

- may be an organic acid such as, for example, acetic acid, citric acid or formic acid, or
- may be sulfamic acid, phosphoric acid, sulfuric acid or hydrochloric acid.

Another preferred embodiment of the invention relates to a powdered composition as defined hereinbefore, wherein it further comprises at least one additive selected from the group consisting of surfactants and corrosion inhibitors.

Another preferred embodiment of the invention relates to a use of a powdered composition as defined hereinbefore,

- for the preparation of a peracetic solution which is bactericidal, fungicidal, sporicidal or virucidal; or
- for the preparation of a peracetic solution for the sanitation and disinfection of surfaces, equipments, tanks, instruments in food plants, water and wastewater treatment plants, dental and medical centers; or
- for the preparation of a peracetic solution for the control of viruses, bacteria, yeast, mold, mycobacterium species, bacterial spores on surfaces, instruments and equipments; or
- for the preparation of a peracetic solution for the sanitation and disinfection of surfaces in contact with food, reservoirs, C.I.P. evaporators, fillers, aseptic equipment and pasteurisers found in dairies, wineries,

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breweries and food, beverage and meat processing and packaging plants;

or

- for the preparation of a peracetic solution for the sanitation of water tanks, boilers, cooling towers and other equipments related to water and wastewater treatment; or
- for the preparation of a peracetic solution which is a chemical sterilisant for surfaces, equipments and instruments in hospitals, dental clinics and medical clinics; or
- for the preparation of a peracetic solution which is a chemical sterilisant for endoscopes; or
- for the preparation of a peracetic solution for the control of malodors, diseases and microorganisms in farms, septic tanks, grease traps, drains and agricultural sectors.

BRIEF DESCRIPTION OF DRAWINGS:

Particularly preferred embodiments of the present invention, which are defined hereinafter, will be better understood with reference to the following drawings in which:

- Figure 1 represents a container a 4 Kg container of Applicant's of BIOXY S^{NEW} prepared by Applicant's company.
- Figure 2 represents bactericidal activity of BIOXY S^{NEW} against *L. pneumophila*.
- Figure 3 represents soil tolerance of BIOXY S^{NEW}.

- Figure 4 represents a peracid release profile of the formulation upon dissolution when dosed at 27g/litre in warm water.
- Figure 5 represents the efficacy of a **BIOXY S^{NEW}** / TAED activated formulation similar to the one above (dosage 0.1g/litre) against *Legionella p.* at 20°C.
- Figure 6 represents peracid release profile of the formulation upon dissolution when dosed at 16 g/litre in warm water (35°C).
- Figure 7 represents peracid release profile and pH profile of the formulation upon dissolution when dosed at 16 g/litre in warm water (35°C).
- Figure 8 represents a graph showing bactericidal efficacy (EN1276) of peracetic acid solutions against *E. coli* under simulated «dirty» conditions at 20°C.
- Figure 9 represents a graph showing bactericidal efficacy (EN1276) OF Pre-formed peracetic acid solutions against *E. coli* under simulated «dirty» conditions at 20°C.
- Figure 10 represents a graph showing bactericidal efficacy (EN1276) of peracetic acid solutions against *Staph. aureus* under simulated «dirty» conditions at 20°C.
- Figure 11 represents a graph showing bactericidal efficacy (EN1276) OF Pre-formed peracetic acid solutions against *Staph. aureus* under simulated «dirty» conditions at 20°C.

- Figure 12 represents a graph showing fungicidal activity (EN1650) of TAED powder formulation against *Candida albicans* under simulated «dirty» conditions at 20°C.
- Figure 13 represents a graph showing bactericidal efficacy (BS EN1276) of peracetic acid solutions against *E. coli* under simulated «dirty» conditions at 20°C.
- Figure 14 represents a graph showing bactericidal efficacy (EN1276) of peracetic acid solutions against *Staph. Aureus* under simulated «dirty» conditions at 20°C.
- Figure 15 represents a graph showing fungicidal activity (EN 1650) of TAED powder formulations against *Candida albicans*, under simulated «clean» and «dirty» conditions.
- Figure 16 represents a graph of the bactericidal efficacy of 10% structured liquid, 15% peroxide liquid @ 1% concentration.
- Figure 17 represents a graph for the efficacy of peracetic acid generated from TAED against *Bacillus subtilis* endospores (suspension test).
- Figure 18 represents a graph of the efficacy of peracetic acid generated from TAED against *Bacillus subtilis* Endospores (surface test).
- Figure 19 represents a graph of the efficacy of peracetic acid generated from TAED against *Bacillus subtilis* endospores (suspension test).

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

The Applicant's powdered composition for the generation of peracetic acid in an aqueous solution at neutral pH level, which is hereinafter called BLOXY S

^{NEW}, is preferably a powdered product composed of Sodium carbonate peroxyhydrate, TAED (Tetra Acetyl Ethylene Diamine), citric acid, sequestrants, etc. This unique and particularly preferred powdered mixture allows to generate peracetic acid in water at neutral pH level. Unlike liquid peracetic acid sold in the market which are highly corrosive with offensive acetic acid smell, **BIOXY S^{NEW}** generates peracetic acid (*in-situ*) once diluted with water at neutral pH level with no offensive odor and no induced corrosion.

Comparison **BIOXY S^{NEW}** vs Liquid Peracetic Acid

Description	BIOXY S - atomes	Liquid Peracetic acid
Activity	10% active	5% active
Concentration used- no rinse	0.2% 2 g / L = 20g / 10 L	0.4% 4 ml / L
Physical status	Solid	Liquid
Transportation	Safe	Hazardous
Odor	No odor	Offensive – Strong acetic acid smell
pH	Reacts with water to generate peracetic acid at neutral pH levels	The pH is highly acidic

Corrosion / surfaces	No induced corrosion	Extremely corrosive to surfaces
Handling / employees	Safe to handle	Extremely dangerous to handle
Storage	Requires a limited place	Requires large and a secured space to prevent leaking
Chemical stability	Stable	Decomposes if exposed to heat or organic materials

BIOXY S^{NEW} as a Biocide

In comparison to many widely used biocides, peracetic acid has numerous advantageous properties, possessing rapid broad spectrum biocidal activity even at low temperatures and in the presence of soil. As delivered, however, preformed peracetic acid is unstable, potentially explosive, highly acidic and as a consequence highly corrosive. These properties make products containing peracetic acid difficult to formulate for long term storage stability and difficult to handle and transport.

Performance Advantages

Non-hazardous and safe to use

As all the reaction components are non-toxic and non-sensitising, **BIOXY S^{NEW}** based biocides are exceptionally safe to use. Unlike preformed peracetic acid, chlorine, or glutaraldehyde, solutions of **BIOXY S^{NEW}** release no irritating fumes or unpleasant odours and require minimal PPE.

Environmentally friendly

The system has a proven history of environmental acceptance as the reaction components readily degrade to produce innocuous by-products in the environment. This allows solutions to be easily and safely disposed of into the water supply.

Non-corrosive

As the strong oxidant can be generated and stabilised under neutral conditions the corrosive effects of acidic, preformed, peracetic acids can be mitigated.

Tailored peracid release

By manipulating the reaction chemistry the rate of peracetic acid release can be effectively tailored to the application. Systems can be formulated to give an efficient and rapid release profile, which is a prerequisite for biocidal-applications requiring short contact times. Alternatively, a slow sustained peracid release can be produced for those applications requiring continuous or residual activity.

Formulation flexibility

In its simplest form **BIOXY S^{NEW}** provides a means of generating peracetic acid in-situ and hence avoids the negatives associated with pre-formed peracetic acid products. In addition, since strong oxidant is only generated upon dissolution or reaction, the use of **BIOXY S^{NEW}** allows the inclusion of otherwise non-bleach stable actives to enhance biocidal performance or biofilm/soil removal. This allows both cleaning and disinfection to be achieved in a single operation.

These benefits have enabled the introduction of **BIOXY S^{NEW}** activated biocides into the domestic, clinical and industrial environments with minimal hazard to the user.

Broad spectrum microbicidal efficacy

BIOXY S^{NEW} delivers effective broad spectrum activity over a wide range of conditions, including varying pH, temperature and soil loading. As a consequence, the system has found use in a range of biocidal products. For example, **BIOXY S^{NEW}** activated denture cleaners provide effective kill against oral pathogens. In the medical arena, the sterilisation of surgical equipment can be rapidly accomplished to ensure the safety of staff and patients. While **BIOXY S^{NEW}** activated laundry and automatic dish wash products provide high level hygiene performance in the domestic and Industrial & Institutional sectors.

The system has proven Tuberculocidal, Pseudomonacidal and anti-Candidal activity. As an example of bactericidal activity, Figure 2 shows the effect of ppm levels of **BIOXY S^{NEW}** activated peroxide against *L. pneumophila*. The omission of TAED from the peroxide containing solution resulted in the complete loss of activity. While a moderate increase in the concentration of both actives was found to give complete kill in less than 30 seconds.

Sterilant activity

BIOXY S^{NEW} activated peroxide formulations have been shown to be highly sporicidal at 20°C, delivering complete kill of a Log 7 inoculation of *B. subtilis* endospores within 5 minutes. This level of performance is sufficient to substantiate cold sterilant claims and ensure the complete destruction of endospores and viruses. In addition, the use of **BIOXY S^{NEW}** activated peroxygen for chemothermal sterilisation would deliver effective sporicidal and virucidal activity at low levels of active.

Soil tolerance

Soil is invariably present when biocidal activity is required and soil tolerance is an important consideration in the selection of an effective biocidal system. Unlike many widely used commercial biocides, **BIOXY S^{NEW}** activated peroxide remains active in the presence of high soil levels. An effect which is clearly illustrated below, Figure 3, for a number of bacterial species. This soil tolerance is in part due to the sustained generation of biocidal species and partly to the ability of peracetic acid to remain biocidally active in the presence of soil. The robust nature of **BIOXY S^{NEW}** activated peroxide is in contrast to chlorine based biocides, whose performance is severely quenched by the presence of soil.

BIOXY S^{NEW} is traditionally formulated with a persalt to form solid, concentrated, products with long shelf lives. This simplifies the logistics of transportation and storage while minimising packaging and removes the need for specialist handling/safety equipment.

Products may take the form of readily soluble powdered formulations which generate biocidal solutions for immediate use. Alternatively, concentrated solutions of peracetic acid may be produced from such formulations by dissolution in, for example, a holding tank. Such solutions, pre-reacted to produce stable peracetic acid, may then be used over several working days. **BIOXY S^{NEW}** activated formulations may also be readily formed into tablets or extruded products for the long-term, sustained release of actives.

CLINICAL STERILANT

Peracetic acid is a highly effective broad spectrum biocide used in a wide range of applications. However the highly corrosive and flammable nature of pre-formed peracetic solutions causes many problems with handling and transportation. In addition the use of co-actives in pre-formed peracetic solutions is not possible. Such problems are overcome by generating peracetic acid *in-situ* using **BIOXY S^{NEW}**. The resultant solutions are non-corrosive and as peracetic

acid is only generated upon dissolution, a wide range of co-actives can be incorporated to further enhance biocidal and cleaning performance.

BIOXY S^{NEW} delivers rapid sporicidal and virucidal activity and are highly effective against a wide range of noscomial infection causing microorganisms including MRSA, *Pseudomonas aeruginosa* and *Escherichia coli*.

BIOXY S^{NEW} has significant advantages compared to other leading clinical sterilants. They are microbiologically superior to glutaraldehyde and as previously mentioned, offer considerably more flexibility and safety in use than pre-formed peracetic solutions.

Figure 4 illustrates the peracid release profile of the formulation upon dissolution when dosed at 27g/litre in warm water. Formulations dosed at this level are highly sporicidal at 20°C, giving a Log 7 reduction of *B. subtilis* endospores within 5 mins – performance sufficient to substantiate cold sterilant claims.

If required, the peracid release of the formulation can be tailored to meet the application needs.

WATER TREATMENT

Peracetic acid is a highly effective broad spectrum biocide used in a wide range of applications. However the highly corrosive and flammable nature of pre-formed peracetic solutions causes many problems with handling and transportation. In addition the use of co-actives in pre-formed peracetic solutions is not possible. Such problems are overcome by generating peracetic acid in-situ at the point of use by using **BIOXY S^{NEW}**. The resultant solutions are non-corrosive and as peracetic acid is only generated upon dissolution, a wide range of co-actives can be incorporated to further enhance biocidal and cleaning performance.

The powdered formulation of **BIOXY S^{NEW}** has been developed for use as a disinfectant in a variety of water treatment applications. These include cooling towers, paper production plants, air conditioning units and swimming pool disinfection.

Products based on this technology deliver rapid biocidal, algaecidal and fungicidal activity and are highly effective against a wide range of pathogens including, *Legionella pneumophila*, *Listeria monocytogenes* and *Pseudomonas aeruginosa*. They are also effective in the removal and prevention of biofilms.

Figure 5 illustrates the efficacy of a **BIOXY S^{NEW}** / TAED activated formulation similar to the one above (dosage 0.1g/litre) against *Legionella p.* at 20°C. Along with powders, formulations can be dosed in tablet and sachet format. Peracid release profile can be tailored to meet application needs. For example, a rapid release can be generated when a knock down kill is required or a slower release sustainable over a period of several days can be provided where longer term activity is necessary.

CLINICAL STERILANT

Peracetic acid is a highly effective broad spectrum biocide used in a wide range of applications. However the highly corrosive and flammable nature of pre-formed peracetic solutions causes many problems with handling and transportation. In addition the use of co-actives in pre-formed peracetic solutions is not possible. Such problems are overcome by generating peracetic acid in-situ using **BIOXY S^{NEW}**. The resultant solutions are non-corrosive and as peracetic acid is only generated upon dissolution, a wide range of co-actives can be incorporated to further enhance biocidal and cleaning performance.

This powdered formulation has been developed for use as a clinical sterilant or disinfectant – dependent on dosage.

Products based on this technology deliver rapid sporicidal and virucidal activity and are highly effective against a wide range of noscomial infection causing microorganisms including MRSA, *Pseudomonas aeruginosa* and *Escherichia coli*.

BIOXY S^{NEW} / TAED activated products have significant advantages compared to other leading clinical sterilants. They are microbiologically superior to glutaraldehyde and as previously mentioned, offer considerably more flexibility and safety in use than pre-formed peracetic solutions.

FIGURES 6 and 7 respectively illustrate the peracid release profile and pH profile of the formulation upon dissolution when dosed at 16g/litre in warm water (35°C). Formulations dosed at this level are highly sporicidal at 20°C, giving a Log 7 reduction of *B. subtilis* endospores within 5 mins – performance sufficient to substantiate cold sterilant claims. If required, the peracid release of the formulation can be tailored to meet the application needs. Peracid release in cold de ionised (20°C) water is also shown.

MEASUREMENT OF PERACETIC LEVELS

Levels of peracetic generated can be monitored in two ways, via iodometric titration or the use of analytical test strips. The test strips are manufactured by Merck and provide a rapid, convenient semi-quantative method of determining peracetic levels (two formats available, 5-50 ppm and 100-500ppm).

EFFICIENCY:

Figures 8 to 19 illustrate efficiency of BIOXY S^{NEW} according to the following formulation and conditions.

Biocidal efficacy of TAED based formulations vs preformed peracetic acid formulations

Powder formulations: EN1276 performance

Formulation tested.

B675 (tetraacetylenediamine)	23.6%
PBS1 (sodium perborate monohydrate)	54.5%
Citric Acid	18.3%
Sequestrant	1.80%
Surfactant	1.80%

pH of all tested solutions (Gram –ve & Gram +ve) adjusted to ~ 7.5

Powder formulations: EN 1650

- *C. albicans*
- 3 g/l BSA and 0.3 g/l BSA
- PAAH ~ 350 ppm – preformed PAAH
- PAAH ~ 350 ppm – TAED based formulations
- pH ~ 9.0. Formulations containing PCS and P BS1, pH altered with the addition of citric acid. Preformed peracetic acid solutions, pH altered with the addition of 5% sodium hydroxide.

Summary

- TAED based formulations give effective kill of both bacteria and fungi using standard test methods.

- Performance delivered by TAED-Persalt is similar to that shown by pre-formed peracetic acid.
- Using a TAED based formulation provides the flexibility to add a range of co-ingredients to broaden the efficacy of the formulation.
- TAED may be incorporated in a range of product formats.

Biocidal Efficacy of TAED based formulations

- Test Methods

BS EN1276 – Quantitative suspension test for the evaluation of bactericidal activity of chemical disinfectants and antiseptics used in food, industrial, domestic, and institutional areas.

BE EN 1650 – Quantitative suspension test for the evaluation of fungicidal activity of chemical disinfectants and antiseptics used in food, industrial and institutional areas.

Powder formulation: BS EN 1276 performance

Formulation tested.

B675 (tetraacetythylenediamine)	23.6%
PBS1 (sodium perborate monohydrate)	54.5%
Citric Acid	18.3%
Sequestrant	1.80%
Surfactant	1.80%

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Formulations dosed to obtain peracetic acid levels of 50 ppm, 175 ppm, and 300 ppm.

Powder formulations: EN 1650

- *C. albicans*
- 3 g/l Bovine Serum Albumin (BSA) and 0.3 g/l BSA
- PAAH ~ 350 ppm – TAED based formulations
- pH ~ 9.0. Formulations containing PCS AND P BS1, pH altered with the addition of citric acid.

Liquid formulation: EN 1276

- *E. Coli*, *S. aureus*, *P. aeruginosa*, *E. hirae*
- 3 g/l BSA AND 0.3 g/l BSA
- Liquid formulation ~ pH 7

Conclusions

- TAED based formulations give effective kill both bacteria and fungi using standard test methods.
- Using a TAED BASED formulation provides the flexibility to add a range of co-ingredients to broaden the efficacy of the formulation.
- TAED may be incorporated in a range of product formats
- Activity much less affected by organic material than hypochlorite.

CLAIMS

- 1- A powdered composition for the generation of peracetic acid in an aqueous solution at neutral pH level, said powdered composition comprising in combination:
 - a peroxygen source which generates hydrogen peroxide when contacted by water;
 - tetraacetylenediamine; and
 - a pH adjuster for the adjustment of the pH of the aqueous solution between 6.5 and 8.
- 2- A powdered composition according to claim 1, wherein the peroxygen source is a persalt whose anion is a percarbonate, a perborate or a persulfate.
- 3- A powdered composition according to claim 2, wherein the peroxygen source is sodium carbonate peroxyhydrate.
- 4- A powdered composition according to any one of claims 1 to 3, wherein it further comprises a sequestering agent for the stabilization of the peracetic acid in the aqueous solution.
- 5- A powdered composition according to claim 4, wherein the sequestering agent is a phosphonic acid based sequestrant.
- 6- A powdered composition according to claim 4, wherein the sequestering agent is nitriloacetic acid or phosphonic acid.
- 7- A powdered composition according to claim 1, wherein the pH adjuster is an organic acid.
8. A powdered composition according to claim 7, wherein the organic acid is acetic acid, citric acid or formic acid.

9. A powdered composition according to claim 1, wherein the pH adjuster is sulfamic acid, phosphoric acid, sulfuric acid or hydrochloric acid.
10. A powdered composition according to any one of claims 1 to 9, wherein it further comprises at least one additive selected from the group consisting of surfactants and corrosion inhibitors.
11. Use of a powdered composition as defined in any one of claims 1 to 10, for the preparation of a peracetic solution which is bactericidal, fungicidal, sporicidal or virucidal.
12. Use of a powdered composition as defined in any one of claims 1 to 10, for the preparation of a peracetic solution for the sanitation and disinfection of surfaces, equipments, tanks, instruments in food plants, water and wastewater treatment plants, dental and medical centers.
13. Use of a powdered composition as defined in any one of claims 1 to 10, for the preparation of a peracetic solution for the control of viruses, bacteria, yeast, mold, mycobacterium species and bacterial spores on surfaces, instruments and equipments.
14. Use of a powdered composition as defined in any one of claims 1 to 10, for the preparation of a peracetic solution for the sanitation and disinfection of surfaces in contact with food, reservoirs, Clean-In-Place evaporators, fillers, aseptic equipment and pasteurisers found in dairies, wineries, breweries and food, beverage and meat processing and packaging plants.
15. Use of a powdered composition as defined in any one of claims 1 to 10, for the preparation of a peracetic solution for the sanitation of water tanks, boilers and cooling towers.
16. Use of a powdered composition as defined in any one of claims 1 to 10, for the preparation of a peracetic solution which is a chemical sterilisant for

surfaces, equipments and instruments in hospitals, dental clinics and medical clinics.

17. Use of a powdered composition as defined in any one of claims 1 to 10, for the preparation of a peracetic solution which is a chemical sterilisant for endoscopes.

18. Use of a powdered composition as defined in any one of claims 1 to 10, for the preparation of a peracetic solution for the control of malodors, diseases and microorganisms in farms, septic tanks, grease traps, drains and agricultural sectors.

Application number / numéro de demande: 2569025
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Figures: 1, 2, 3, 8, 9, 10, 11

12, 13, 14, 15, 16, 17

Pages: _____

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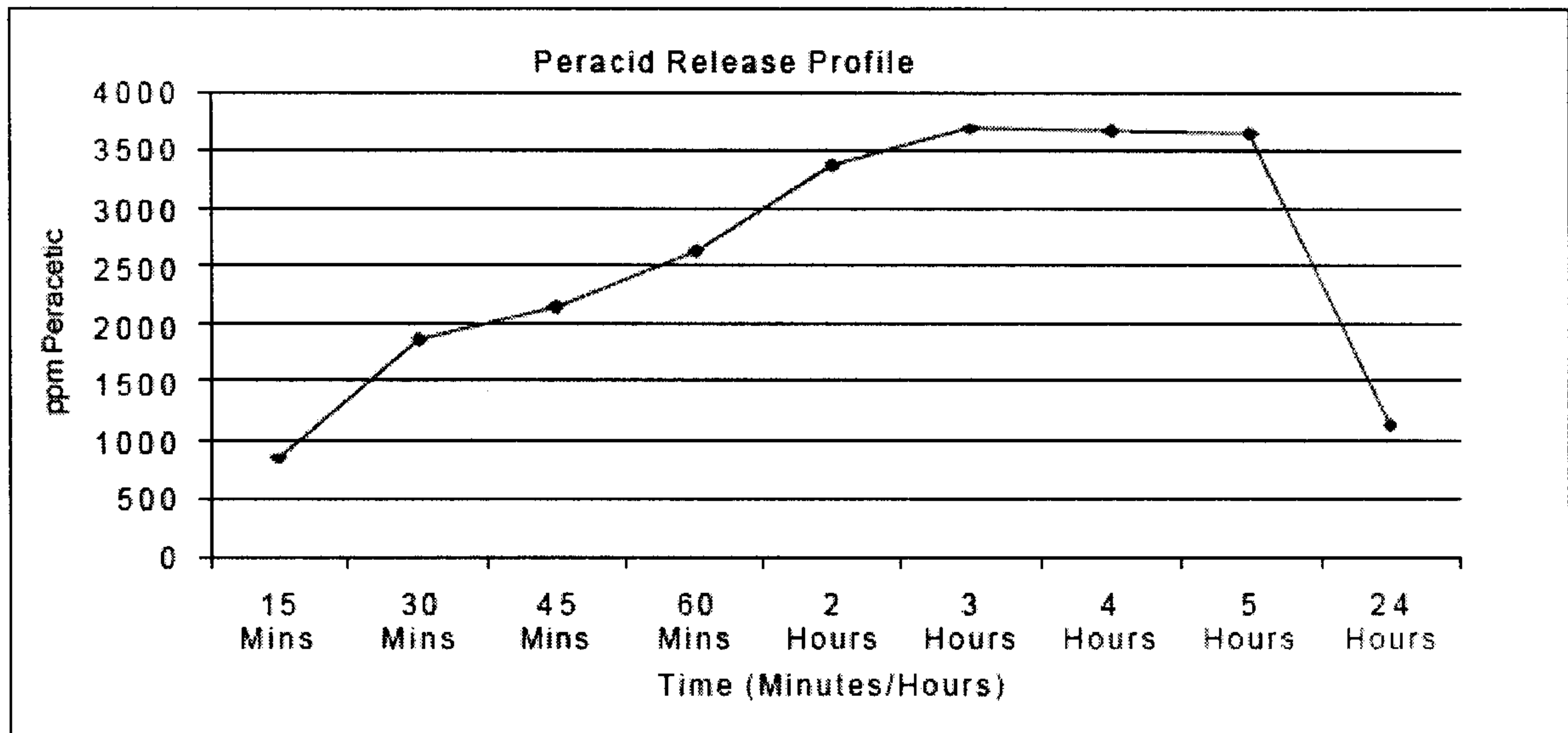


FIGURE 4

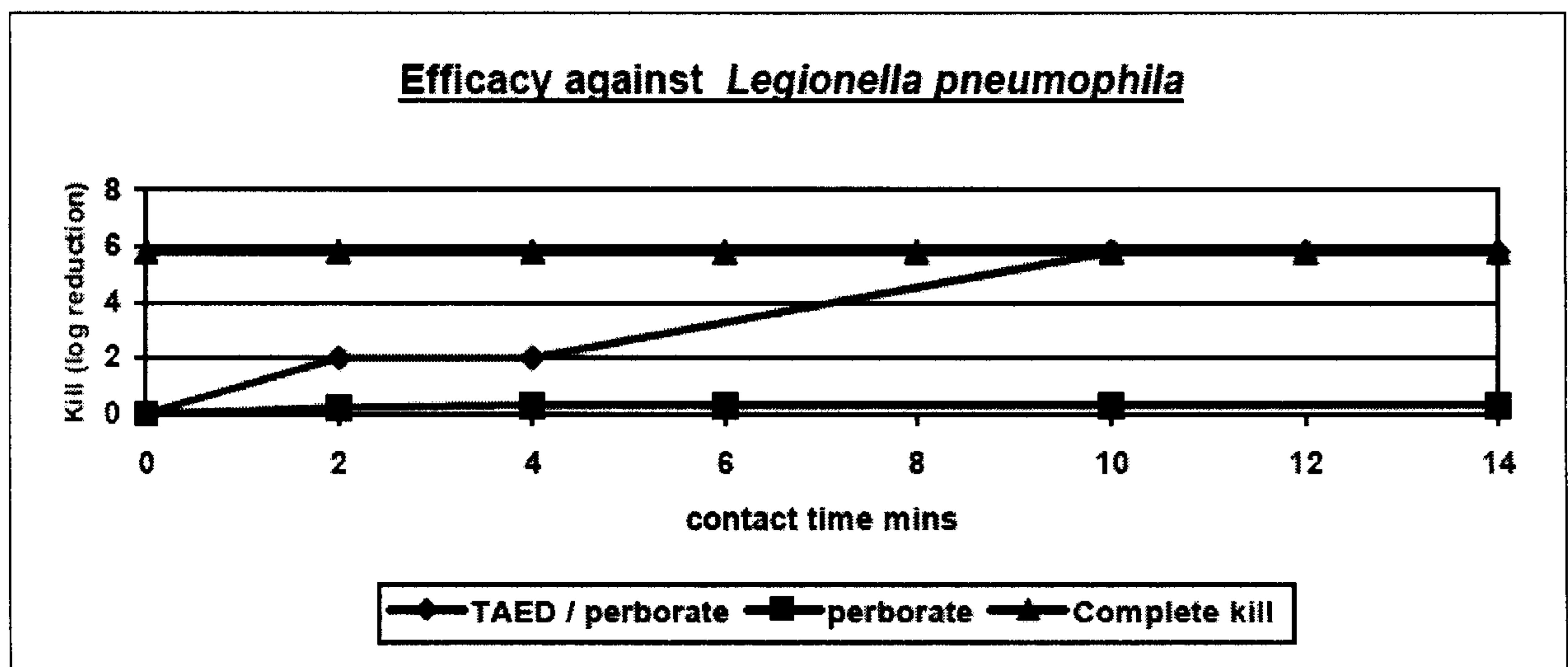


FIGURE 5

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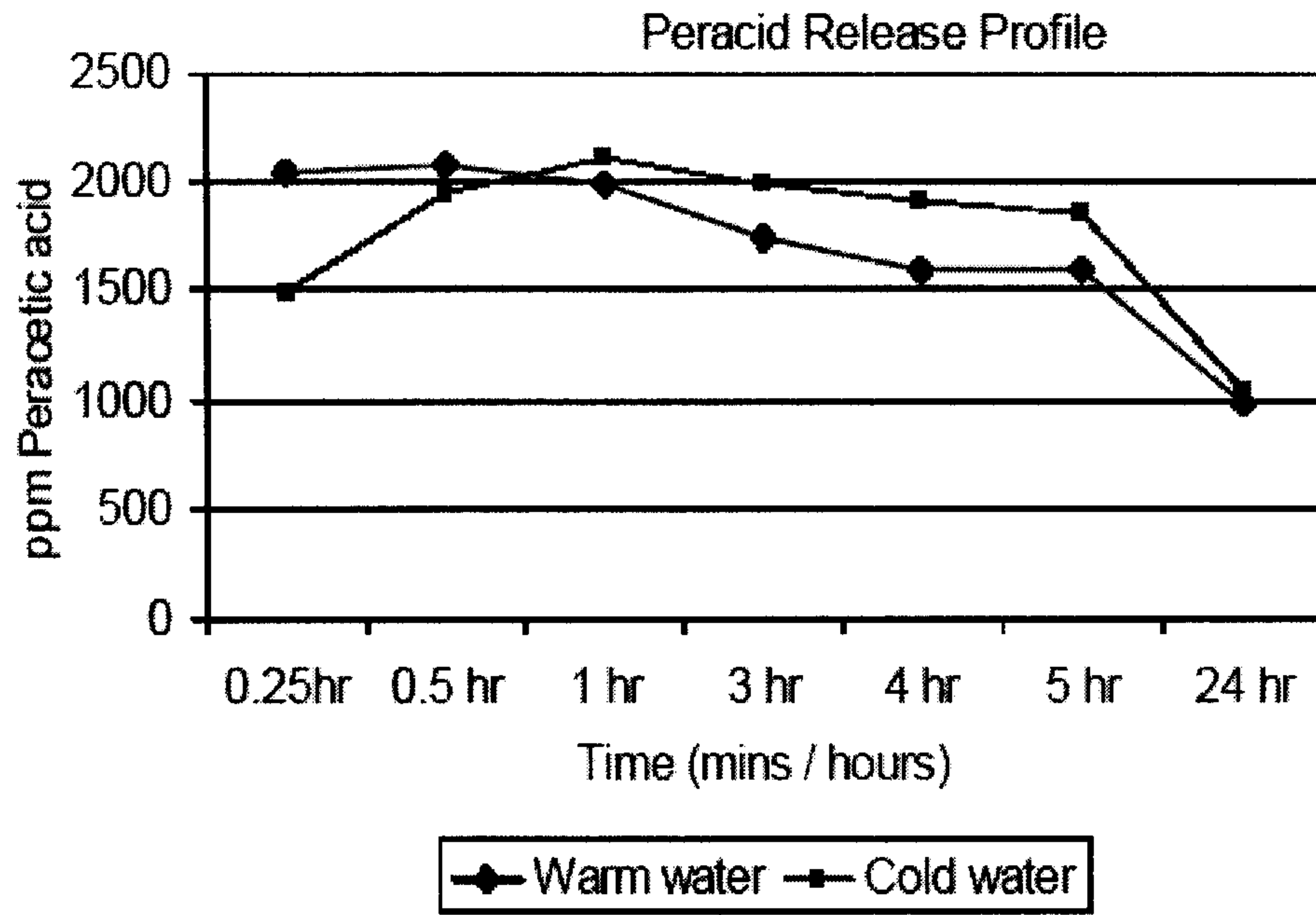


FIGURE 6

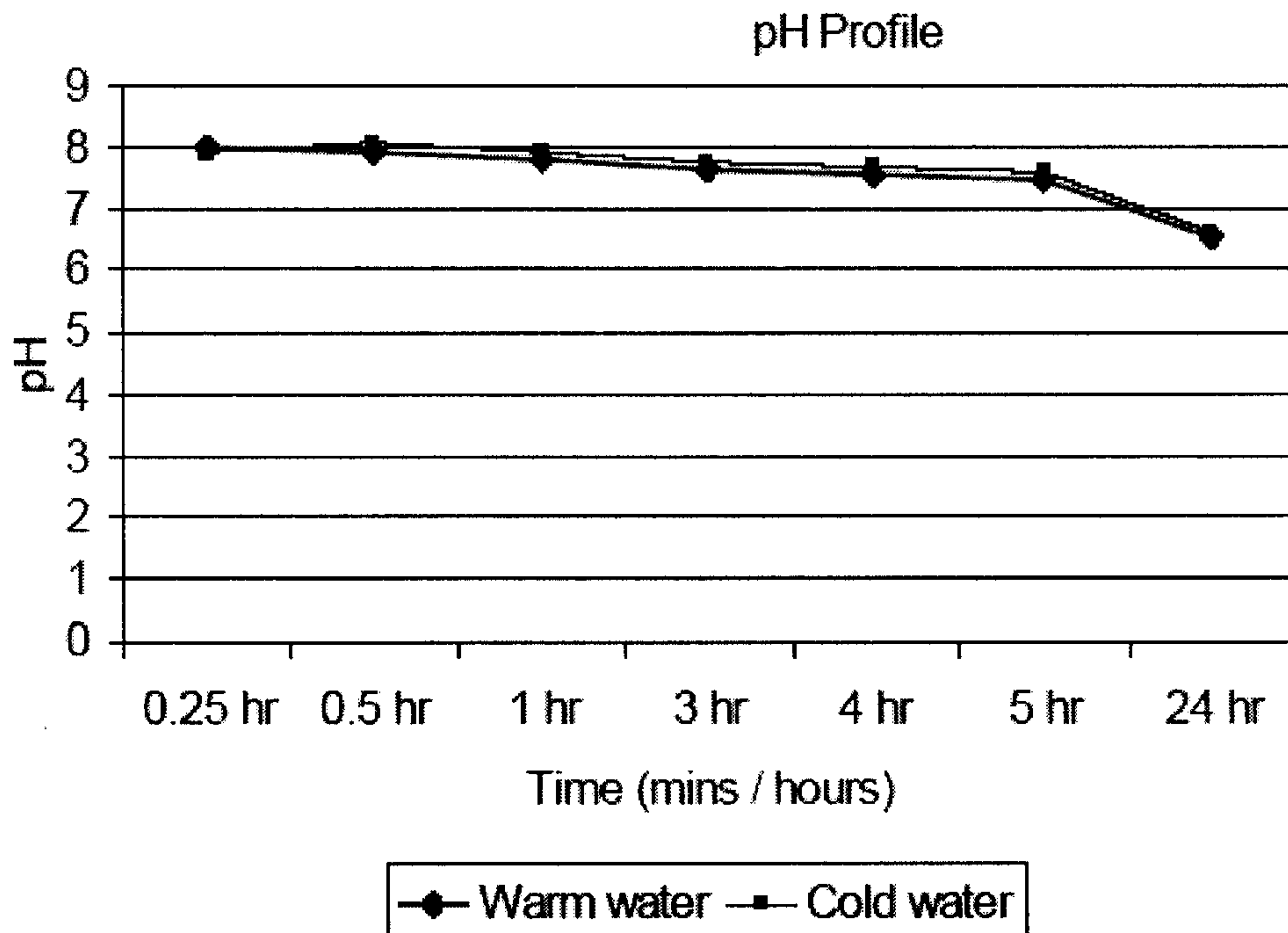


FIGURE 7

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Efficacy of Peracetic Acid Generated from TAED Against *Bacillus subtilis* Endospores (Surface Test)

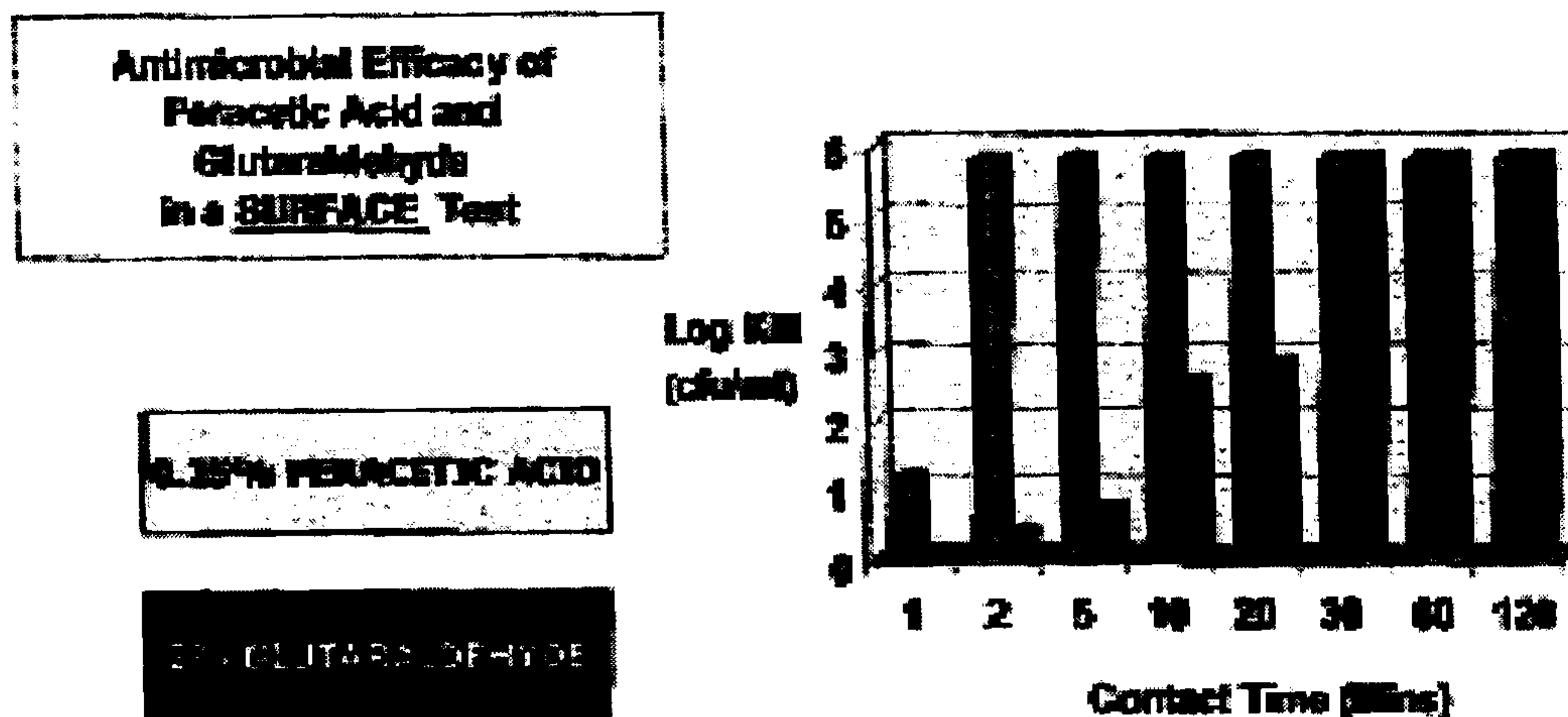


FIGURE 18

Sporicidal Activity (*Bacillus subtilis*) - Surface Test

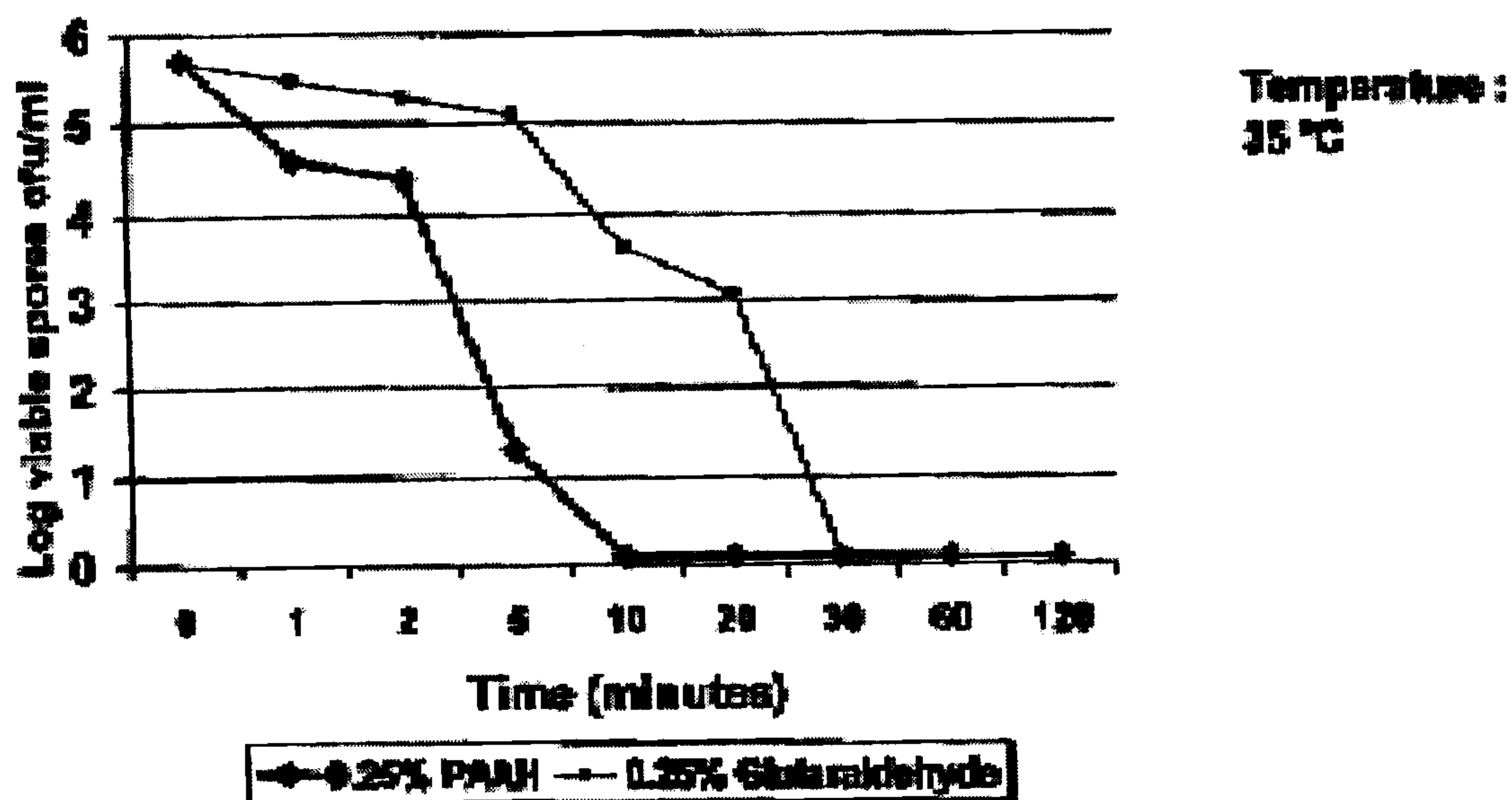


FIGURE 19