Tiny fuel cell might replace batteries in laptop computers, portable electronics

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If you're frustrated by frequently losing battery power in your laptop computer, digital camera or portable music player, then take heart: A better source of "juice" is in the works. Chemists at Arizona State University in Tempe have created a tiny hydrogen-gas generator that they say can be developed into a compact fuel cell package that can power these and other electronic devices -- from three to five times longer than conventional batteries of the same size and weight.

The generator uses a special solution containing borohydride, an alkaline compound that has an unusually high capacity for storing hydrogen, a key element that is used by fuel cells to generate electricity. In laboratory studies, a prototype fuel cell made from this generator was used to provide sustained power to light bulbs, radios and DVD players, the researchers say.

The fuel cell system can be packaged in containers of the same size and weight as conventional batteries and is recharged by refilling a fuel cartridge, they say. Research on these battery replacement fuel cells, which they claim are safer for the environment than regular batteries, was described today at the 232nd national meeting of the American Chemical Society.

"We're trying to maximize the usable hydrogen storage capacity of borohydride in order to make this fuel cell power source last longer," says study leader Don Gervasio, Ph.D., a chemist at the University's Biodesign Institute, Center for Applied NanoBioScience. "That could

lead to the longest lasting power source ever produced for portable electronics."

One of the challenges in fuel cell development is finding hydrogen-rich compounds for the fuel source. Many different hydrogen sources have been explored for use in fuel cells, including metal hydride "sponges" and liquids such as gasoline, methanol, ethanol and even vegetable oil.

Recently, borohydride has shown promise as a safe, energy-dense hydrogen storage solution. Unlike the other fuel sources, borohydride works at room temperature and does not require high temperatures in order to liberate hydrogen, Gervasio says.

Gervasio and his associates are developing novel chemical additives to increase the useful hydrogen storage capacity of the borohydride solution by as much as two to three times that of simple aqueous sodium borohydride solutions that are currently being explored for fuel cell development. These additives prevent the solution from solidifying, which could potentially clog or damage the hydrogen generator and cause it to fail.

In developing the prototype fuel cell system, the researchers housed the solution in a tiny generator containing a metal catalyst composed of ruthenium metal. In the presence of the catalyst, the borohydride in the water-based solution reacts with water to form hydrogen gas.

The gas leaves the hydrogen generator by moving across a special membrane separating the generator from the fuel cell component. The hydrogen gas then combines with oxygen inside the fuel cell to generate water and electricity, which can then be used to power the portable electronic device. Commercialization of a practical version of this fuel cell could take as many as three to five years, Gervasio says.

Source: by Mark T. Sampson, American Chemical Society