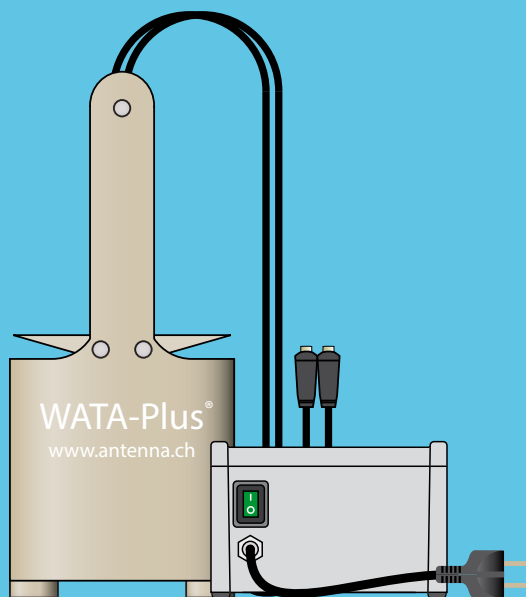


WATER AND HYGIENE

WATA-Plus[®]

OPERATING INSTRUCTIONS

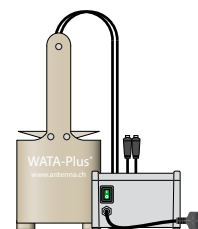


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This guide explains how to use the WATA-Plus® electrolyser to produce a sodium hypochlorite solution with a 0.6% concentration of active chlorine (6 g/L) that can be used for water treatment or disinfection purposes. The WATA-Plus® produces a sodium hypochlorite solution by electrolyzing salt water. All that is needed are clear water, salt and electricity to use the WATA-Plus®. Water is chlorinated by adding a dose of sodium hypochlorite to potentially contaminated water, thereby destroying at least 99%* of pathogenic microorganisms in approximately 30 minutes.

1. PRESENTATION



The WATA-Plus® produces 15 litres of sodium hypochlorite solution in 4 hours, which can treat up to 60 000 litres of water, meeting the drinking water needs of 15 000 people (4 L/person/day).

The WATA-Plus® works with direct current and consumes a nominal power of 180 W.

AC/DC power supply provided to hook up to the grid:

- ▶ Input voltage: 90–264 VAC
- ▶ Input frequency: 47–63 Hz
- ▶ Input current: 2 A / 230 VAC
- ▶ Output voltage: 12 VDC
- ▶ Nominal output current: 29.2 A

For utilisation with solar power, a pair of DC cables with a connector is provided to allow direct connection to a solar unit (see section 5).

- ⚠ **The device should be used only by a responsible person familiar with this user guide.**
- ⚠ **The sodium hypochlorite solution can be corrosive and irritating when in contact with skin, eyes, mucosa and airways, causing cough and other breathing difficulties. In case of accidental contact, rinse with clear water. Do not inhale or ingest.**
- ⚠ **Store the sodium hypochlorite solution in an opaque, clean, labelled and well-sealed flask, out of the reach of children. Keep the flask in a cool and shady place.**
- ⚠ **Use the sodium hypochlorite solution within 24 hours following its production.**
- ⚠ **Never use metal containers for the procedure or for storage.**
- ⚠ **Do not use or store near fire, flames or sparks.**
- ⚠ **During maintenance, do never rub the titanium plates.**

2. NECESSARY MATERIALS

- ▶ WATA-Plus® kit
- ▶ Ordinary salt
- ▶ Clear water
- ▶ Funnel
- ▶ Plastic container holding approximately 25L
- ▶ Wooden/plastic table

3. RECOMMENDATIONS FOR THE PRODUCTION OF SODIUM HYPOCHLORITE

⚠ Choose one or several people to be responsible for production

These persons should be trained and possess a general knowledge of chemistry. Production with the WATA-Plus® involves more than just adding salt to water. Failure to follow indicated procedures will lead to excessive energy consumption that will adversely affect the proper functioning and life span of the power supply.

⚠ Some precautions at the electrical level

The box containing the power supply should be put in a dry area away from splashing water and should always remain closed, especially when the WATA-Plus® is in use. **It should be placed as far as possible from the chlorine vapours and never placed at ground level.** It should be opened only by qualified persons with electrical training after the power supply has been unplugged. The electrical voltage in the electrolysis bath involves no risk of electrocution for the user. However, precautions should be taken regarding access to the device only by authorized persons. Furthermore, salt and chlorine are not good for electrical devices, so rinse your hands/gloves before handling the power supply.

⚠ Choose an appropriate area and time for production

Only those persons specially trained in using the WATA-Plus® should use it. Owing to significant emissions of hydrogen (a highly flammable gas) produced during electrolysis, when the WATA-Plus® is in use, the device should be kept far from fire, flame and sparks. In addition, it is advisable not to inhale the chlorine emissions, which are also produced during electrolysis, and to work in a well-ventilated room. **Production should be carried out in a ventilated area with a temperature between 25 and 30°C**, protected from dust and the sun's rays. In countries with a hot climate, it is best to work early in the morning or in the evening, when temperatures are lower.

⚠ Target output and concentration

The WATA-Plus® uses electrolysis of salt water at **25 g/L** (375 grams of salt per 15 litres of water) to produce a sodium hypochlorite solution with a **6 g/L** concentration of active chlorine. Failure to follow these parameters could lead to a poor quality production or a damaged power supply.

⚠ In case of unstable current, use a voltage regulator

If the power grid is subject to intermittent outages or sudden voltage dips and surges (fluctuations in the intensity of light emitted by the bulbs provide sufficient evidence that this is occurring), the power supply could be destroyed. If this is the case, use a voltage regulator. Likewise, if a generator has a large variation in operating regimes, it is advisable to use a voltage regulator.

⚠ Use with a generator

The generator should not run out of fuel while the WATA-Plus® is in use. Ensure that the tank is full before starting production. Wait until the generator is stable before plugging in the WATA-Plus®. When the procedure is complete, first unplug the WATA-Plus®'s power supply and then turn off the generator.

⚠ Respect the prescribed production volumes.

The recommended volume of each production run is 15L.

⚠ Overheating of the power supply

If overheating occurs, the power supply will automatically shut off and then restart when its internal temperature falls below 70°C. However, it is advisable to stop the procedure and allow the power supply to cool down for 15 minutes.

⚠ Respect the 6 g/L concentration

The WATA-Plus® is designed to produce a sodium hypochlorite solution with a 1 to 6 g/L concentration of active chlorine. The concentration must not exceed 7 g/L. Prolonged use or excessive salt will result in raising the temperature of the bath, not in increasing concentration. If this occurs, there is a risk of damaging the power supply and/or not achieving 6 g/L concentration. Use WataTest® to measure concentration once the procedure is complete.

⚠ Water temperature for production

To begin the procedure, use water with a temperature between 20 and 27°C. Check the temperature using a clean thermometer.

⚠ Use a log book

To facilitate the monitoring of chlorine production and to trace the origin of any problems that might arise, use a log book to record, each time the WATA-Plus® is used, the name of the person responsible for production, the starting and finishing times of production and a short description of the procedure. You'll find examples in the «tool kit» on our website, www.antenna.ch.

⚠️ Regularly check production

Production should be checked at least every hour or more frequently. Watch for bubbles in the solution; this is proof that electrolysis is working properly. Make sure that the power supply does not overheat. Check the temperature of the solution. A high temperature causes a loss of efficiency during the production of active chlorine. If there is a possibility that dust or other substances could fall into the solution, cover it with a mosquito net type lid. This will allow the gas to escape and, if the area is well ventilated, to dissipate.

⚠️ Precautions

Do not bend the power cables.

⚠️ Maintenance and repair

Do not attempt to perform electrical repairs if you are not competent to do so. Contact Antenna or a specialist who will help you or refer you to appropriate services. If the power supply or device is defective, we recommend to dispose them in proper treatment plants, for appropriate recycling.

⚠️ Failure to comply with the operating instructions described in this manual will void the warranty.

4. WATER QUALITY

The initial quality of the water used affects the efficiency of the sodium hypochlorite production and the efficacy of the water disinfection. The main parameters characterizing the initial quality required for the water are pH and turbidity.

PH

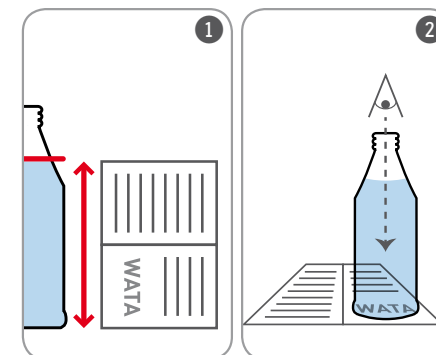
The pH is a measure of a solution's acidity or alkalinity on a scale from 0 to 14, with a pH of 7 indicating a neutral solution (such as pure water), <7 indicating an acid solution (such as lemon juice) and >7 indicating an alkaline solution (such as soap). The pH affects chlorine's ability to destroy microbes and viruses. Based on World Health Organization recommendations*, to effectively disinfect water with sodium hypochlorite, the water used should have a pH between 6.5 and 8.5. It is therefore recommended to measure pH.

TURBIDITY

Turbidity measures the opacity of a liquid. Turbidity of water is caused by the presence of solid particles in suspension (clay, sand, bacteria, chemical or metallic residues, etc.) that make the water cloudy. Water with an elevated turbidity could lead to the formation of undesirable products during the production of sodium hypochlorite. During the chlorination process, elevated turbidity could diminish the treatment's efficacy. Following recommendations in the Sphère Handbook**, to guarantee optimal efficiency in producing sodium hypochlorite and chlorinating drinking water, **the water used should measure less than 5 units of turbidity (NTU).**

For more than 5 units of turbidity, when the water is mildly turbid (<30 units of turbidity), a double dose of sodium hypochlorite can be used, and when the water is even more turbid (>30 units of turbidity), it must be filtered and/or decanted and then disinfected with a double dose of sodium hypochlorite. **However, it is absolutely necessary to verify that residual chlorine remains in the water 30 minutes after disinfection (see chapter 10).** If it is not possible to use a turbidity meter, we suggest an alternative, though imprecise, method to measure turbidity.

To determine whether the water can be used to produce sodium hypochlorite or to chlorinate drinking water, fill a water bottle to the height of this manual when it is open and in a vertical position ①. Then place the bottle over the WATA® logo and look at it from above through the bottle ②. If you can read the WATA® logo through the water, this means the water measures less than 5 units of turbidity.



⚠️ There should be ample illumination but the light should not be blinding. The bottle should be transparent, colourless, clear and without scratches or dirt. A flat-bottomed bottle is preferable. Since it is not always possible to meet all of these conditions, catching a slight glimpse of the WATA® logo is acceptable.

WATA®

5. SOURCES OF ELECTRICITY/ENERGY

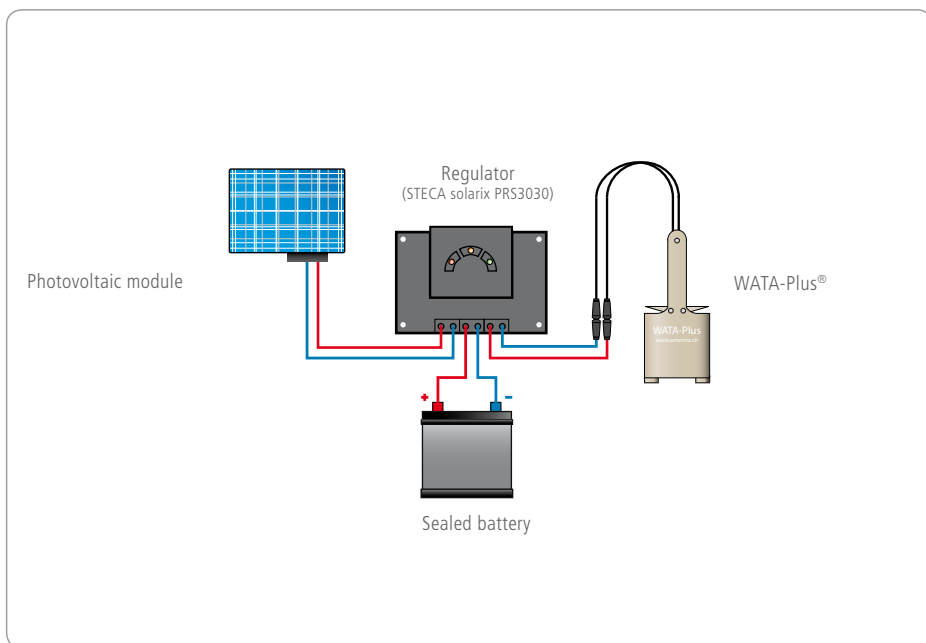
The WATA-Plus® can operate with a number of different power supply options.

USING THE POWER GRID

To use the device with a power grid or an alternating current generator, simply plug in the power supply provided.

USING A SOLAR MODULE

For use with a solar module: Since the energy generated by a solar electric panel varies depending on the amount of sunshine, it is strongly recommended to use a solar module (see diagram) whose regulator will supply constant energy to the WATA-Plus® and protect your battery, ensuring that the sodium hypochlorite solution is produced in the necessary conditions. The size of the solar panel always depends on the amount of solar radiation at the point of use. The battery should function with 12 VDC.



To determine the size of your solar module (solar electric panel, battery and regulator), we recommend that you consult a specialist. To give an idea of what is required, the tables below show approximately the capacity of the battery and peak power of the solar panel that are necessary depending on your needs and on the amount of solar radiation.

SOLAR MODULE: CHOOSING THE BATTERY, CAPACITY NEEDED [AH]

	Minimum capacity needed for a lead-acid battery (12 V) with a depth of discharge of 50%
1 production run of 15L per day	120 Ah
2 production runs of 15L per day	240 Ah

SOLAR MODULE: CHOOSING THE SOLAR ELECTRIC PANEL, PEAK POWER NEEDED [WC]

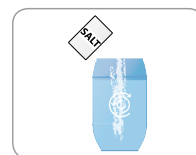
Daily solar radiation at the place of use*	7 kWh/m ² /d	5 kWh/m ² /d	3 kWh/m ² /d
1 production run of 15L per day	157 Wc	222 Wc	369 Wc
2 production runs of 15L per day	314 Wc	444 Wc	738 Wc

* For an example, refer to the following website site: <https://eosweb.larc.nasa.gov/>

6. PROCEDURE FOR PRODUCING SODIUM HYPOCHLORITE SOLUTION

The production of sodium hypochlorite solution differs according to the quality of the salt used. If the salt is pure or refined, follow procedure 6.1. If it is coarse or dirty, follow procedure 6.2.

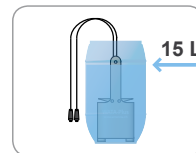
6.1 PREPARING THE SOLUTION FOR ELECTROLYSIS WITH PURE OR REFINED SALT (15L BASE)



1 Pour 15 litres of clear water into a clean plastic container.

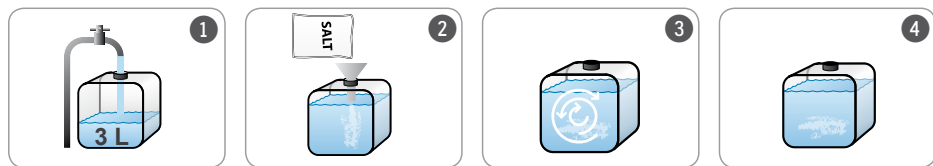
2 Add 375 grams of refined salt.

3 Mix thoroughly until the salt is completely dissolved.

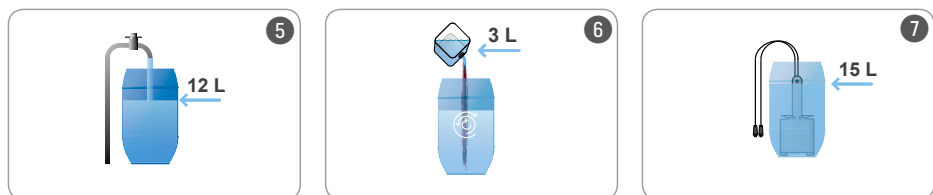


4 Immerse the body of the WATA-Plus® in the salt water. The device should be completely submerged.

6.2 PREPARING THE SOLUTION FOR ELECTROLYSIS WITH COARSE OR DIRTY SALT (15L BASE)



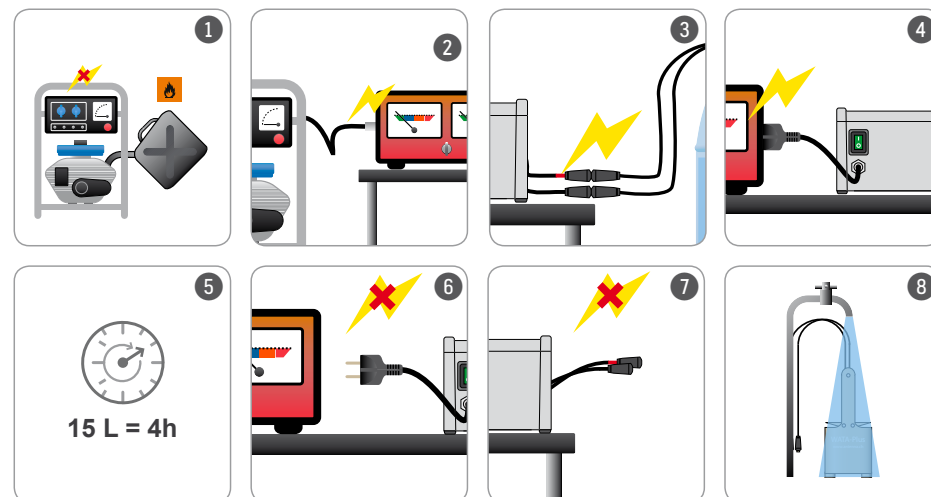
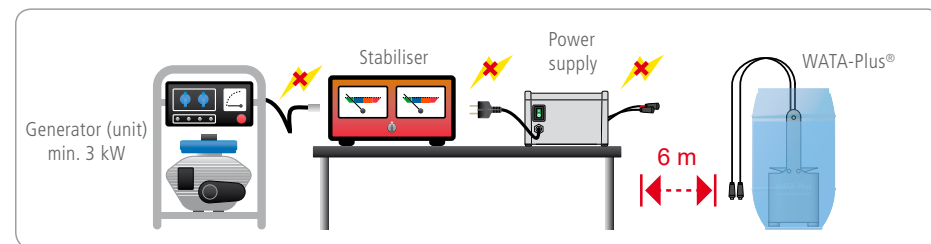
- 1 Pour 3 litres of clean water into a clean plastic container.
- 2 Add 375 grams of salt.
- 3 Regularly shake/mix for 15 minutes so that the maximum amount of salt dissolves.
- 4 Allow the salt's impurities to settle at the bottom of the container. At this point, the salt is dissolved in the water.



- 5 Pour 12 litres of water into a plastic container (never use metal).
- 6 Place a filter (e.g. a coffee filter or a clean, very finely-woven cloth) over the container and add the 3 litres of water containing the pre-dissolved salt. Mix well.
- 7 Immerse the body of the WATA-Plus® in the salt water: the handle should remain out of the water, but the body of the device should be completely submerged.

6.3 INSTALLING AND CONNECTING THE WATA-PLUS® DEVICE

- ⚠ You are advised to install a stabiliser between the power source and the 12 V/29.2 A power source. Have the electrical system's stability inspected by a specialist.
- ⚠ Using a diesel generator (or generator unit), the recommended minimum power is 3 kW/kVA.
- ⚠ The power source must be located as far as possible away from the water-production container, so as to protect it from the highly-corrosive chlorine vapour. The power source must not be laid on the ground. Ideally, it should be placed in a room other than the chlorine production room.



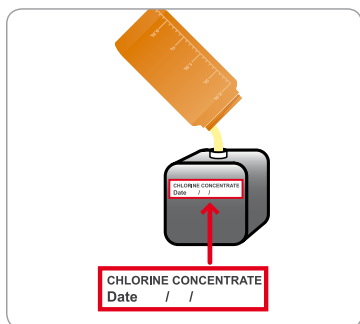
- 1 Fill the fuel tank full and turn on your diesel generator (if you are using the mains electricity network, go directly to point 2).
- 2 Connect a current stabiliser to the 120/230 V (alternating current) electrical power socket, and switch it on.
- 3 Connect the WATA-Plus® device to the 12 V/29.2 A power supply.
- 4 Connect the 12 V/29.2 A power source to the stabiliser and turn the power source's green switch to on.
- 5 Wait 4 hours to generate 15 litres of sodium hypochlorite solution (6 g/L).
- 6 At the end of the process, turn the power source green switch to off. Disconnect the 12 V/29.2 A power supply from the stabiliser.
- 7 Remove the WATA-Plus® device from the bath, and then disconnect the 2 WATA-Plus® cables. Turn the stabiliser's switch to off.
- 8 Unplug the stabiliser from the wall socket. Rinse the WATA-Plus® device in clean water, then store it out of harm's way in a dry place. Protect it by covering with a clean cloth.

6.4 WATA-PLUS® MAINTENANCE

After each use, rinse the WATA-Plus® with clean water. With time, white deposits (limestone) might appear on the electrodes. To clean them, prepare a solution of 50% vinegar and 50% clean water. Use a bucket of about 10 litres and prepare approximately 6 litres of a solution composed of 3 litres of vinegar and 3 litres of water. The titanium plates must be completely immersed in the solution. Let the device soak in the vinegar solution for at least 24 hours and then visually inspect the condition of the device (the limestone deposits have disappeared). Rinse with clean water. Never rub the titanium plates.

7. STORAGE AND STABILISATION

7.1 STORAGE



Store the sodium hypochlorite solution in a clean, tightly-closed, opaque, non-metallic container, and label it with the production date. Place the container in a cool place, out of the reach of children. Do not expose to sunlight.

⚠ Sodium hypochlorite can keep for 24 hours without any need for testing. After that time has elapsed, measure the concentration with the WataTest® and adapt the dilutions accordingly.

7.2 STABILISING THE CHLORINE SOLUTION

⚠ To use a sodium hypochlorite solution produced by the Maxi-WATA® electrical chlorinator device after more than 24 hours, we propose a stabilisation method using caustic soda (NaOH).

This new process requires the use of a pH meter or pH testing strips. Laboratory skills and equipment are also required, but the process ensures a six-month minimum storage life. Information about this procedure is available at www.antenna.ch

⚠ If you would like to produce sodium hypochlorite for the purposes of distributing it in vials, stabilisation will be required. You must comply with legislation effective in the country where you operate. A quality control procedure validated by the local authorities must be implemented.

8. MEASURING ACTIVE CHLORINE CONCENTRATION WITH WATATEST®



It is essential to test the quality of the sodium hypochlorite solution produced in order to determine the dosage to apply depending on its use.

The WataTest® reagent allows to perform this control easily and quickly. Please refer to the WataTest® user's manual.

9. USING A SODIUM HYPOCHLORITE SOLUTION TO CHLORINATE DRINKING WATER

⚠ It is important to chlorinate only water of sufficient quality, i.e. with a turbidity of less than 5 units, and a pH between 6.5 and 8.5 (see section 4). If the water is muddy, cloudy or coloured, it is crucial to filter or clarify it beforehand.

The dose of active chlorine to add to the water so as to make it drinkable depends on how contaminated the water is initially. To ensure that 99% of pathogenic organisms are destroyed 30 minutes after chlorination, it is sufficient to check whether any residual chlorine remains in the water. For this purpose, we propose a pragmatic method that is ideal for visual checking using the WataBlue® reagent to determine whether a sufficient quantity of residual chlorine remains in the water.

To guide you for the first dosage, we recommend a dose of 1.5 mg/L of sodium hypochlorite. At this dose, 1 litre of sodium hypochlorite at a 6 g/L concentration produced by the WATA® device can be used to treat approximately 4,000 litres of water, if the initial water quality is compliant with the above-mentioned turbidity and pH criteria.

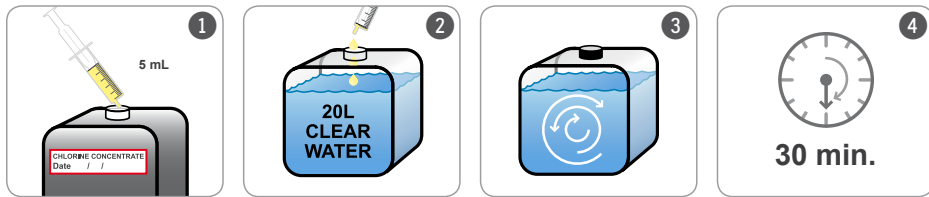
- ⚠ Drinking water must contain between 0.5 et 1 mg/L of free residual chlorine.**
- ⚠ The treated water must be stored in a clean, opaque, closed tank.**
- ⚠ Chlorination must be performed under the supervision of a qualified person.**

**INDICATIVE DOSAGES FOR CHLORINATING DRINKING WATER
DEPENDING ON THE CONCENTRATION PRODUCED BY WATA:**

		Volume of water to be disinfected		
		10L	20L	100L
Active chlorine concentration using the WataTest®	3 g/L	5.0 mL	10.0 mL	50.0 mL
	4 g/L	3.8 mL	7.5 mL	37.5 mL
	5 g/L	3.0 mL	6.0 mL	30.0 mL
	6 g/L	2.5 mL	5.0 mL	25.0 mL
	7 g/L	2.1 mL	4.3 mL	21.4 mL

⚠ It is absolutely necessary to test for residual chlorine using the WataBlue® test 30 minutes after chlorinating your drinking water. Only this test result will guarantee protection against waterborne diseases.

EXAMPLE OF CHLORINATION FOR 20L OF DRINKING WATER



- 1 Using a small syringe, collect 5 mL of your sodium hypochlorite solution.
- 2 Add 5 mL of sodium hypochlorite per 20L of plain water.
- 3 Shake vigorously (for chlorinating a water tank, add the sodium hypochlorite to the half-full tank, then add the rest of the water).
- 4 Wait 30 minutes for the sodium hypochlorite to act to inactivate the microbes.
- 5 Test for the presence of residual chlorine using the WataBlue® reagent.

**10. TESTING DRINKING WATER
WITH WATABLUE® (DETERMINATION
OF RESIDUAL CHLORINE)**



It is important to test the concentration of residual chlorine to protect the treated water against a possible recontamination and to avoid a strong taste of chlorine.

The WataBlue® reagent test determines the concentration of residual chlorine in the treated water. Please refer to the WataBlue® user's manual.

11. USING THE SODIUM HYPOCHLORITE SOLUTION FOR DISINFECTION/CLEANING

Disinfection is a process that eliminates pathogenic organisms, designed to halt or prevent infection by microorganisms.

PREPARING DISINFECTANT SOLUTIONS AT HOME

Use	Advised concentration of chlorinated solution	Vol. of sodium hypochlorite equivalent to a concentration of 6 g/L	Vol. of water	Procedure
Washing hands	0,5 g/L	1	10	Rub hands with the chlorinated solution for 30 seconds; allow to dry.
Floors (including floors and walls of latrines)	0,8 g/L	1	6	Wash with chlorinated solution; leave in contact for 5 min., then rinse.
Washing food and fresh vegetables	0,05 g/L	1	100	Soak food items in the chlorinated solution for 5 min., rub, and then rinse.
Dishwashing	0,5 g/L	1	10	Rinse the dishes in the chlorinated solution and then wash as usual.
Clothing / laundry	0.2 g/L	1	30	Soak garments in the chlorinated solution for 5 min then rinse carefully. Do not use chlorine to disinfect wool, silk or nylon.

PREPARING DISINFECTANT SOLUTIONS AT HEALTH CENTRES

⚠ Surgery and sterilisation : disinfection by sodium hypochlorite is not sterilisation. Surgical instruments must be sterilised in an autoclave or a Poupinel sterilising oven.

Use	Advised concentration of chlorinated solution	Vol. of sodium hypochlorite equivalent to a concentration of 6 g/L	Vol. of water	Procedure
Washing hands	0,5 g/L	1	10	Clean and dry the hands, then rub with the chlorinated solution for 30 seconds; allow to dry.
Disinfecting wounds (Dakin's solution) only with chlorine at 6 g/L	6 g/L	1	-	Use the solution pure, on a clean compress applied directly to the wound.
Floors (including floors and walls of latrines)	2 g/L	1	2	First sweep the floors and wash them with soap and water. Next apply the chlorinated solution for 10 min., then rinse and allow to dry.
Clothes, gowns and bed linen	2 g/L	1	2	Soak the clothes in the chlorinated solution for 10 min., rinse then wash as usual. Hang out to dry.
Containers and objects	2 g/L	1	2	Soak in the chlorinated solution for 10 min., then rinse and dry.

⚠ The sodium hypochlorite must be diluted in cold water.

⚠ Never mix the sodium hypochlorite solutions with soap, detergents or other household cleaning products, since mixing with strong acids generates chlorine gas fumes.

All the scientific references used in compiling this manual are available on request. Kindly translated by Translators Without Borders.

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