

PowerOxide™ - MD **Modified Formula From PowerOxide™ Certified to ANSI 60** **Instructions for Use**

Description

PowerOxide™ MD is a two-component kit for production of ~0.2% chlorine dioxide solution – multi-purpose disinfectant with high efficacy against bacteria, protozoa, fungi and viruses (from 99.9% to 99.9999%, depends on the type of microorganism or virus and concentration of solution). Each PowerOxide™ MD kit consists of two powder components – Component A and Component B, which are both intended to be mixed in water to produce chlorine dioxide gas that will instantly dissolve in water.

Please review the MSDSs of both PowerOxide™ MD components prior to use, and follow the safety precautions for preparation of chlorine dioxide solution.

WARNING:

The two PowerOxide™ MD components should never be combined dry. It may result in the release of high concentration chlorine dioxide gas, which can cause fires. If two the components are mixed dry accidentally, immediately add a generous amount of water.

For the same safety reason Osorno does not favour the production of one component chlorine dioxide powder or tablet.

Never allow any part of the body to get in contact with concentrated solution of chlorine dioxide; do not inhale chlorine dioxide fumes. Avoid solution agitation or splashing, because this will cause the release of chlorine dioxide gas from water solution.

Preparation of Concentrated Solution

- Always use **cold or room temperature** water to prepare chlorine dioxide solution, and follow these instructions.
- Always use the complete contents of a kit – never use the components only in part! Please ensure that the proper ratios are used!
- Always wear protective clothing – gloves, goggles, respirator with 3M 6006 NIOSH filter for ClO₂, filter, and apron.
- Please follow chemical preparation instructions listed in the table below.

PowerOxide™ Kit	Preparation of Concentrated Chlorine Dioxide Solution
For 1 litre	<p>Prepare a 250 ml container for components dissolution and a 1 l bottle (HDPE or glass with tight cap) for mixing and storing of the chlorine dioxide solution. Label the bottle for concentrated chlorine dioxide solution accordingly.</p> <ul style="list-style-type: none">• Dissolve the content of the package marked “Component A” in water filled in 250 ml container. Upon complete dissolution, transfer the solution into the 1 l bottle.• Fill the 250 ml container with water and transfer that water to the 1 l bottle.

	<ul style="list-style-type: none"> • Dissolve the content of the container marked “Component B” in 250 ml of water. Upon complete dissolution, transfer the solution into the 1 l bottle that already contains the Component A solution and the previously added water. • Fill the 250 ml container with water and transfer the water to the 1 l bottle with already added components.
For 4 litres	<p>Prepare a 1 l container for components dissolution and a 4 l jug (HDPE or glass with tight cap) for mixing and storing of the chlorine dioxide solution. Label the jug for concentrated chlorine dioxide solution accordingly.</p> <ul style="list-style-type: none"> • Dissolve the content of the package marked “Component A” in water filled in 1 l container. Upon complete dissolution, transfer the solution into the 4 l jug. • Fill the 1 l container with water and transfer that water to the 4 l jug. • Dissolve the content of the container marked “Component B” in 1 l of water. Upon complete dissolution, transfer the solution into the 4 l jug that already contains the Component A solution and the previously added water. • Fill the 1 l container with water and transfer the water to the 4 l jug with already added components.
For 20 litres	<p>Prepare a 4 l container for components dissolution and a 20 l delcan (HDPE) for mixing and storing of the chlorine dioxide solution. Label the delcan for concentrated chlorine dioxide solution accordingly.</p> <ul style="list-style-type: none"> • Dissolve the content of the package marked “Component A” in water filled in 4 l container. Upon complete dissolution, transfer the solution into the 20 l delcan. • Fill the 4 l container with water and transfer that water to the 20 l delcan. Repeat this action to add 4 l second time. • Dissolve the content of the container marked “Component B” in 4 l of water. Upon complete dissolution, transfer the solution into the 20 l delcan that already contains the Component A solution and the previously added water. • Fill the 4 l container with water and transfer the water to the 20 l delcan with already added components.
For 80 litres	<p>Prepare a 20 l delcan for components dissolution and an appropriate drum that will fit 80 l chlorine dioxide solution for mixing and storing (100 l drum HDPE drum will work). Label the drum for concentrated chlorine dioxide solution accordingly.</p> <ul style="list-style-type: none"> • Dissolve the content of the package marked “Component A” in water filled in 20 l delcan. Upon complete dissolution, transfer the solution into the prepared drum. • Fill the 20 l delcan with water and transfer that water to the drum. Repeat this action to add 20 l of water second time. • Dissolve the content of the container marked “Component B” in 20 l of water. Upon complete dissolution, transfer the solution into the drum that already contains the Component A solution and the previously added water. • Fill the 20 l delcan with water and transfer the water into the drum with already added components.

PowerOxide™ MD solutions are ready to use within 30-60 minutes after preparation. The reaction time may be longer (up to 3 hours) if the water is cold (less than 20°C). ***The full strength of the solution will***

be achieved within 2 days. The prepared chlorine dioxide solution must be stored in dark place. The concentration of chlorine dioxide will be stable for about 3 weeks, than it will start decreasing.

Applications

1. **Drinking Water Disinfection in animal husbandry.** The concentration of the injected product can vary, but it is not recommended to exceed a dosage of 1.2 mg/l of chlorine dioxide. **It is important to remember that low concentrations of chlorine dioxide (for example, 0.25 mg/l) are already able to destroy E. coli within a few minutes. In terms of disinfection efficiency and speed, chlorine dioxide is far superior to chlorine.**
 - a) PowerOxide™ - MD is typically applied in emergency situations where large quantities of water need to be disinfected in a short period of time, or as an interim solution when a chlorine dioxide generator is not available.
 - b) PowerOxide™ - MD can be used on a regular basis for the disinfection of farm drinking water if water consumption is relatively low.

The injection rate of chlorine dioxide depends on the rate of disinfectant consumption by the water and type of the injection pump. If medicators are used for the injection of chlorine dioxide, then the concentrated solution must be diluted. E.g. if a medicator is set for 1:128 dosing rate and the required injection rate is about 2 mg/l of chlorine dioxide, then the concentrated solution should be diluted. The dilution rate will be 1: 7 (1 part of concentrated PowerOxide™ solution in 6 parts of water).

NOTE: Please inquire regarding the dilution rate of the concentrated solution if different dilution rate is required. Osorno personnel will assist with calculations.

2. **Disinfection of the distribution system when the barn is empty.** In this case the recommended dosing rate of chlorine dioxide is a minimum 5 mg/l. When the required concentration is reached at the end of the distribution, leave water in the pipes for maximum of 1 hour. After one hour, decrease the injected concentration of chlorine dioxide to 2-3 mg/l, open the taps at the end of the distribution and let the water run while chlorine dioxide is injected. Open each tap and nipple in the distribution gradually and let disinfected water run for at least 10 minutes through each open port. Repeat this procedure for all taps and nipples in the barn. When disinfection is finished, close the taps at the end of the distribution and switch to normal operation.
3. **Disinfection of the well (replaces shock chlorination).** The recommended target concentration is a minimum 10 mg/l of chlorine dioxide (applicable concentration depends on the water composition and condition of the well). In order to verify the required amount of PowerOxide™ MD concentrated solution, calculate the volume of water in the well. If target concentration is 10 mg/l, each 100 l of water will require 500 ml of PowerOxide™ MD concentrated solution. Pour calculated amount of chlorine dioxide on the top of the water surface. Use the well pump to circulate water in the well until the disinfectant will be distributed evenly throughout the whole water column (avoid splashing and agitation, insert hose for water return below the water surface). Let the chemicals stay in the well for about 2-4 hours, then waste from the well until no chlorine dioxide is detected¹.
4. **Disinfection of hard surfaces.** Chlorine dioxide is a universal disinfectant that can be used for not only the disinfection of water, but also for the disinfection of hard surfaces and air. The concentration of stock solution for surface disinfection should be between 100 and 200 mg/l. If PowerOxide™ MD concentrated solution is used for surface disinfection, then it has to be diluted either 1:20 (1 part of chemical in 19 parts of water) or 1:10 (1 part of chemical in 9 parts of water) respectively. Prepared stock solution can be filled into sprayer bottle and applied on surfaces. For efficient disinfection, the surface must be completely moist (20-50 ml per 1 m²). Let moisture to dry. Do not wipe surface after drying.

1 For chlorine dioxide testing can be used InstaTest stripes high or low range. Osorno can provide them upon request.

NOTE: It is important to know that chlorine dioxide is a gas (with a yellow-reddish colour) that easily dissolves in water, which stays in water as a gas, and should the solution be agitated, chlorine dioxide will escape from the water into the air. This is why it is important to wear protective clothing (respirator with 3M 6006 NIOSH filter for ClO₂, goggles and apron) while chlorine dioxide is sprayed on surfaces. A portion of the chlorine dioxide will escape into the air during the surface spraying. After spraying allow the surface to dry. Washing of surfaces is not required. Chlorine dioxide will decompose to sodium chloride – ordinary salt. Remember that chlorine dioxide may bleach clothing! **During surface disinfection it is strongly recommended to remove people and domestic animals from the premises.** People and animals can return back to the premises 1-2 hours after disinfection is finished.

5. **Disinfection of air.** The disinfection of air is a very complicated procedure (in terms of safety) and should be demonstrated by a professional at least once before personally performing it. For this application the volumes of the rooms that are to be disinfected must be calculated. The required concentration of chlorine dioxide will depend on the purpose of the application – disinfection for the elimination of viruses, bacteria, and fungi, or the neutralization of organic smells (cat urine, cigarette smoke, etc.). The minimum concentration required for disinfection, (e.g. inactivation of the Influenza A virus) should be 0.3 mg/m³ (0.1 mg/l)², the maximum recommended concentration for domestic application should be about 8 mg/m³. **As an example can be used volume of 100 m³. For inactivation of Influenza A virus in volume of 100 m³ will be required 30 mg of chlorine dioxide, which in case of PowerOxide™ MD correspond to 15 ml of concentrated solution.** Air disinfection with chlorine dioxide can be carried out in two ways: airing of chlorine dioxide out of a water solution or fumigation. The efficiency of disinfection will heavily depend on the humidity and temperature inside the target area. The humidity must be above 60% and the temperature should be above 18°C.

NOTE: It is important to remember that chlorine dioxide is a gas that easily dissolves in water, but stays in the water as a gas, and should the water solution be agitated, chlorine dioxide will escape from the water into the air. The amount of chlorine dioxide gas that escapes from water increases with the increase in concentration of the chlorine dioxide solution. In solutions with concentrations above 100 mg/l, chlorine dioxide gas will slowly release by itself. This is why, it is important to keep concentrated solutions tightly sealed and wear protective clothing (respirator or full face mask with 3M 6006 NIOSH filter for ClO₂ applications, goggles, and an apron) when the container is open and while air disinfection with chlorine dioxide is being performed. **During air disinfection, all people and domestic animals must be removed from the premises being disinfected, the ventilation system must be switched off in order to reach the maximum effect.** People and animals can return back to the premises 3-4 hours after disinfection is finished. The ventilation system must be switched ON immediately once the premises are populated again.

2 OSHA regulations - in the final rule, OSHA is retaining the 0.1-ppm 8-hour TWA and adding a 15-minute STEL of 0.3 ppm for chlorine dioxide. Jan 19, 1989