

Urine could be the answer to cheaper electricity

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(PhysOrg.com) -- Urine can be an abundant fuel for electricity generation, according to British scientists in the first study of its kind.

Researchers from the University of the West of England, Bristol, have described a way of directly producing electricity from [urine](#) using [Microbial Fuel Cells](#) (MFCs).

Their research is published in the latest [Royal Society of Chemistry](#) journal, *Physical Chemistry Chemical Physics*.

The aims of the team included investigating whether untreated urine can produce electricity through MFCs and to calculate the energy yield from urine when utilised in MFCs. An estimated 6.4 trillion litres of urine is produced every year leaving the researchers to call urine a potential [alternative energy source](#) that has so far been neglected.

Three MFCs made from acrylic with 25ml anode and cathode chambers were used in the experiments. Anode and cathode [electrodes](#) were connected via small pumps to 1l reservoir bottles. Neat (unprocessed) urine was added either as large volumes, ranging between 25ml to 300ml, into the re-circulation reservoir bottle, or by small volumes, 0.1ml to 10ml, as injections directly into the anode inlets. Urine was used fresh or within one week from donation and the samples, between 400-500ml per donation, were taken from a single healthy volunteer on a normal diet with no history of urinary tract or renal disease.

Prior to an injection of 25ml of urine, the MFC was producing 0.9 milliampere per metre squared (mA/m^2), which increased to $2.9 \text{ mA}/\text{m}^2$ after one hour from the point of injection.

This amount of urine was sufficient for continuous energy generation over three days, at which point the performance began to plateau and returned to the power output level that the MFC was producing prior to the injection.

The scientists showed that an addition of 25ml of fresh urine took three days to be utilised in a single 25ml volume MFC. For a stack of 10 MFCs, the same sample would require eight hours to be utilised. Based on a daily urine production of 2.5l per person, it would require approximately 300 MFCs to utilise the daily production of an average human being.

The team at Bristol has been running these experiments over two years and say the response to the addition of fresh urine has been consistent throughout. For the single MFCs used in this study, the efficiency of conversion was shown to have an inverse relationship to the amount of urine added as fuel. For volumes up to 25ml of added urine, the efficiency of direct conversion to electricity was between 60 to 70 per cent, whereas for volumes of more than 700ml, efficiency ranged between 22 to 30 per cent.

Lead researcher Ioannis Ieropoulos said: "With an annual global production rate of trillions of litres, this is a technology that could help change the world. The impact from this could be enormous, not only for the wastewater treatment industry, but also for people as a paradigm shift in the way of thinking about waste."

More information: Urine utilisation by Microbial Fuel Cells; energy fuel for the future, Ioannis Ieropoulos, John Greenman and Chris

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Quick facts:

-- 6.4 trillion litres of annual urine production is based on a world population of 6.97 billion and average daily urine production of 2.5l per adult human

-- mA/m² is the international unit of electric current density

Provided by Royal Society of Chemistry

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