New salt-based battery a leap for green energy

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(Phys.org) -- Murdoch University researchers have come up with a potential solution to one of sustainable energy's greatest challenges: power storage for use in non-generation times.

According to project leaders Drs Manickam Minakshi and Danielle Meyrick of Murdoch's School of Chemical and Mathematical Sciences, while the efficiency of wind and solar technologies has improved rapidly, one major problem has remained unsolved.

"The central obstacle facing sustainable energy is unreliability. Wind turbines don't turn on a still day. Solar doesn't work at night and can be hampered in the day by cloud, dust or snow coverage," Dr Minakshi

said.

“To provide power at non-generation times, excess energy needs to be stored in batteries, but storage technologies now being considered, such as molten salt or molten sulfur, work at high temperatures, making them expensive and impractical.”

“Our water-based sodium-ion battery has shown excellent potential for affordable, low-temperature storage.”

Dr Minakshi said he was drawn to sodium because its chemical properties were similar to lithium, the element that powers most portable electronic devices.

His challenge was to find material for cathodes and anodes capable of accommodating sodium’s ionic size – which is 2.5 times larger than that of lithium.

“Ions travel out of the cathode and into the anode to form a current. As an imperfect analogy, you can think of them as mesh filters that ions pass through. We had to find materials with larger gaps in their mesh,” Dr Minakshi said.

Dr Minakshi tested various metals and phosphates, eventually finding success with manganese dioxide as the cathode and a novel olivine sodium phosphate as the anode. The result is a safe, cost-effective battery with high energy density.

“While the technology is too bulky for portable devices, it has excellent potential for large-scale use, including storing energy from wind turbines and solar farms for later feeding into local electricity grids, as well as use in industry,” Dr Minakshi said.

The battery has the added advantage of being based on globally abundant and affordable sodium, iron and manganese – putting green energy potential in the hands of the developing world.

“Our research has reached the stage where we’re ready to move beyond our lab towards larger-scale commercialisation. This is a very exciting time.”

Provided by Murdoch University