Safer medical kit by plasma-activated water

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similar to the form created in neon signs, fluorescent tubes and TV displays – to create water that stays significantly antibacterial and can be used as a disinfectant for at least seven days after becoming plasma-active.

Their study, published today, 4 November 2011, in IOP Publishing's *Journal of Physics D: Applied Physics*, reports on the exposure of water to the cocktail of compounds contained in plasma which subsequently cause it to stay antibacterial for a week, opening up a multitude of applications such as the sterilisation of medical equipment and the treatment of wounds.

To do this, the researchers, from the University of California, Berkeley, created plasma in air and exposed it to a solution of distilled water for 20 minutes to activate it. Once activated, the researchers allowed the water to sit for periods of up to one week before dropping a pellet of E.coli bacteria into the solution.

The bacteria were left in the water for either 15 minutes or three hours and the number of living bacterial cells present was then measured and compared to the numbers of cells in an untreated solution. Surprisingly, the solution created up to seven days earlier had a significant antibacterial effect when the bacteria were exposed for three hours.

A handheld, plasma-activating device – which has already been demonstrated in the research lab – could be extremely effective in low-resource or disaster-struck countries where sanitation and waterborne

diseases are a critical issue, such as Haiti where millions of people were left homeless and at risk of cholera and typhus following a devastating earthquake.

Known as the fourth state of matter, plasma is a gas that has had some of its electrons removed by passing electricity through it and has already had its disinfectant capabilities demonstrated through the development of a device that can sanitise skin (www.iop.org/news/09/november/page_42357.html)

Progressing research by a range of different groups who have shown how plasmas created next to water can turn it into an acidic solution that contains a cocktail of compounds which effectively kill off bacteria suspended in the solution, the researchers sought to explore the potential further.

The team examined how effective the compounds created in plasma-activated water (PAW) are against bacteria, how long PAW remains antibacterial, and the ideal storage conditions for it.

Professor David Graves, lead author of the study, said: "One of the most difficult problems associated with medical facilities in low-resource countries is infection control. It is estimated that infections in these countries are a factor of three to five times more widespread than in the developed world.

"We know that products such as hydrogen peroxide, nitrates and nitrites are created as the plasma is directed at the water, and that these products are antibacterial, especially under the acidic conditions created by plasma exposure.

"However, we have shown that these compounds alone cannot explain the entire antibacterial effect observed so we will direct future research

to focus on identifying all of the chemical products responsible for this antibacterial nature," continued Professor Graves.

More information: Matthew Traylor et al 2011 J. Phys. D: Appl. Phys. 44 472001

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