Wound irrigation solution and gel

Granudacyn®

- For acute, chronic and contaminated wounds as well as superficial and partial thickness burns
- Prevents the proliferation of Gram+/- bacteria, viruses, fungi and spores[1]
- Reduction of wound malodour[2]

Granudacyn®

Mölnlycke®

Mode of action

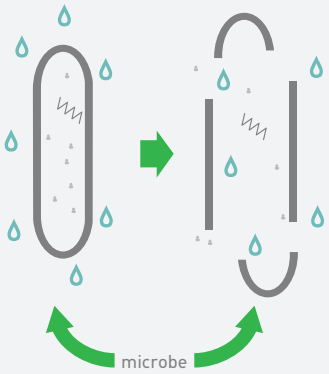
Granudacyn® is an irrigation solution for cleansing and moisturising acute, chronic and contaminated wounds as well as for superficial and partial thickness burns. Hypochlorous acid (HOCl) ensures safe preservation and makes Granudacyn a reliable wound irrigation solution. HOCl prevents the proliferation of Gram+ and Gram- bacteria including; MRSA, ORSA, VRSA, VRE, viruses, fungi and spores.

Granudacyn works mechanically

Granudacyn is preserved to allow for a multi-patient use up to 90 days (gel) and 60 days (solution) after opening. To ensure the safe use after opening the products are preserved with a substance naturally occurring in our body: hypochlorous acid[2].

1. Disrupts the cell wall structures.

The hypochlorous acid in Granudacyn attacks the cell wall of the microorganism and increases its permeability[3].



2. Osmolysis leads to cell rupture.

A hypotonic solution causes water to flow into the cells to equalise the osmotic gradient. The result is osmolysis: the increasing internal pressure causes the cells to burst.

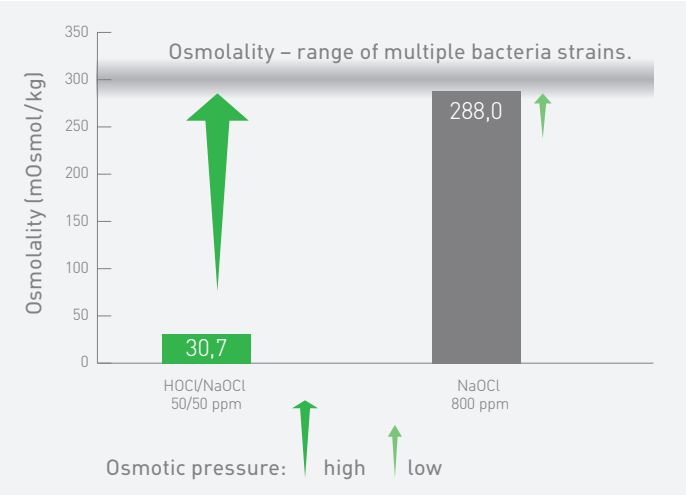
Granudacyn facilitates the mechanical removal of microorganisms and cell debris. This fact contributes to the quick elimination of often unpleasant odour and eases wound debridement. Granudacyn can also be left in the wound to soak the wound tissue.

Osmolality[4]

The osmolality of two products was compared in a laboratory.

It was found that the HOCl/NaOCl product was clearly hypotonic, the pure NaOCl product was isotonic. The stronger the hypotension (arrow in the diagram), the stronger the osmolytic effect on a microorganism.

The combination of HOCl/NaOCl and the low osmolality makes Granudacyn an effective irrigation solution[2].



Tolerability

Granudacyn® is a purified wound irrigation solution, safely preserved by HOCl. HOCl is an important component of our natural immune system and is formed and released in macrophages as the body's own active substance during phagocytosis. As an oxidant, HOCl acts as a potent microbicidal agent within our neutrophils. In contrast to unicellular pathogens, human body cells, have developed protective mechanisms that make them insensitive to low concentrations of HOCl. Results from tests on the chorioallantoic membrane of hen's egg (HET-CAM) supporting this: products preserved with 50ppm HOCl and 50ppm NaOCl achieved the highest scores for wound tolerability in terms of vascular reaction[6].

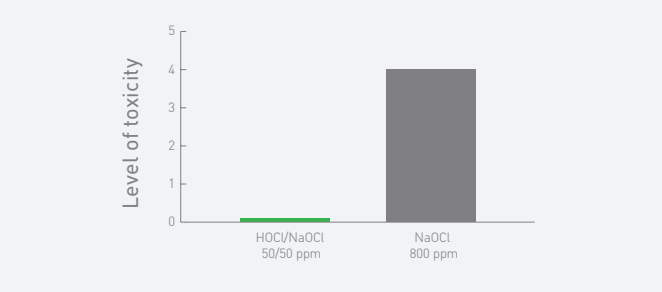
Biocompatibility index

The biocompatibility index (BI) is defined as the ratio of the mean inhibitory concentration IC50 on L929 cells and of the concentration causing 3 $\log_{10}$-reduction in microbial CFU. A BI >1 represents a solution with a positive benefit/risk ratio, whereas a BI <1 indicates a relatively high risk of side effects[2].

Active substance	Product concentration (mg/L)	IC_{50} (mg/L)[4]	rf (3$\log_{10}$ - E.coli) (mg/L)[5]	$BI_{E.coli}$ (mg/L)	rf (3$\log_{10}$ - S.aureus) (mg/L)[5]	$BI_{S.aureus}$ (mg/L)
HOCl/NaOCl	50/50	330	25	13.20	20	16.50
OCT	1,000	38	22.5	1.69	17.5	2.17
PHMB	1,000	136	90	1.51	100	1.36
PVP-I	100,000	4,750	7,000	0.68	7,000	0.68
CHX	2,000	83	100	8.83	85	0.98

Cytotoxicity[4]

Test substance 1 preserved with 50ppm HOCl/ 50ppm NaOCl (Granudacyn) caused neither toxicological nor biological damages to sub-confluent monolayer of mouse fibroblasts (L929). In contrast: test substance 2 preserved with a high concentration of 800ppm NaOCl led to severe cytotoxic reactions in mouse fibroblasts[3]. Granudacyn is not cytotoxic.

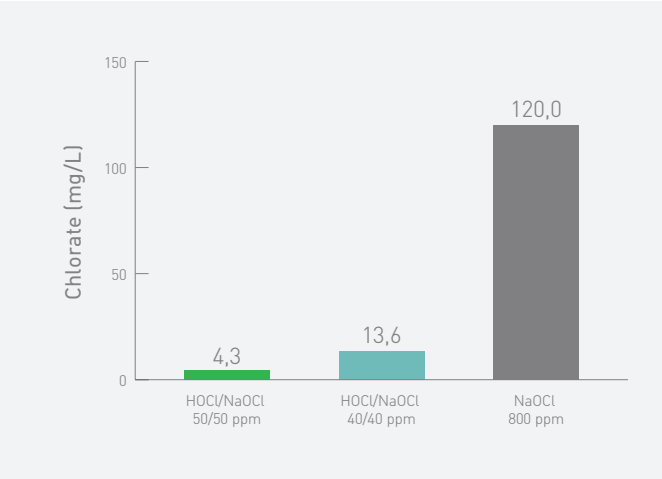


Chlorates[4]

In a laboratory examination, the content of chlorates of three different products was measured:

- Product 1 with HOCl/NaOCl 50/50ppm (Granudacyn showed the lowest chlorate content of 4.3mg/L
- Product 2 preserved with HOCl/NaOCl 40/40ppm showed a chlorate content 3-times higher than 1 of 13.6mg/ml
- Product 3 using NaOCl in 800ppm concentration had a chlorate content of 120.0mg/L

Chlorates are formed under adverse storage conditions (e.g. heat, solar radiation, etc.). Chlorates are powerful oxidants and should be kept separate from organic or easy-to-oxidise materials. The lower the chlorate content, the lower the risk of an unstable solution.



Characteristics of several preservatives

Overview preservatives[2]

Active substance	Onset of action	Depth of effects[b]	Resistances	Selective effects	Supports wound healing	Sensibilisation	Systemic risk
NaOCl/HOCl[a]	30s–5min	2	no	yes	yes	no	no
OCT	3–10h	1[c]	no	yes	no inhibition	no	no
PHMB	3–10h	2	no	yes	yes	no	no
PVP-I (10%)	30min	3	no	yes	partly inhibits	yes	yes

a. Does not apply to NaOCl-mono-products
b. Extrapolated from physico-chemical properties or demonstrated absorption
c. If in combination with phenoxyethanol 2 or 3

Depth of effects legend:
1. Superficial effect
2. Shallow penetration
3. Deeper than 2

Overview application areas[2]

Active substance	Fistulas	Peritoneal lavage	CNS tissue	Cartilage tissue	Prevention SSI
NaOCl/HOCl*	yes	possible	possible	possible	possible
OCT	no	contraindicated	contraindicated	contraindicated	unknown
PHMB	no	contraindicated	contraindicated	≤ 0.005%	effective
PVP-I	no	contraindicated	toxic	yes	tendentially better

*does not apply to NaOCl-mono-products

In the 'Consensus on Wound Antisepsis: Update 2018'[2], the HOCl/NaOCl combination – as it is used in Granudacyn – was rated first-choice recommendation for peritoneal lavage, as well as decontamination of acute and chronic wounds.

Granudacyn can be used for the cleaning, moistening and rinsing of the following wound types:

- All chronic wounds of any depth, such as diabetic foot ulcers, pressure injuries, venous leg ulcers, etc.
- All acute wounds, cuts, bite wounds, lacerations, abrasions
- Surgical wounds (intraoperative and postoperative)
- Wounds with exposed cartilage, tendons, ligaments and/or bones
- Superficial and partial thickness burns
- Radiation ulcers
- Fistulas and abscesses
- Cavities such as ear, nose, throat
- Critically colonised wounds
- Soft tissue injuries

Proven safety

In-vitro tests of antimicrobial efficacy

Quantitative in-vitro suspension tests (EN 13727, EN 13624, EN 13704, EN 14476 – phase 2) with Granudacyn wound irrigation solution, in the presence of an additional organic load of 0.3g/L albumin.

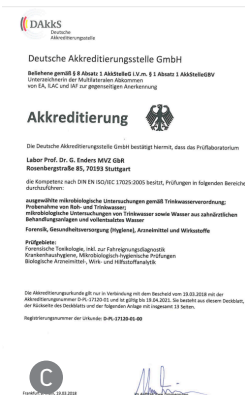
Category	Microorganisms	Time (sec)	Reduction (log_{10}) of microbial load	Reduction (%)
Bactericidal	Escherichia coli (ATCC 25922)[B]	15	> 5.3	99.999%
	Pseudomonas aeruginosa (ATCC 15442)[B]	15	> 5.3	99.999%
	Staphylococcus aureus (ATCC 29213)[B]	15	> 5.5	99.999%
	Enterococcus faecilis (ATCC 29212)[B]	30	> 5.2	99.999%
	Acinetobacter baumannii (ATCC 19606)[B]	15	> 5.2	99.999%
	Salmonella typhimurium[A]	60	> 5.2	99.999%
	Enterococcus hirae[A]	60	> 5	99.99%
Bactericidal (resistant strains)	Methicillin-/Oxacillin-/Vancomycin-resistant Staphylococcus aureus (MRSA, ORSA, VRSA) (ATCC 11729)[2]	15	> 5.2	99.999%
	Methicillin resistant Staphylococcus aureus (MRSA) (DSM 11729)[A]	60	> 5.2	99.999%
	Vancomycin resistant Enterococcus faecalis (VRE) (DSM 13591)[A]	60	> 5.5	99.999%
Fungicidal	Candida albicans (ATCC 10231)[B]	15	> 4.3	99.99%
Sporocidal	Clostridium difficile[A]	300	> 4	99.99%
Virucidal	Poliovirus[c]	300	> 4	99.99%
	Bovine Viral Diarrhea Virus (BVDB)[c]	300	> 4	99.99%
	Norovirus[c]	300	> 4	99.99%
	Adenovirus[c]	300	> 4	99.99%

The same in vitro preserving effect of Granudacyn was also observed after 1 hours incubation. In vivo, the preserving effect of Granudacyn should be combined with thorough debridement for effective cleansing and moistening of contaminated and (critical) colonised wounds.

The testing of antimicrobial efficacy was conducted in the following independent and accredited laboratories:

[A] with 80% product concentration in laboratory WHU GmbH

[B] with 97% product concentration in laboratory L+S AG



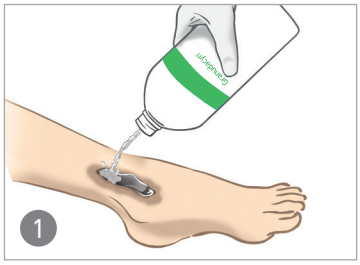
[C] with 100% product concentration in laboratory Enders

Granudacyn® product portfolio

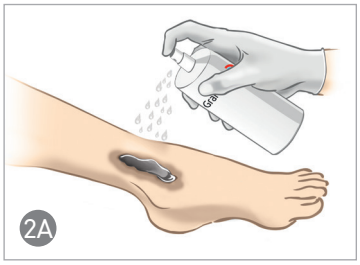
- Ready-to-use hypotonic irrigation solution
- Neutral pH
- Safely preserved
- Solution with shelf life of 24 months after manufacturing and 60 days after opening
- Gel with shelf life of 18 months after manufacturing and 90 days after opening
- Can be warmed to body temperature before usage
- Non cytotoxic and non-irritating
- Ready-to-use
- Eases the loosening of crusted wound dressings
- Can be combined with Granulox®
- Does not require neutralisation or rinsing off

Application

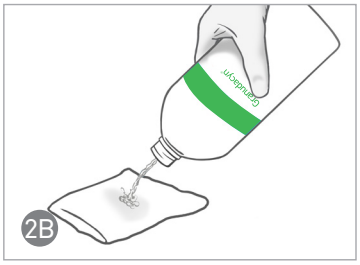
Irrigation solution and spray: for cleaning and for precise application and dosing.



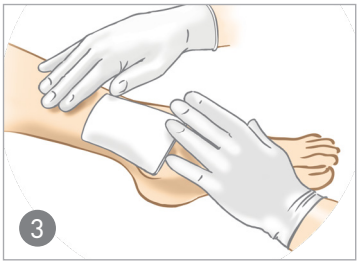
1. Careful wound cleansing with Granudacyn irrigation solution.



2A. Spray from a distance of approximately 15–30cm onto the cleaned wound.

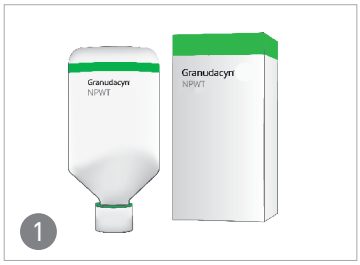


2 B. Clean the wound or apply onto the wound with a soaked compress.

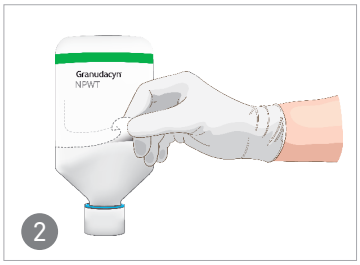


3. Suitable to be combined with standard wound dressings.

Granudacyn can be used for instillation with NPWT (negative pressure wound therapy).



1. Take NPWT bottle out of packaging.



2. Release carrying handle from label and pierce bottle.

3. Hang the bottle on carrying handle on the installation device.

Can be used for moistening the wound dressing and moisturising the wound itself as well as for loosening encrusted wound dressings

Granudacyn®

- Cleans the wound mechanically
- Is free of microorganisms and pH neutral
- Is not cytotoxic and non-irritating
- Is hypotonic
- Is free of heavy metals
- Reduces wound malodor
- Solution with shelf life of 24 months
- First choice for peritoneal lavage
- Can be applied on CNS tissue, cartilage and bone
- Well suited for cavities and fistulas
- Can remain in the wound
- No special disposal requirements
- Available in solution, spray, gel and NPWT format

Product information

Product	Size	Product code	Shelf life	Pcs/box
Granudacyn Wound irrigation solution	50ml spray	360150	24 months	20
	250ml spray	360100		15
	500ml	360101		12
	1000ml	360102		6
Granudacyn Wound gel	50g	360107	18 months	12
	100g spray	360108		12
	250g spray	360106		15

Proving it every day

At Mölnlycke®, we deliver innovative solutions for managing wounds, improving surgical safety and efficiency, and preventing pressure injuries. Solutions that help achieve better outcomes and are backed by clinical and health-economics evidence.

In everything we do, we are guided by a single purpose: to help healthcare professionals perform at their best. And we are committed to proving it every day.

References:
1. In-vitro suspension test (EN13727, EN 13624, EN 13704, EN 14476 – phase 2) with Granudacyn® wound irrigation solution.
2. Consensus on Wound Antisepsis: Update 2018, Skin Pharmacol Physiol 2018;31:28–58, DOI: 10.1159/000481545.
3. Fukuzaki, Biocontrol Science,2006,Vol.11,No.4,147-157.
4. Method Ph.Eur. 2.2.35, test conducted by BIOSERV Analytik- und Medizinprodukte GmbH, Rostock, Germany.
5. Method according to EN 1040 tested by Labor LS SE & Co. KG, Bad Bocklet, Germany. 6. Harnoss et al., Wound Rep Regen, 2018; 1-7.

www.molnlycke.com.au | www.molnlycke.co.nz

Mölnlycke, 12 Narabang Way, Level 4, Belrose, NSW, 2085. Phone 1800 005 231. New Zealand Orders & Enquiries 0800 005 231, www.molnlycke.co.nz.

Mölnlycke®