Hydroxyl-Generators from CEBE®

Reinigungschemie GmbH

The NEW Technology for Odor Control

Hydroxyl generators - Technology from NASA

Ozone as a highly effective odor neutralizer and germ killer is widely known. It is also generally known that in order to use ozone effectively and efficiently the areas to be treated have to be closed off so that no one may be present during ozone treatment.

The working mechanism is well-known and because of this NASA had to rethink its approach as it was searching for a way to treat odors and germs on the space station but with the condition that people were able to be present during treatment. The effective mechanism was to be maintained, however.

Aside from ozone, which as a layer in our atmosphere forms an effective protection against UV-light, nature also knows the hydroxyl radical.

Intensive research and tests showed that this radical is completely harmless for humans and animals. In addition, it does not affect materials as does ozone at very high concentrations. At the same time it is highly unstable and therfore reactive just like the ozone molecule. The mechanism with which the hydroxyl radical decays is very similar to that of ozone, too. The hydroxyl radical is able to decompose organic sbstances, but other than ozone it can also decompose some anorganic substances. Therefore it is one step ahead of ozone in that respect.

What exactly is a hydroxyl radical (•OH)? It is the neutral form of the hydroxyl ion (OH-). Hydroxyl radicals are diatomic molecules, highly reactive and short-lived, with an average half-life of 2 seconds (in comparison with ozone, which has a half life of 6 minutes). The hydroxyl radical was discovered in 1963 and is often called the cleaner of the troposphere (the lowest layer in our atmosphere) since it reacts with many pollutants and helps destroy them. It also plays a role in the decomposition of greenhouse gases such as methane and ozone.

One thing that one may not do is compare the atmospheric hydroxyl radical with the so-called free radicals as they occur in the human body.

The hydroxyl radical is so unstable that it decomposes instantaneously upon contact with another substance. That and its extremely short half-life make it defacto impossible to ingest. That is what makes its application so safe that it may be used in the presence of humans and animals.

There are, however, two things that have to be considered: first, the neutralization process is slower than that of ozone and second: a hydroxyl generator needs at least 60% relative humidity in order to operate efficiently.

The reason for the prerequisite of such high humidity is simple: the generator splits the water molecule into two parts: a hydrogen radical and a hydroxyl radical. Without water, that is humidity, no hydroxyl radicals and therefore in reverse, the more humidity the more hydroxyl radicals.

This provided, it opens a wide range of possibilities because the advantage is obvious: hydroxyl generators are safe in their application, even in inhabited areas.

This would make it possible, for example, that an affected person could continue to occupy the affected rooms after a fire while the odors are being neutralized with hydroxyl radicals. A company does not have to close off areas immediately but instead may still be able to occupy them thereby minimizing any interruptions.

One restrictive argument has to be mentioned, however: ozone works faster. Therefore, if it is possible to close off the affected areas, ozone is more effective. As a rule of thumb one can say that ozone is typically 3 to 5 times faster.

By using hydroxyl generators insurance companies can save a lot of money for out-housing, for example. The affected persons are often glad to be able to stay in their own four walls at home or at work. The fire damage restorer may recall the one or other comlaint about persistent “ozone odor“ after treatment: this is yesterday‘s news with hydroxyl technology and is another big advantage.

As a result the hydroxyl generator should be the first machine which is unpacked and set up at a damage site and may be kept in operation for the entire time. In the U.S.A. these machines are billed with as much as 200 US Dollars per day.

Experience has shown that these generators may be employed successfully after fires and biological contamination. Whether a protein fire, water damage, odors from decaying bodies, urine odor, mould odor - no problem whatsoever.

The hydroxyl generators are also ideal for use in an odor treatment chamber because one may enter the chamber without risk at any time. The generator can run 24/7 without any danger. In addition there are no risks of bleaching or discoloration in damp materials as well as no risks of material damage, period.

One restriction, however, has to be mentioned for the hydroxyl generator: as with ozone, hydroxyl radicals come in gas form. This means that they are not suited for the treatment of porous substrates/surfaces. If porous surfaces are contaminated they should be treated with the appropriate procedure as before.

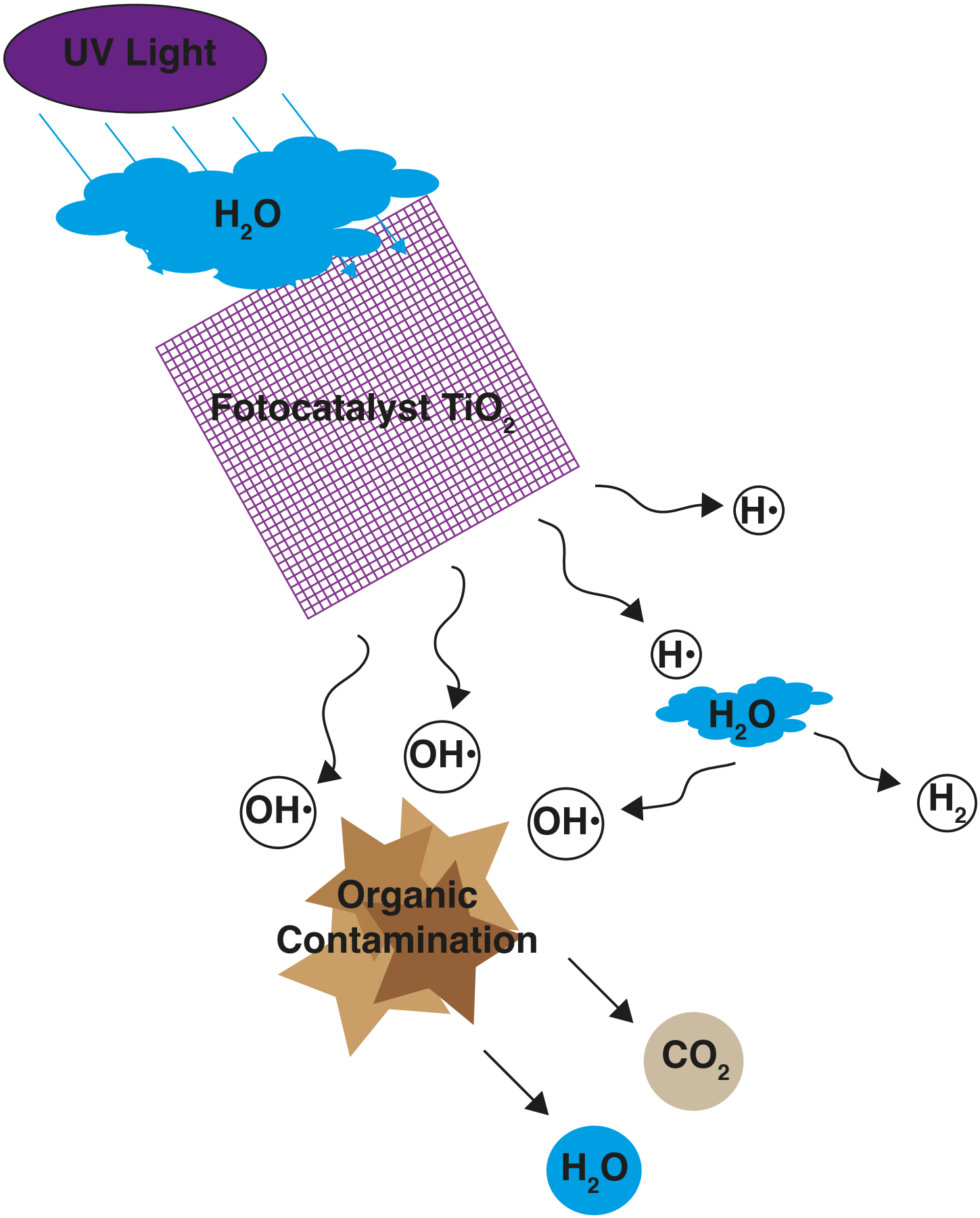
How are hydroxyl radicals generated?

In nature UV light plays the main role. Water molecules are split into hydrogen radicals and hydroxyl radicals. The hydrogen radicals react with water or with each other to form a hydrogen molecule (in trace amounts) and a hydroxyl radical.

There are some variations in hydroxyl generators - one similarity is that they all utilize UV light but that is it. UV light may be produced at wave lengths from 100 to 400 nanometers. Whether or not and, if yes, how much ozone is produced besides the hydroxyl radicals depends on the wavelength of the UV light used in the generator.

The TITAN hydroxyl generators use UVA light which is harmless for humans regarding eyesight and skin contact. With a wavelength of 365 to 385 nanometers in conjunction with a special catalyst made of titanium dioxide hydroxyl radicals are generated but no ozone.

Figuratively the process may be depicted as shown below:



Here some examples of how hydroxyl radicals react with organic substances:

Nicotine $C_5H_4NC_4H_7NCH_3 + 54\ OH\bullet \rightarrow 10\ CO_2 + N_2 + 34\ H_2O$

Dibutyl phthalate $C_6H_4(COOC_4H_9)_2 + 86\ OH\bullet \rightarrow 16\ CO_2 + 54\ H_2O$

Due to the extremely short half-life of the hydroxyl radical it is iomportant to have strong air movement in order to spread the radicals as far as possible. The TITAN 4000 has an air movement of 135 135 m^3 per minute. This ensures that the generator his able to provide for suffcient reach of the hydroxyl radicals so that odors can be neutralized efficiently.

Where can hydroxyl generators be used?

Due to the fact that hydroxyl generators are harmless a multitude of possibilities exist.

Possible applications:

- Geriatric centers and old folks homes
- Undertakers
- Fire damage restoration
- Medical centers and private practices
- Bowling centers
- Dry cleaning
- Fitness clubs
- Hotels
- Car dealerships
- Car repair shops
- Kindergardens, schools, etc
- Cinema centers
- Air conditioning
- Storage facilities
- Food retailers
- Messy houses/apartments
- Trash collection rooms
- Public toilets
- Car rental agencies
- Restaurants und bars
- Beauty salons
- Crime scene cleanup
- Carpet and upholstery cleaners
- Laundromats/Laundries
- Water damage restoration
- **and many more**

TITAN 1000-I

Technical Data

Voltage	220 Volts, 50/60 Hz
Power	220 Watt
Air movement	2.70 m^3/min.
Max. treatment volume	270 m^3
Dimensions (H x W x D)	15 x 22,5 x 30 cm
Weight	3.6 Kg
Filter	10 x 10 cm

TITAN 4000-I

Technical Data

Voltage	220 Volt, 50/60 Hz
Power	880 Watt
Air movement	135 m^3/min.
Max. treatment volume	1,080 m^3
Dimensions (H x W x D)	66 x 66 x 30 cm
Weight	17.3 Kg
Filter (electrostatic)	50 x 50 x 1,25 cm
	82% efficiency

HYDROXYL MAXIMIZER

The hydroxyl generator technolöogy requires water above all in order to generate hydroxyl radicals. This means that the higher the relative humidity the greater the amount of hydroxyl radicals generated.

In order to support this process, especially in situations where relative humidity is low, we have the Hydroxyl Maximizer. It uses ultrasound technology to create a very fine, cold, water vapor. The Hydroxyl Maximizer is placed directly behind the TITAN 4000. This increases the influx of humidity and therefore the amount of hydroxyl radicals generated.

In case you ask yourself the question: doesn‘t this also increase the relative humidity of the area being treated? The answer is NO. On the contrary, since the generator converts the water into hydroxyl- and hydrogen-radicals, the exit humidity is 15 to 40% less than the entering humidity!

NOTES

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