



# VINKOCIDE™ SR 1 VINKOCIDE™ SR 3

- system cleaners for biofilm removal in industrial supply systems and production -

## Technical Data Sheet

### PRODUCT FEATURES

**Vinkocide™ SR** products are highly effective system cleaners with excellent cleaning properties. Mud, bacterial slime, clumps of fungi and yeast colonies are detached, container and pipelines are cleaned even in inaccessible places.

- ▶ All-in-one cleaner with a broad range of applications
- ▶ Good cleaning efficacy
- ▶ Economic usage
- ▶ Only short interruption of production
- ▶ Easy to rinse off
- ▶ Contain bio dispersants

Although some biocides may have an additional cleaning effect, most do not. In such cases, disinfection will not lead to a solution of the problems, but sometimes to rapid regrowth of biofilm instead.

**Vinkocide™** system cleaners effectively remove biofilms from surfaces and prevent new contamination of the system caused by shedding from mature biofilms. Existing biofilms are infiltrated, which leads to the detachment of the destabilized films. This can reduce the regular use of in-can biocides.

### MODE OF ACTION

These innovative system cleaners have short use times and high efficiency. In contrast to standard products, the time for cleaning cycles should be reduced by combining steps like biofilm treatment and removal, and the biomass rinsed off the system. The aim is to significantly reduce the usual cleaning times and downtimes.

**Vinkocide™** system cleaners contain surfactants as cleaning and reinforcing components. Other ingredients are acid (Vinkocide SR 3) or alkali (Vinkocide SR 1). The cleaners also contain bio dispersants to detach and bind biofilms and remove them from the system. This prevents a recontamination from deposition of the abraded biofilms. Booster substances intensify the efficiency as biofilm remover.

Additionally, they can be combined with fast acting biocides to kill the microorganisms within the detached biofilm as well as of residuals of them on the surfaces.



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## SUSTAINABILITY

Biocidal products are indispensable for the high standard of health and hygiene in our society, they ensure and improve the quality of products and industrial processes. Biocidal products protect goods and help to maintain the value of products. Any incorrect, overdosed or unnecessary use of biocidal products should be prevented. Biocidal products should be used to achieve optimal results and a long-term efficacy while reducing potential risks to health and environment.

System cleaners improve production hygiene in the sense of "best practice" and help to reduce and optimize the use of biocides for in can preservation.

## APPLICATION NOTES

**Use dilution:** 10% to 20% as appropriate.

**Use directions:**

1. Pre-clean the contaminated system with water to remove product residues.
2. Fill the system to be cleaned with Vinkocide SR 1 System Cleaner using the appropriate dilution (10% to 20% depending on the level of contamination) and circulate within the system for 4 hours.
3. The amount of solution should be at least 10% of the volume to be cleaned.
4. Then empty the system and flush with water for about 1 hour.
5. Fill the system to be cleaned with Vinkocide SR 3 System Cleaner in the appropriate dilution (10% to 20% depending on the level of contamination) and circulate within the system for 4 hours. Vinkocide SR 3 can be combined with 1% of Vinkocide DBNPA 20. Then follow steps 3 and 4.

**Material compatibility:** In the tests performed, System Cleaners were used as 20% solution in water. The test ran for 22 days at room temperature and daily rotation of the beakers. In practice, the cleaning procedure will not take longer than 8 – 12 hours (e.g. overnight cleaning).

Both cleaning solutions show a good compatibility with stainless steel and plastic materials. Using Vinkocide SR 3, a brownish discoloration of plastic tubes (esp. soft silicon and polyethylene) is possible. Cracks or damages on plastic tubes were not observed. Using Vinkocide SR 1, no visual effects to the tubes could be observed. Sealing materials (vulcanized fiber, rubber sealing) were swollen during a long-term test.

Copper was corroded and carbon steel was etched by SR 3.

Copper in contact with SR 1, shows a small layer (blushing). No effects were noticed on carbon steel.



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**Storage:** Prevent from freezing and keep away from high temperatures and direct sunlight. Store in original containers at room temperature.

Packaging: 25 kg, 200 kg, 1000 kg  
Shelf life: 6 months

These notes reflect current experience and our best knowledge. Individual conditions can lead to variations in performance. Therefore, we do not take any liability for the use of the products.

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## WHAT IS A BIOFILM?

Biofilms are dynamic heterogenous microbial communities of bacteria and fungi surrounded by a protective slime matrix. Microorganisms can attach to surfaces and produce an extracellular polymeric matrix (EPM) to enable a strong attachment and protection from external attack. The biofilm will grow and mature as the organisms grow, divide and metabolize.

Biofilms are ubiquitous. It is thought that more than 99% of the microorganisms on earth live in aggregates. Such aggregates can differ widely, ranging from microcolonies or films on surfaces ("biofilms"), flocs ("floating biofilms") to sludge. The cells can live in close associations at high densities and are embedded in an organic matrix of biopolymers, the so-called extracellular polymeric substances (EPM) which are produced by the organisms themselves. In everyday life, they are known as "slime". Biofilms are the first form of life recorded on earth, dating back over 3.5 billion years and they also are the most successful form of life.

Characteristic components of the EPM are polysaccharides, proteins, nucleic acids, and lipids. EPMs are involved in the formation of a three-dimensional, gel-like, highly hydrated and locally charged (often anionic) biofilm matrix, in which the microorganisms are more or less immobilized. However, the organisms are able to communicate with each other. EPM also prevents molecules, like biocides, penetrating the biofilm matrix.

Biofilms can have detrimental effects in the human environment when occurring in the wrong place and/or wrong time. Biofilms can be involved in the destruction of the materials they colonize; these processes are described as biocorrosion or biodeterioration. The damage of biofouling is very difficult to assess, but even crude estimates amount to many millions of Euro every year in industrialized countries. Biofilms are involved in all kinds of biofouling, for example in cooling water systems they cause increase in resistance to heat energy transfer, increase in fluid frictional resistance, or acceleration of metallic corrosion.

Biofilms are known to exert enhanced resistance to biocides; they are 10 to 1 000 times less susceptible towards a wide variety of different antimicrobial agents than are the corresponding planktonic cells.



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Laboratory tests have shown that suspensions of bacteria like *Staphylococcus*, *Streptococcus*, *Pseudomonas* or *Escherichia coli* typically;

- Attach to a surface within a few minutes
- Build strongly attached micro colonies within 2–4 hours
- Build EPM and show increased tolerance against biocides within 6–12 hours
- Develop within 2-4 days a mature biofilm, which is extremely resistant against biocides and releases flowing bacteria
- Quickly recover from mechanical destruction and build new biofilms within 24 hours.

### EFFICACY TESTS

Based on the standards of DIN/EN, ASTM and EHEDG a 3-step test was designed, including static and dynamic phases as well as field tests.

#### Static Tests

Test strips from stainless steel and glass were used, following the test protocols of ASTM G1. Over 4 weeks biofilms (algae, aerobic and anaerobic bacteria, mixed cultures) were grown on these test stripes according to ASTM E2799 and EHEDG Doc. 15. The system cleaners were dropped onto the test stripes (250 µl) and rinsed with water after 5 minutes. Control stripes were also cleaned under running water without mechanical action. The efficacy was proven with epifluorescence microscopy.

Vinkocide SR 3 showed a convincing biofilm removal on steel. At 10 % no more biofilm could be detected. Vinkocide SR 1 was more effective on glass.

#### Stainless steel:

Control



System Cleaners.

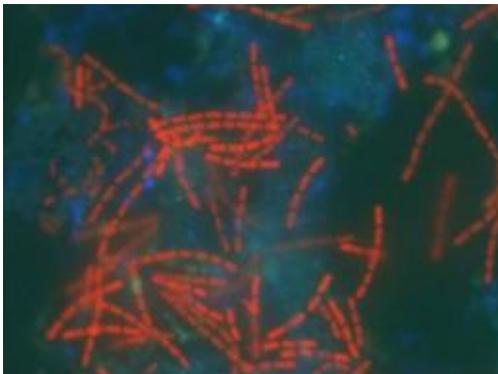


Vinkocide SR 3 shows an excellent removal of the biofilm. It also removes corrosion products.

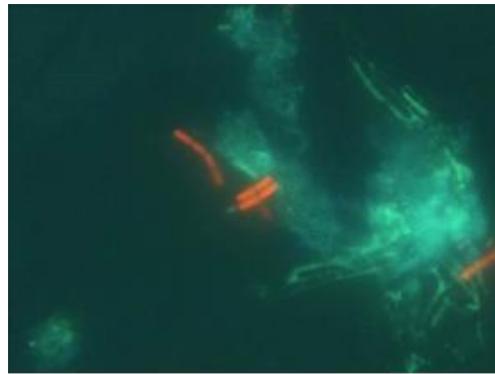
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### Glass:



600x, control: filiform cells fixed with bacterial EPM.



600x, Vinkocide SR 3: footprints of the removed algae in the EPM.

### **Dynamic Tests (a mini plant)**

The mini plant was built of two separate, but identical circuits in which bacterial and algae biofilms were grown over 10 weeks. For the circuits different materials were used, including silicon and PVC. In all cases the growth of biofilm was strongest on PVC. The system cleaners were tested in several test series, which differed in concentration and time. The test implements the EHEDG- Guidelines Doc. 2 in a circuit-test running a circuit with system cleaner and a reference circuit without cleaner.

### Example of a test:

- Running of the mini plant with algae and bacteria in 3 parallel cycles, photo documentation
- Preparation of the cleaners and the biocide (Vinkocide SR 1 and SR 3 each 20% proportion DPNBA 1%)
- Weighing of the hoses and switch to the container with the cleaners
- Circulation of the cleaners / biocide for periods of 90 minutes and 16 hours
- Photo documentation, weighing of the hoses
- Rinsing off the hoses with water for 1 hour
- Photo documentation, weighing of the hoses

### Results:

- The thickness of the residual biomass increases from Vinkocide SR 1 to Vinkocide SR 3 and to pure DPNBA solution.
- With DPNBA alone massive deposits remain.
- After system cleaner usage a high lethality can be observed in the residual biofilms.
- With DPNBA alone the lower layers of the biofilms are not killed, DPNBA does not penetrate the biofilm.

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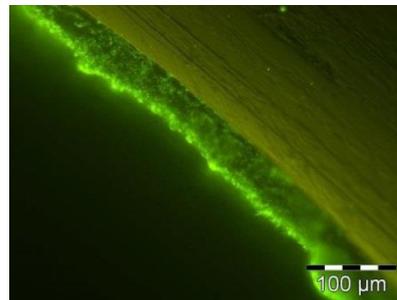
- The system cleaners show a better penetration, the biocide can get deeper into the biofilm.

Vinkocide SR 1:



Massive discharge of biofilm

Vinkocide SR 3 + DBNPA:



Dead cells are marked all over the biofilm, SR 3 penetrates the biofilm matrix.

During the first test run of 90 minutes, biofilm removal from the contaminated tubes was visually observed in the beginning and biofilm residues were floating in the outgoing cleaner solutions. Using an overnight cleaning procedure, the biofilm removal effect was significant.

Discharge of biofilm:

Vinkocide SR 1



Vinkocide SR 3



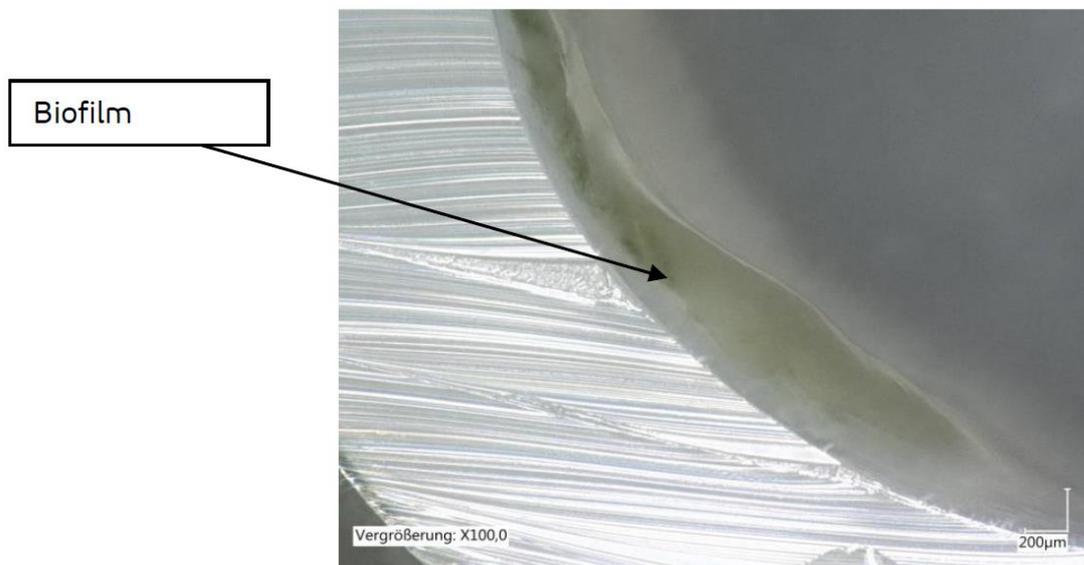
The efficacy of Vinkocide SR 3 + DBNPA can be characterized by the destruction of the EPM and of the cell structures. Dead biomass is produced and largely discharged. The removal of biofilms is better from metal surfaces than from plastics.

Best results of biofilm removal gave up to 96.4% biomass output, which was obtained with a combination of both cleaners. The efficacy is independent from the sequential arrangement, which should be specified according to the pipe materials.

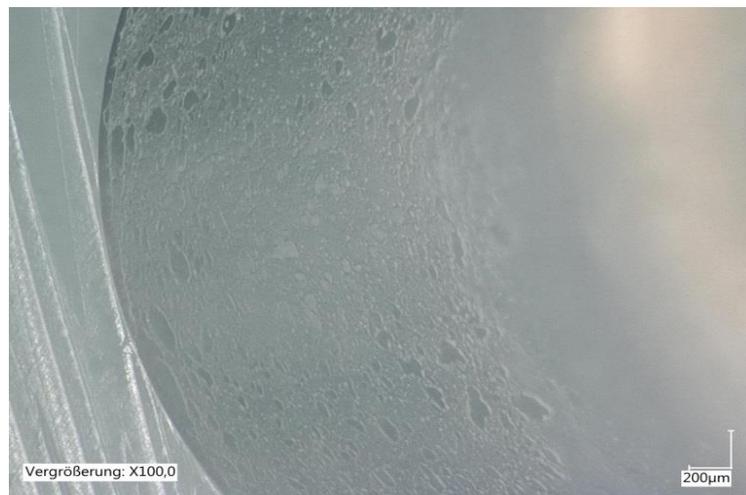
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Also, a 6 months old biofilm in the same test unit confirmed the excellent efficacy of the cleaners. 10% dilution of System Cleaners were circulated for just one hour and then flushed with water. The biofilm could be removed apparently totally.



Tube with biofilm on the walls



Tube after cleaning: free of biofilm

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## Field tests

Vinkocide SR 3 has been tested at a 10% dilution in a system consisting of a storage tank and a circulating pipeline system of about 22 – 25 m<sup>3</sup>. Samples of surfaces were taken before and after cleaning. This included the surface in the upper part of the storage tank and a valve at the bottom which represented a “dead end” with practically no circulation. Consequently, there were still relevant amounts of bacteria present after cleaning. From this valve also, small amounts of residual water were taken.

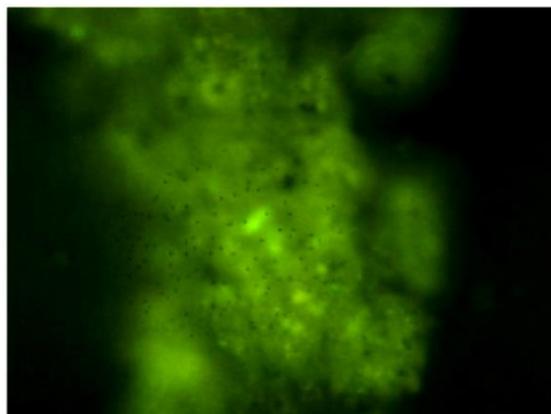
### Test A:

Sample	Caso	Sabouraud
Water from valve before cleaning	Very strong growth of bacteria	
Water from valve after cleaning	200 000 cfu/ml	-
Agar plate storage tank before cleaning	Strong growth of fungi	
Agar plate storage tank after cleaning	Very few bacteria	
Agar plate valve before cleaning	Strong growth of bacteria	
Agar plate valve after cleaning	Few bacteria	

cfu = colony forming units

The cleaned surfaces showed a clear reduction of bacterial counts on the surface after cleaning with Vinkocide SR 3.

The used cleaner solution was examined with microscopy. Parts of removed biofilm, slime, bacteria and fungal spores could be seen:





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### **Test B:**

The use of the system cleaners SR 1 and SR 3 resulted in an obvious reduction of the biofilm, which could be flushed out of the system. Compared to flushing with water only, the use of SR 3 did not just remove the biofilm, but also reduced the microbial count to below of the detection limit.

The cultures from swab samples and liquid samples showed a significant reduction of cultivable microorganisms following the use of SR 1/ SR 3. Especially with the "final flushing ", huge biofilm particles were released, which were no more cultivable.

Water sample after use of SR 1 / SR 3 and flushing with water:



Massive discharge of biofilm, no growth of microorganisms

Our recommendations regarding our products are given in good faith, but imply no corresponding liability. Our Conditions of Sales and Supply apply in all other respects.

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