**AQUCAR™ MEM 20 Water Treatment Microbiocide**

2,2-Dibromo-3-nitrilopropionamide (DBNPA)

CAS Reg. No. 10222-01-2

EINECS No. 2335397

Non-Oxidizing Biocide to Reduce Biological Fouling in Reverse Osmosis (RO) Systems for Industrial Water Production and off-line cleaning of RO membranes producing potable and municipal water.

**General**

![Image of Reverse Osmosis System](Photo courtesy of Inalsa)

Biofouling of RO membranes is a common problem for many membrane filtration systems that source water from open ocean intakes, sea water wells, brackish river water and other surface waters that contain naturally occurring organic matter. The limiting factor to biofouling control is the incompatibility of the polyamide thin-film composite RO membrane to chlorine exposure, as well as exposure to other oxidizing chemicals commonly used for process water disinfection.

DBNPA may be used to control bacteria and reduce biofouling in various membrane system types (reverse osmosis, ultra-filtration, nano-filtration, and microfiltration) used for industrial water processing. Acceptable industrial applications include reverse osmosis systems for the production of boiler make-up water for electric power production, electronic component rinsing, and in chemical manufacturing industry. DBNPA can also be used for off-line cleaning of RO membranes producing potable and municipal water.

**AQUCAR™ MEM 20 Water Treatment Microbiocide** is for use in RO systems in the industrial market and for off-line cleaning of RO membranes producing potable and municipal water. **It is important to note that AQUCAR MEM 20 Water Treatment Microbiocide is NOT approved for on-line use in RO systems that produce potable and municipal water.**

**Note:** Due to regional differences, 20% DBNPA for industrial RO systems is approved and marketed in Europe under the product name of AQUCAR DB 20 Water Treatment Microbiocide. In other approved regions of the world it is marketed under the name AQUCAR MEM 20 Water Treatment Microbiocide.
The following are typical properties of AQUCAR™ MEM 20 Water Treatment Microbiocide; they are not to be considered product specifications.

Active ingredient (%): 20% by weight
Inert ingredients: Polyethylene glycol and water
Color: Colorless to brown
Appearance: Liquid
Odor: Odorless to mild
Freezing point: < -50°C (per ASTM D-97)
Boiling point: > 70°C for solution, but active ingredient decomposes prior to boiling
Freeze-Thaw stability: Passed 7 cycles at -15° to 20°C
Specific gravity: 1.20-1.30 g/mL @ 23°C
Vapor pressure: 18.9 mmHg @ 25°C

AQUCAR MEM 20 Water Treatment Microbiocide is an aqueous formulation containing 20% (w/w) concentration of DBNPA (2,2-Dibromo-3-nitrilopropionamide). When properly applied to the RO feed water systems, AQUCAR MEM 20 Water Treatment Microbiocide is:

- Fast-acting, non-oxidizing biocide
- Effective against a broad spectrum of microorganisms
- Completely miscible with water upon dispersion at end-use levels

DBNPA, the active ingredient in AQUCAR MEM 20 Water Treatment Microbiocide, has proven efficacy at low concentrations against bacteria, fungi, yeast, cyanobacteria (also referred to as blue-green algae) and true algae. The DBNPA molecule will function immediately upon introduction into the feed water and antimicrobial control is rapidly achieved if properly dosed.
Because of its extremely rapid kill, proliferating microbes and their biofilm formation on RO membranes and in feed channel spacers is reduced significantly. The low persistence of DBNPA minimizes safety and environmental concerns with water discharge and atmospheric emissions.

When added to an RO system, DBNPA is rejected by the thin-film composite membrane layer, and at use dilution, shows excellent compatibility with all materials of construction of the RO membrane module. DBNPA has been used with great success in industrial water applications such as boiler make-up water for electric power generation, electronic component washing, in electroplating industry and also in chemical industry for polymer solutions. DBNPA can be used for off-line cleaning of RO membranes producing potable and municipal water as long as the system is rinsed completely to remove AQUCAR™ MEM 20 Water Treatment Microbiocide prior to using the elements for potable and municipal water production.

Biofouling of the RO membranes can involve a variety of added expenses that contribute to the total cost in producing water – increased energy to drive the high-pressure feed water pumps, chemicals and waste disposal for RO element cleaning, new RO element installation, penalties for lost production, contract laboratory assistance and technical consultation, and increased addition of pretreatment chemicals. AQUCAR MEM 20 Water Treatment Microbiocide offers an opportunity to reduce and/or eliminate many of these added cost items.

**Dosage Requirements**

**On-line Application for RO Membranes Producing Water for Industrial Uses**

AQUCAR MEM 20 Water Treatment Microbiocide may be added to the RO feed water at a rate of 1 to 100 ppm based on the feed water flow rate (0.1 to 10 fl. oz./min. per 1000 gallons/min. feed water, or 0.8 to 80 mL/min. per cubic meter/min. of feed water). Apply product to the service cycle feed water on a regular basis using an addition cycle of at least 30 minutes. The frequency of addition may be daily or as necessary in order to maintain RO productivity performance. For highly fouled systems, a 100 ppm dosage should be applied each day for several hours until the system performance has recovered.

**Note:** In The Netherlands, Antimicrobial 7287 is approved for on-line cleaning at 2.5 to 50 mL per 1000 liters feed water. Dosing is maintained until the system is under control.

Do not add AQUCAR MEM 20 Water Treatment Microbiocide in the presence of sodium bisulfite or other reducing agents which are commonly added to the feed water of the membrane system. Addition of any reducing agents must be suspended at least 15 minutes prior to the addition of the product in order to avoid neutralization and deactivation of the active ingredient.

**Off-line Cleaning of RO Membranes Producing Water for Industrial Uses**

AQUCAR MEM 20 Water Treatment Microbiocide may be added to the feed tank used for an off-line cleaning procedure. Addition should be at a rate of 20 to 200 ppm based on the total amount of solution in the feed tank (2 to 20 fl. oz. per 1000 gallons, or 16 to 160 mL per cubic meter). Following the complete transfer of feed solution, re-circulate or soak for 1 to 3 hours to ensure sufficient contact for all RO membrane modules with the DBNPA solution. Frequency of addition should be every 5 days or as needed.
Note: In The Netherlands, Antimicrobial 7287 is approved for off-line cleaning (shock dosing) at 25 to 250 mL per 1000 liters feed water, 1-3 times per week. Repeat until the system is under control.

Add AQUCAR™ MEM 20 Water Treatment Microbiocide separately to the feed tank system. Do not mix with other chemical additives as this may result in rapid decomposition of the product due to the high pH of many additive formulas. It is important to thoroughly rinse the feed tank system so it is free of any high pH chemicals prior to introducing AQUCAR MEM 20 Water Treatment Microbiocide.

Off-line Cleaning of RO Membrane Systems Producing Potable and Municipal Water

AQUCAR MEM 20 Water Treatment Microbiocide can be added to the feed tank used for an off-line chemical cleaning procedure. Addition should be at a rate of 20 to 200 ppm based on the total amount of solution in the feed tank. Following the complete transfer of feed solution, re-circulate or soak for 1 to 3 hours to ensure sufficient contact of all RO membrane modules with the DBNPA solution. Frequency of cleaning should be based on extent of fouling or as needed. A moderately biofouled system could be cleaned once every week.

Note: The RO system should be completely rinsed with permeate quality water until concentration of residual DBNPA in final rinse water is below 40 ppb when measured by N, N-Diethyl-p-phenylenediamine (DPD) colormetric test method.

Due to regional differences in regulatory requirements, it is the responsibility of the user to confirm in their respective region that all regulatory approvals are obtained prior to use of AQUCAR MEM 20 Water Treatment Microbiocide in off-line cleaning of RO systems producing potable and municipal water.

Note: Add AQUCAR MEM 20 Water Treatment Microbiocide separately to the feed tank system. Do not mix with other chemical additives as this may result in rapid decomposition of the product due to the high pH of many additive formulas. Do not use heated water with product in the feed tank for cleaning RO membranes producing potable and municipal water as this may degrade the biocide. It is important to thoroughly rinse the feed tank system so it is free of any high pH chemicals prior to introducing AQUCAR MEM 20 Water Treatment Microbiocide.

Equally important to ensuring a reliable, accurate delivery of AQUCAR MEM 20 Water Treatment Microbiocide is a successful tie-in to the process logic controller to suspend the addition of sodium bisulfite and/or any other reducing agents used for feed water pre-treatment. It is imperative to initiate this step at least 15 minutes prior to the addition of the product. Failure to coordinate the timed addition of AQUCAR MEM 20 Water Treatment Microbiocide with the stoppage of sodium bisulfite will result in the deactivation of the DBNPA molecule.

DBNPA offers an advantageous combination of quick kill properties followed by fast chemical degradation, including hydrolysis. The dominant degradation pathway at use conditions involves reactions with nucleophilic substances or organic material invariably found in water. Nucleophilic degradation forms cyanoacetamide. When the disposal of concentrate involves the release to large open waterways, additional degradation will occur via exposure to UV-radiation. When sufficiently diluted, DBNPA and its degradation products become biodegradable. The ultimate degradation products formed from both chemical and biodegradation processes of DBNPA include ammonia, carbon dioxide, and bromide ions. Therefore, meeting the local environmental regulations for the permitted discharge of the...
reject stream should not be affected with DBNPA use. However, compliance with local environmental regulations is the responsibility of the end-user.

**Note:** Reverse Osmosis (RO) concentrate streams should not be discharged to lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the local regulatory authorities. Discharge of RO concentrate streams to sewer systems may require approval of the local sewer treatment plant authority.

AQUCAR™ MEM 20 Water Treatment Microbiocide is available in different size drums, pails and IBC totes.

**Use Instructions for Various RO Membrane Systems**

*AQUCAR MEM 20 Water Treatment Microbiocide should not be used for On-line Application for RO systems producing potable and municipal water.*

1. AQUCAR MEM 20 Water Treatment Microbiocide may be used for on-line, service cycle addition of all membrane systems (microfiltration, ultra-filtration, and nano-filtration) that are used to pre-treat the feed water to either a BW or SW membrane RO membrane system that produces industrial water.

2. AQUCAR MEM 20 Water Treatment Microbiocide may be used for on-line, service cycle addition in any RO systems producing industrial water. It can be used for seawater (SW) or brackish water (BW) membrane type. The product can be used continuously or on an intermittent usage basis as required to maintain the performance of RO membranes.

3. AQUCAR MEM 20 Water Treatment Microbiocide may be used for off-line addition as part of a chemical clean-in-place (CIP) treatment in RO and NF-type membrane systems producing water for industrial applications.

4. AQUCAR MEM 20 Water Treatment Microbiocide may be used for off-line cleaning of RO membrane systems producing potable and municipal water as long as the membranes are rinsed completely to remove residual product prior to potable and municipal water production.

**Note:** Do not add AQUCAR MEM 20 Water Treatment Microbiocide in the presence of sodium bisulfite or other reducing agents commonly added to the feed water of the RO systems. The addition of any reducing agents must be suspended at least 15 minutes prior to the addition of product in order to avoid neutralization and deactivation of the active ingredient.

**Note:** Add AQUCAR MEM 20 Water Treatment Microbiocide separately to the feed tank system. Do not mix with other chemical additives as this may result in rapid decomposition of the product due to the high pH of many additive formulations.
Dow Microbial Control encourages its customers to review their applications of Dow Microbial Control products from the standpoint of human health and environmental quality. To help ensure that Dow Microbial Control products are not used in ways for which they are not intended or tested, Dow Microbial Control personnel are willing to assist customers in dealing with ecological and product safety considerations. Contact your representative if you need any assistance or information. When considering the use of any Dow product in a particular application, review the latest Safety Data Sheet and country-specific product label to ensure the intended use is within the scope of approved uses and can be accomplished safely. Before handling any of the products mentioned in the text, obtain available product safety information and take necessary steps to ensure safety of use.

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