Capillary condensation technology produces drinkable water from diesel exhaust

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Researchers have developed a method for capturing drinkable water from the diesel exhaust of Humvees and other machines. Image credit: U.S. Marine Corps photo by Cpl Stephen M. Kwietniak.

(PhysOrg.com) -- Every person in the US military needs about 7 gallons of water per day for drinking, cooking, and cleaning. Supplying and transporting all that water takes a great deal of time and effort that might otherwise be used for other purposes. To address this problem, researchers at the Department of Energy's Oak Ridge National

Laboratory (ORNL) are developing a technology that harvests water from the combusted diesel fuel that is used to power tanks, Humvees, generators and other machines.

As hydrocarbon fuels such as diesel burn, they get oxidized, producing carbon dioxide and water. The water comes out of the engine as hot steam in the exhaust, and needs to be condensed into water to be used.

As the ORNL researchers have demonstrated, they can condense this steam into water using capillary condensation. In contrast to thermodynamic condensation, which condenses steam into water by cooling it, capillary condensation relies on capillary action in the micropores of hollow pipes. As the exhaust runs through these microporous pipes, it condenses into water in the micropores, and is then drawn off outside the pipe to allow more steam to condense. At the same time, the pores act as a filter by continuously displacing the water. As a result, the condensed water does not have enough time to absorb water-soluble contaminants, leaving clean, drinkable water. Unlike thermodynamic condensation methods, capillary condensation requires no cooling or energy, and is also a lot less bulky.

Using the new capillary condensation technique, one gallon of diesel fuel can theoretically produce one gallon of water, according to ORNL project leader Melanie Debusk. Although not all of the water is recoverable, the researcher's system can recover about 65-85% of it. Since a Humvee has a 25-gallon tank, it could provide enough water for about three soldiers per tank of fuel burned.

As noted in a news article at The Register, a similar technique has recently been investigated for recovering water from the flue gas at coal-fired power plants. Another application might be to control the buoyancy in zeppelins and other airships, which get lighter as they burn fuel. If some of the exhaust could be converted into water, it could decrease the

buoyancy and make it easier to land.

The researchers at ORNL hope to achieve full-scale development of the new system for the military within the next few years, which has a budget of about $6 million.

More information: Cosmic Log and The Register