Sunlight plus lime juice makes drinking water safer

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Looking for an inexpensive and effective way to quickly improve the quality of your drinking water? According to a team of researchers from the Johns Hopkins Bloomberg School of Public Health and the Johns Hopkins School of Medicine, sunlight and a twist of lime might do the trick. Researchers found that adding lime juice to water that is treated with a solar disinfection method removed detectable levels of harmful bacteria such as *Escherichia coli* (*E. coli*) significantly faster than solar disinfection alone. The results are featured in the April 2012 issue of *American Journal of Tropical Medicine and Hygiene*.

"For many countries, access to clean drinking water is still a major concern. Previous studies estimate that globally, half of all hospital beds are occupied by people suffering from a water-related illness," said Kellogg Schwab, PhD, MS, senior author of the study, director of the Johns Hopkins University Global Water Program and a professor with the Bloomberg School's Department of Environmental Health Sciences. "The preliminary results of this study show solar disinfection of water combined with citrus could be effective at greatly reducing *E. coli* levels in just 30 minutes, a treatment time on par with boiling and other household water treatment methods. In addition, the 30 milliliters of juice per 2 liters of water amounts to about one-half Persian lime per bottle, a quantity that will likely not be prohibitively expensive or create an unpleasant flavor."

In low-income regions, solar disinfection of water is one of several household water treatment methods to effectively reduce the incidence

of diarrheal illness. One method of using sunlight to disinfect water that is recommended by the United Nations Children's Fund (UNICEF) is known as SODIS (Solar water Disinfection). The SODIS method requires filling 1 or 2 L polyethylene terephthalate (PET plastic) bottles with water and then exposing them to sunlight for at least 6 hours. In cloudy weather, longer exposure times of up to 48 hours may be necessary to achieve adequate disinfection. To determine if one of the active constituents in limes known as psoralenes could enhance solar disinfection of water, Schwab and Alexander Harding, lead author of the study and a medical student at the Johns Hopkins School of Medicine, looked at microbial reductions after exposure to both sunlight and simulated sunlight. The researchers filled PET plastic bottles with dechlorinated tap water and then added lime juice, lime slurry, or synthetic psoralen and either *E. coli*, MS2 bacteriophage or murine norovirus. Researchers found that lower levels of both *E. coli* and MS2 bacteriophage were statistically significant following solar disinfection when either lime juice or lime slurry was added to the water compared to solar disinfection alone. They did find however, that noroviruses were not dramatically reduced using this technique, indicating it is not a perfect solution.

"Many cultures already practice treatment with citrus juice, perhaps indicating that this treatment method will be more appealing to potential SODIS users than other additives such as TiO2 [titanium dioxide] or H2O2[hydrogen peroxide]," suggest the authors of the study. However, they caution, "additional research should be done to evaluate the use of lemon or other acidic fruits, as Persian limes may be difficult to obtain in certain regions."

More information: "Using Limes and Synthetic Psoralens to Enhance Solar Disinfection of Water (SODIS): A Laboratory Evaluation with Norovirus, Escherichia coli and MS2," was written by Alexander S. Harding and Kellogg J. Schwab.

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