H1N1 Virus Can Be Killed by Acidic Ozone Water

November 9 2009, By Lisa Zyga

Scientists have found that acidic ozone water can effectively kill H1N1 viruses, with the advantages that it leaves no environmentally harmful residue and is inexpensive to prepare. Image credit: Wikimedia Commons.

(PhysOrg.com) -- Scientists have found that acidic ozone water can deactivate H1N1 viruses very effectively, offering a promising disinfectant for the millions of people trying to avoid the disease. Acidic ozone water (AOW) is made from regular tap water mixed with a small amount of acid such as hydrochloric acid, along with an ozonized gas that can be produced in the lab. After deactivating the virus, the substance eventually decays into plain water, leaving no residue or harmful materials in the environment.

Scientists Han Uhm of Ajou University in Korea, along with Kwang Lee and Baik Seong of Yonsei University in Korea, have published the

results of their study on the H1N1 disinfectant in a recent issue of *Applied Physics Letters*. Besides being environmentally benign, AOW also has the advantage that it may cost significantly less to prepare compared with chemical disinfectants.

During the past several months, H1N1 has infected thousands of people worldwide and has proven to be a highly contagious disease. Attempts to combat the disease have included preventative vaccines and the use of disinfectants to prevent the spread of the disease. However, most of these disinfectants have chemicals that can harm the environment.

In the current study, the researchers found that they could make neutral water acidic by mixing a very small amount of hydrochloric acid into the water. Adding just 22 grams of hydrochloric acid to one ton of neutral water can change the pH value of the water from 7 to 4. As the scientists explain, the negative chlorine ions have a sterilizing effect on viruses, and a strong acidity in general also has a sterilizing effect.

Although acidic water itself can partially inactivate the H1N1 virus, the scientists also added an ozone gas concentration of more than 10 mg/liter to the water to enhance the sterilization effect. All the viruses were killed after five minutes of mixing the acidic ozone water with about 430,000 viruses in the environment.

When observing the number of viruses killed in a given time, the researchers found that the acidic ozone water had a synergic effect, outperforming the sum of the individual effects of acidic water and ozone water. Part of the reason for the enhanced sterilization is that, while ozone decays over time due to impurities, the acidification of water slows the decay, prolonging the time of disinfection.

In another experiment, the researchers found that *E. coli* cells treated with acidic ozone water at pH 4 and an ozone concentration of 20

mg/liter destroyed the cell envelopes. Based on this observation, the scientists speculate that acidic ozone water may work by destroying the H1N1 virus envelopes, disabling their ability to establish an infection.

“Most of the virus inactivation experiments in our lab have been conducted using the host cells for viruses,” Uhm told *PhysOrg.com*. “The host cells used were the cells from advanced animals like green monkey kidney cells, human cells, or egg cells. These cells are breeding well even after the exposure to acidic ozone water. Meanwhile, the microbe cells are killed very effectively by AOW. I believe that some kinds of antioxidant in the advanced cells may protect the cells from ozone attack. But the microbe cells without the antioxidant may be destroyed by the strong oxidation activity of ozone in AOW.”

Uhm added that the AOW could be used in a variety of areas to avoid the spread of H1N1.

“AOW may be abundantly available due to its easy preparation,” he said. “I am not an industrialist, but a scientist. I do not have any specific plan to make it available by myself, but some capable people may do. The AOW may be useful in hospitals, in livestock industries, in dairy farms, in seafood industries, or in agriculture. I initially studied the AOW for protection of mankind from an attack of bio weapons.”

More information: Han S. Uhm, Kwang H. Lee, and Baik L. Seong. “Inactivation of H1N1 viruses exposed to acidic ozone water.” *Applied Physics Letters* 95, 173704 (2009).