WATER ON FIRE MAKES SCIENTISTS BURN

Radio-wave-induced water dissociation **ISN'T A MIRACLE,** they say

IT'S DRAMATIC, no doubt. Take a simple radio-frequency field, a beaker of salt water, a match, and voilà—the water bursts into flame.

This phenomenon was discovered by self-titled inventor John Kanzius, who had already made a name for himself designing a possible therapy for cancer that involves attaching nanotubes to tumor cells, where the tubes then heat up in the presence of radio waves and kill the tumor cells.

His new application for the effects of radio waves, involving what he claims is the dissociation of water into its combustible components, hydrogen and oxygen, is generating an even bigger media splash. News of the phenomenon spread like a virus through the popular online video site YouTube. And the phenomenon caught the interest of Pennsylvania State University's Rustum Roy, an emeritus geochemistry professor and an espouser of water structure theories that have been known to raise a scientific eyebrow or two.

The burning salt water effect appears to be genuine: The solutions really do ignite when placed in a strong radio-frequency field (www.youtube.com/watch?v=aGgoATfoBgo). The flame looks like that observed in normal H_2 gas burning, notes Martin Chaplin, an applied science professor at London South Bank University, where he ponders water structure.

But explanations for the phenomenon span extremes. Some say radio-wave-zapped salt water is a miracle fuel that could provide nearly free energy—the angle seized upon by some mainstream media. Others claim a routine plasma is being generated at the solution's surface. Roy and Kanzius are publishing results of their own investigation into the phenomenon in the journal *Materials Research Innovations,* published by Springer. The journal, which Roy founded, accepts papers on the basis of what it calls "super peer review," meaning that authors need only have published previously in a peer-reviewed journal. In their recent work, Roy and Kanzius show that the flame varies little with the concentration of salt in the water but doesn't appear without any salt at all. They note a strong spectral line of sodium in the flame, which is hardly surprising, observers say.

But Roy's explanation for the phenomenon is far from mainstream. Drawing on work by Juliana Brooks, an M.D. affiliated with a Maryland company called General Resonance and who holds patents citing resonance effects on matter/radiation interactions, Roy says he believes the frequency required to generate the water-burning effect is very specific. The radio waves required are only one-millionth as powerful as the infrared energy required for a primary O–H bond stretch in water that might lead to bond dissociation, he says. The radio waves excite very small resonances in the O–H bonds, eventually triggering large effects that dissociate the water molecules, he adds.

Roy says the effect is "pretty universal" and "has nothing to do with the salt explicitly." He asserts that international science and business groups are eager to determine potential uses of the technology.

BUT SKEPTICS say more conventional explanations should be easy to test. Chaplin suggests that the radio-frequency stimulation could generate a plasma at the surface of the liquid in which small numbers of ions might be entering the gas phase and getting accelerated in the field; they in turn could ionize vaporized water molecules, which could dissociate into hydrogen and oxygen gas, which could then burn.

Such effects are well-known in analytical devices such as mass spectrometers, in which argon gas is ionized to form a high-energy plasma. "But it should work for water vapor, as long as there are some ions in the gas phase," Chaplin says. "Clearly less energy is got out than put in, whatever the mechanism." But that does not mean the phenomenon isn't interesting or potentially useful, he says.

Others are decidedly unimpressed. Water structure expert Richard Saykally, a chemistry professor at the University of California, Berkeley, notes the possibility that a plasma could be generated. Salt water in a 300-W electromagnetic field "very likely makes some kind of plasma," he says. "But the efficiency of hydrogen generation is undoubtedly very low."

RUSTUM ROY

FIRE WATER When exposed to a radio-frequency field, salt water appears to burst into flame.

Saykally dismisses the invocation of some special water structuring, which Roy and Kanzius suggest might contribute to the effect. "I think this falls into the realm of pseudoscience," he says.

Philip Ball, a consultant editor at *Nature* and author of the book "H_2O: A Biography of Water," acknowledges that the new paper is "straightforward enough." But he notes the phenomenon's potential likeness to electrolysis and wonders why the authors haven't addressed this point. "It is surely not so hard to establish how much hydrogen you're making this way and compare that with what electrolysis generates for the same power input," he says.

The American Physical Society's resident skeptic Robert L. Park, physics professor at the University of Maryland and author of "Voodoo Science," also has his doubts. "They make no effort to even estimate power output and consumption," he says. "Is this what science has come to?"—ELIZABETH WILSON

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