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Hemp Can Make Better Supercapacitor Electrodes

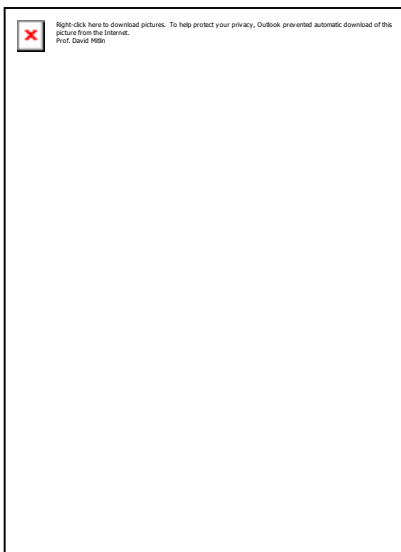
Hemp Can Make Better Supercapacitor Electrodes

June 28, 2016

SOURCE: [Dave Burkey](#) for the NHA

Almost everyone uses electronics. And most of those electronics uses a battery. However batteries can discharge quite rapidly which requires you to recharge the batteries quite often. I know this happens with my smart phone and tablet all the time.

Researchers at the University of Alberta's National Institute for Nanotechnology (NINT) have discovered that hemp based electrodes for supercapacitors outperform standard supercapacitors by nearly 200%. At present, the preferred material for making electrodes is graphene. Electrodes are what connect an electrical storage medium to the outside world. Some materials can handle high current applications and others allow quick access times. Graphene does both.



Prof. David Mitlin

There is one drawback, however. Graphene costs about \$2,000 per gram. Looking for a less costly solution, researchers at NINT, led by chemical and materials engineering Professor David Mitlin, developed a process for converting fibrous hemp waste into a unique graphene-like nanomaterial that outperforms graphene. What's more, it can be manufactured for less than \$500 per ton. "Our work actually opens up a very cheap and mass-producible manufacturing method for graphene quality material — something that has never been achieved before," says Mitlin.

Carbon is the primary component of most electrodes. Whether it is activated carbon, templated carbon, carbon nanofibers, carbon nanotubes, or graphene, all have been intensively studied as materials for supercapacitor electrodes. Many are expensive to manufacture. They also have limited power characteristics.

"It is becoming well understood that the key to achieving high power in porous electrodes is to reduce the ion transport limitations" says Mitlin. "Nanomaterials based on graphene and their hybrids have emerged as a new class of promising high-rate electrode candidates. They are, however, too expensive to manufacture compared to activated carbons derived from pyrolysis of agricultural wastes, or from the coking operations."

Mitlin decided to test hemp bast fiber's unique cellular structure to see if it could produce graphene-like carbon nanosheets. Hemp fiber waste was heated under pressure at 180 °C for 24 hours. The resulting carbonized material was treated with potassium hydroxide and then heated to temperatures as high as 800 °C, resulting in the formation of uniquely structured nanosheets. Testing of this material revealed that it discharged 49 kW of power per kg of material — nearly triple what standard commercial electrodes supply, 17 kW/kg. "The resultant graphene-like nanosheets possess fundamentally different properties, such as pore size distribution, physical interconnectedness, and electrical conductivity—as compared to conventional biomass-derived activated carbons," Mitlin tells the American Society of Mechanical Engineers.

"We were delighted at how well this material performed as supercapacitor electrodes," says Mitlin. "This novel precursor-synthesis route presents a great potential for facile large scale production of high performance carbons for a variety of diverse applications including energy storage, portable electronics, uninterruptable power sources, medical devices, load leveling, and hybrid electric vehicles."

This breakthrough, if it can be commercialized successfully, could be a significant factor in reducing the cost of electric vehicles and energy storage systems.

Also, Solar researchers are learning to make Solar Cells out of Graphene which is more efficient than Silicone in turning sunlight into electricity. With this new technology of making Graphene from hemp, the cost of manufacturing solar cells will plummet, and the price for energy storage will plummet as well, and the efficiency of both cells, and storage medium rise.