Research for Progress
ANTENNA TECHNOLOGIES

Antenna-WATA

Frequently Asked Questions (FAQ)

GENERALITIES

Whom are Antenna-WATA devices addressed to?

Antenna-WATA devices are mainly addressed to large NGOs which are active in the field of water and humanitarian emergency, small local NGOs, hospitals and community clinics. Antenna Technologies also diffuses the devices within small rural communities. These projects are always supported by training and education programs.

Why is it useful to produce chlorine on the site of use?

Producing chlorine on the site of use avoids most storage and transportation problems. Whatever its chemical form, chlorine is rather difficult to store (it is very corrosive and instable) and its transportation is submitted to numerous restrictions (it can cause fires or explosions).

In which other forms is active chlorine available?

Sodium hypochlorite (NaClO) is available as a liquid. Being unstable, large distributors add it with a stabilizer (this mix is bleach). Calcium hypochlorite ($Ca(ClO)_2$) is available as tablets or granules, but is highly corrosive and reactive. Dichlorine (Cl_2) is commercialised pressurized (liquid) in metallic cylinders. Its transportation is dangerous and its use requires specific infrastructures.

When diffusing Antenna-WATA devices within small rural communities, which accompanying measures are provided?

When Antenna Technologies diffuses Antenna-WATA devices within communities which are not accustomed to water chlorination, training programs on water chlorination and water quality control are provided. A special effort is also made to sensitize on the protection of water sources. If needed, measures can be proposed and implemented for the protection of water resources.

How much does it cost to produce potable water with Antenna-WATA?

The price of electricity and the quality of water have considerable variations from one country to another, as well as within a single nation. It would therefore be very hazardous to advance a given cost of drinking water production with Antenna-WATA. The figures advanced below thus only show an order of magnitude. Some data can nevertheless give some elements of answer:

- After the initial investment, the costs generated by using Antenna-WATA devices are limited to electricity, salt and the purchase of adequate recipients.
- If chlorine production and distribution is performed on a professional basis, one should expect extra labour costs.
- For an average quality of water, one litre of concentrate enables to disinfect 4'000 litres of contaminated water.
- According to the WHO, the daily needs in drinking water are 15 litres per person per day in average.
- Producing one cubic metre of drinking water requires 0.01 kWh of electricity with a Mini-WATA, and 0.012 kWh with WATA or Maxi-WATA.

For example, only taking into account the price of electricity in France (0.1085 €/kWh), the indicative price – without initial investment – of one litre of active chlorine concentrate is below 0.01 Euro. Thereby, the energy required for producing drinking water for a community of 1000 people during one month costs about 1 Euro. To this, one has to add the liquidation of the devices (about 2 euros) and the cost of 3kg of salt needed for the production of active chlorine.

What is saturated brine and why is it needed?

Saturated brine is a solution in which the largest amount of salt has been possibly dissolved. Water has a salt dissolution capacity of 360 g/l which is pretty constant regardless of the temperature. This means that when one tries to dissolve very large quantities of salt in a given volume of water, only the amount corresponding to the dissolution capacity is actually dissolved. When this limit is reached, the solution is known as saturated. From there on, grains of salt remain at the bottom of the recipient.
Antenna-WATA devices can guarantee their production rate of active chlorine only if the initial salt concentration in water is precisely 25 g/l. The smaller the volume to electrolyse, the larger is the risk of salt over-dosage. Yet, if no precision scale is available, it is difficult to measure the 37.5 grams of salt which are necessary when using a Mini-WATA in a 1.5 litre bottle. It is therefore much easier and safer to add 120 ml of saturated brine with a syringe. One thus kills two birds with one stone because salt over-dosing in the water to be electrolysed with a Mini-WATA could damage both its electrodes and its electric alimentation (the solution's conductivity increases with the salt concentration).

What is the difference between WATA and WATALYS?

WATA is the original device described in the international patent WO 2005/044739 A1 registered by Antenna Technologies. WATALYS is a non-permitted copy sold by Bulane, a commercial company based in Geneva. Antenna Technologies has decided not to bring this case before the court because it has neither time nor means to do it.

FUNCTIONING OF ANTENNA-WATA DEVICES

How do Antenna-WATA devices work?

To work, Antenna-WATA devices only require clear enough water, salt and electricity. Once immersed into the salty water and connected to an adequate electric source, the electrolysis begins. This transforms the dissolved salt (sodium chloride) into active chlorine (sodium hypochlorite).

Which electric sources can be used for the correct functioning of Antenna-WATA devices?

Mini-WATA:

a) Standard power supply: Mini-WATA is supplied with its 5V / 1A transformer, which can simply be plugged to the electric network.

b) Solar power supply: an adaptor is fixed to the device, which enables its direct coupling with a 10 watts photovoltaic panel. For such a use, please contact first Antenna Technologies.

WATA:

a) Standard power supply: WATA works with any 12V source of direct current (DC), which is able to deliver at least 4 amperes. It can be a battery charger (or any other transformer) plugged into the electric network, or a car battery. In that case, it is important to recharge it after every 5 hours of functioning (for a 75 Ah battery) and not to let it unload beyond 50% of its total capacity (voltage under 11.5 V). It is therefore essential to get a voltmeter in order to check that the charged battery delivers minimum 13 volts. Make sure that the battery is connected to the WATA when measuring its voltage with the voltmeter.

b) Solar power supply: WATA can be coupled with a photovoltaic panel of minimum 50 watts. Under this configuration, it must be connected to a charge regulator, itself connected to a car battery (see user guide). For such a use, please contact first Antenna Technologies.

Maxi-WATA:

Maxi-WATA is supplied with a 720 watts transformer delivering the 30 amperes of direct current which are required for its functioning. Therefore, the transformer only has to be connected to the electric network.

How important is the quality of the water used for the electrolysis?

The water used for the electrolysis must be clear enough. Indeed, using water that is muddy or heavily concentrated in fluoride may reduce the electrodes' lifetime. Therefore, if the water is cloudy, it is necessary to filter it or to let the dirt deposit before using it for the electrolysis.

How many litres of drinking water can be treated with Antenna-WATA?

Mini-WATA:

Mini-WATA produces 1.5 litre of active chlorine concentrate in 12 hours. Therefore, working continuously, it produces 3 litres per day. For an average quality of water, this enables producing about 10'000 litres of drinking water per day. According to WHO standards (15 l/per/day), this covers the daily needs in drinking water for more than 600 people.

WATA:

WATA produces 1 litre of active chlorine concentrate per hour. Therefore, working continuously, it can produce 24 litres per day. For an average quality of water, this enables

producing about 90'000 litres of drinking water per day. According to WHO standards, this covers the daily needs in drinking water for 6'000 people.

Maxi-WATA:

Maxi-WATA produces 25 litres of active chlorine concentrate in 2 hours. Therefore, working continuously, it produces 300 litres per day. For an average quality of water, this enables producing about 1'200'000 litres (1200 m^3) of drinking water per day. According to WHO standards, this covers the daily needs in drinking water for 80'000 people.

Why is a battery needed when using a WATA with solar panels?

The intensity (amperes) of the electric current provided for the electrolysis with Antenna-WATA has to be as constant as possible, in order to guarantee a concentration of 6 g/l of active chlorine in the solution produced. Photovoltaic cells can hardly deliver such a constant current intensity, it is therefore necessary to make use of a battery simultaneously to using a solar alimentation (as shown in the user guide). This way, the current intensity's variations are buffered and passing clouds, for example, thus don't reduce the device's production rate.
If you intend using a WATA or Mini-WATA with solar alimentation, please contact Antenna Technologies.

How long can Antenna-WATA devices be used for?

All three models of Antenna-WATA devices are guaranteed for at least 20'000 hours of functioning under normal conditions. In practice, if they are properly used and well maintained, their lifetime is even longer.

How long can the chlorine concentrate be stored for?

Active chlorine is very sensitive to light. The sun's ultraviolet (UV) rays destroy it rapidly. To a lesser extent, air can also reduce the concentrate's quality. It is therefore very important to store the solution produced with Antenna-WATA in closed and opaque recipients, and to keep them in the shade. Under these conditions, the active chlorine concentrate can be conserved during 4 weeks without any problem, and then be used for drinking water chlorination or for disinfection. Be aware that a recipient full of concentrate can be conserved longer than one that is half empty (the air in the recipient slowly oxidises the solution).

What is the WataTest reagent?

The WataTest reagent is a non-toxic product recently developed by Antenna Technologies which enables the fast and inexpensive measurement of the concentration of sodium hypochlorite in the solution produced with Antenna-WATA. It is particularly useful to people whose business is to produce and sell active chlorine for drinking water chlorination or disinfection purposes. For them, it is essential to be able to guarantee the desired concentration of sodium hypochlorite of 6 g/l in the solution they sell.
The WataTest reagent is still on its field-testing phase. It is therefore given for free to any owner of an Antenna-WATA who asks for it.

CHLORINATION OF DRINKING WATER

What is drinking water chlorination?

Water chlorination consists in the addition of a given dose of active chlorine into potentially contaminated water, in order to kill all germs and pathogens. The dose added depends on the initial water quality. The disinfectant properties of chlorine are due to its strong oxidant power. About 30 minutes after mixing, all the germs are killed and the water is potable.
It is important to treat clear water only. If it is muddy, cloudy or coloured, it must imperatively be filtered before chlorination. It is also possible to wait until all water particles deposit at the bottom of the recipient (sedimentation).

Against which diseases is chlorination efficient / inefficient?

Chlorine efficiently destroys the quasi-totality of pathogenic germs. It is therefore efficient for fighting against diarrhoeas, dysenteries, cholera, typhoid fever, salmonellosis and hepatitis A. On the other hand, it is inefficient against the cryptosporidium parasite and certain worm cysts (helminthes).

Is chlorination efficient against heavy metals and other chemical pollutants of water?

No, chlorine is a disinfectant, which means that it destroys and inactivates living germs which are source of diseases (bacteria, viruses and parasites). Chlorine cannot purify chemically contaminated water (pesticides, heavy metals, drugs...).

Why should one always leave residual chlorine in drinking water?

The World Health Organization (WHO) recommends leaving about 1 mg/l of chlorine (called residual chlorine) in drinking water. The residual chlorine is measured 30 minutes after the chlorination process. This enables 1- to be sure that all germs are eliminated and 2- to have a security margin against a new contamination after treatment. This security margin is only valid as long as the treated water is stored in a clean and closed recipient.

How can residual chlorine be tested?

Various colorimetric tests for measuring residual chlorine in drinking water are sold on the market. On one hand, there are paper strips that must be dipped in the water to be tested. On the other hand, there are DPD (diethyl-para-phenylene diamine) tablets which react when dissolved into a small volume of water. Comparing the colour of the reaction with a sample of control colours tells the residual chlorine concentration. However, the paper strips have shown not to be reliable enough, whereas DPD tablets are very costly and toxic.
Antenna Technologies therefore recently developed a new reagent, called **ATblue** reagent, which enables a very reliable measurement of residual chlorine in drinking water at extremely low cost.

What is the ATblue reagent?

The **ATblue** reagent is a product recently developed by Antenna Technologies which enables a very reliable measurement of residual chlorine in drinking water at extremely low cost. About 1200 times cheaper than DPD (diethyl-para-phenylene diamine) tablets, one single drop of **ATblue** reagent in a test tube tells instantaneously if the treated water fulfils the WHO standards for residual chlorine in drinking water. While it is being validated, Antenna Technologies provides all Antenna-WATA users with this reagent.

The **ATblue** reagent also has the advantages of being absolutely non-toxic and potentially stored during several months without loosing its reliability, unlike DPD which is highly toxic and which must by stored in a cool and dry place during maximum one month.

What are the other methods to make potable water?

Besides chlorination, the main water disinfection methods are:

- *Sand filtration*: requires sand, implementation and maintenance are complex
- *Solar UV treatment*: only efficient on a very small scale
- *Clay filtration*: fragile and only efficient on very small scale
- *Boiling*: efficient on a small scale and large energy consumption (especially wood and coal)
- *Non-chlorinated chemical treatments (silver salts, bromine, ozone, etc)*: numerous disadvantages such as high costs, danger for health and / or risky handling
- *Treatment with UV tubes*: expensive equipment, very low flow.

What are the advantages of chlorination over other methods?

The main advantages of chlorination are its low cost and the comparatively little infrastructures it requires. Moreover, the residual chlorine provides a security margin against a new contamination by pathogenic micro-organisms, which is not the case with other drinking water disinfection methods. Also, only chlorination enables an absolutely reliable quality control.

What are the advantages of Antenna-WATA over solar water disinfection methods such as the SODIS process?

Disinfection of drinking water with solar UV radiations is a widely used method in developing countries. Relatively inexpensive, it is however efficient on a very small scale only. Indeed, plastic bottles of maximum 2 litres shall be exposed to sunlight during 6 to 48 hours - depending on the weather - in order to disinfect drinking water from pathogenic micro-organisms. On the same time basis, Antenna-WATA enables disinfecting thousands of litres of drinking water. Therefore, for equivalent volumes, Antenna-WATA induces a much lesser workload and also a lower production cost. Moreover, chlorination enables an immediate, inexpensive and totally reliable quality control.

DISINFECTION WITH ACTIVE CHLORINE CONCENTRATE

Whom is the disinfection with active chlorine addressed to?

In the first place, it is useful to hospitals and other health clinics. Disinfection with active chlorine can indeed drastically reduce the occurrence of insufficient hygiene-related diseases. On the other hand, it can also be useful in small food-related businesses such as butcheries, groceries, canning factories or restaurants. Access to quality chlorine at reasonable cost is also interesting for households, who can use it for regular cleaning of sensitive rooms and surfaces (kitchen, latrines...).

What are the advantages of disinfection with the concentrated solution of active chlorine?

Disinfection with the active chlorine concentrate is very efficient and inexpensive. Its range of efficiency is very wide; the solution can be used for various purposes depending of its degree of dilution:

- Washing of food and crudités: 1 volume of solution for 100 volumes of water, let react 5 minutes and then rinse with potable water
- Dishes, crockery, work surfaces and kitchen utensils: 1 volume of solution for 5 volumes of water
- Floors, bathrooms and latrines' surfaces: 1 volume of solution for 3 volumes of water
- Laboratory equipment, pipettes and boxes of human samples: no dilution, let immersed during minimum 12h and then rinse with potable water
- Disinfection of wounds: no dilution

Active chlorine has a very strong oxidising power which kills or inactivates the great majority of living germs. In medical institutions, the disinfection of equipments with the active chlorine concentrate is also efficient against HIV/AIDS. However, be aware that **it is not equivalent to a sterilisation!** Last advantage: the solution produced with Antenna-WATA is less toxic than bleach.

Can the chlorine concentrate be used for the sterilisation of surgical instruments?

Chlorine disinfection is not a sterilisation. The chlorine concentrate cannot be used for sterilising surgical instruments. These have to be sterilised in an autoclave or a hot air oven.

What is the difference between bleach and the solution produced with Antenna-WATA?

There are two fundamental differences between bleach and the concentrated solution of active chlorine produced with Antenna-WATA. 1- Bleach contains a stabilizer (caustic soda) to raise its pH and thus ensure a longer lifetime to the product. 2- The solution produced with Antenna-WATA is five times less concentrated in chlorine than bleach. However, as it contains no caustic soda, the active chlorine reacts faster.

Also, for the very same reason, the solution produced with Antenna-WATA it not corrosive. It can therefore be used for disinfecting wounds (it corresponds to Dakin solution, well-known amongst doctors and nurses). Moreover, drinking bleach is very dangerous because of the toxicity caustic soda. On the other hand, an intake of the solution produced with Antenna-WATA is certainly displeasing, but not risky.

How long can the active chlorine concentrate produced with Antenna-WATA be stored?

If stored in adequate conditions (clean, opaque and closed recipients), the chlorine concentrate remains stable during minimum one month. However, it can easily be used during six months, even though its disinfectant power tends to weaken slowly.

What is Dakin solution and should it be used?

Dakin solution is a liquid concentrated with active chlorine, which has antiseptic properties. Invented during World War I, it was used to disinfect open or infected wounds. The active chlorine concentrate produced with Antenna-WATA devices corresponds to Dakin solution. It can therefore be used without dilution, applied with a clean compress on the wound to disinfect.

DANGERS AND ANNOYANCES

Is it dangerous to use the Antenna-WATA technology?

Mini-WATA:

There is absolutely no risk using Mini-WATA. Its very low voltage (5V) avoids all risk of electrocution.

WATA:

There is absolutely no risk using WATA. Its low voltage (12V) avoids all risk of electrocution. It is however advised not to inhale the chlorine emissions produced during the electrolysis.

Maxi-WATA:

Using Maxi-WATA requires a bigger attention than the two smaller models. Only the people who have received a specific training shall use it. In particular, the strong hydrogen emissions produced during the electrolysis mean that no flame or spark should in any case be brought close to a functioning device. Moreover, it is advised not to inhale the chlorine emanations, which are also produced during the electrolysis, and to work in a well ventilated room. Finally, safety precautions must be taken (restricted access to the devices) in order to avoid all risk of electrocution.

What are the risks related to the intake, especially by children, of the concentrated solution of active chlorine?

The intake of concentrated active chlorine is very unlikely to happen, considering its irritant smell and bad taste. Nevertheless, in case a child takes a large gulp of it, it is not necessary to run to the nearest hospital. Just make the child drink potable water in order to lessen the bad taste. To the contrary, an intake of bleach is truly dangerous, because of the toxic caustic soda it contains.

Is residual chlorine harmful in any way?

So far, no study could prove any harmful impact of residual chlorine on human health, when found at concentrations such as those recommended by WHO standards for drinking water (1 mg/l). Some by-products resulting from the reaction of chlorine with organic matter (organochlorides) can however have an impact on the long term. For this reason, it is advisable not to chlorinate water that is heavily charged with organic matter.

Which impacts can organochlorides have on the organism?

Under massive and long term doses, some organochlorides have shown to be carcinogenic for rats. Nevertheless, the benefits of chlorination on short and middle term bases widely make up for this unwanted effect. For example, in 1991, after the publication of new results on the harmful effects of organichlorides, the authorities of Lima (Peru) decided to stop all chlorination in the water supply network. This resulted in a terrible cholera epidemic affecting 1 million people and killing 10'000. Water chlorination was urgently reintroduced, but several years were needed to eradicate the epidemic.

Is it dangerous to add too much chlorine concentrate in drinking water?

Occasional chlorine over-dosage in drinking water involves absolutely no risk for health. For that matter, drinking water supplies in large cities of developing countries often have chlorine concentrations above WHO standards (up to 2 mg/l). Besides, the consumer immediately recognises the strong smell and bad taste of chlorine in drinking water when it is over-dosed. Regular quality control with the **ATblue** reagent avoids such disagreements and thus enables drinking safe and good-tasting water.