Unleashing the power of the peanut

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Video Abstract

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Abstract

Dr. Dey and his team from India have found a rather extraordinary use for an otherwise ordinary material. They've developed a supercapacitor capable of storing nearly one-third as much energy as an alkaline battery using peanut shells. A much cheaper and safer alternative to the toxic materials found in most energy storage devices, peanut shells could be a welcome ingredient that powers our increasingly electronic world. Peanut shells aren't inherently good at storing charge. But locked inside their complex carbon-based structure is the potential to extract a valuable "wonder material" that is: graphene. To do that, the research team used common methods for obtaining graphene from biomass. They crushed and carbonized the shells in the lab—but then added two important steps. First, the team blasted their blackened peanut-shell powder with ultrasound waves. Much like the peanut, graphene is best when peeled. In fact, graphene is nothing more than a single molecular layer of graphite, or pencil lead. The problem is that graphene tends to cling strongly to itself. Pounding the powder with ultrasound helped pull as many layers of graphene as possible. Then, to generate enough surface area to hold enormous amounts of charge, the team treated the graphene layers with a strong base. The result was a thick ink capable of soaking up as much charge in a few drops as millions of normal capacitors joined in series. In fact, the team showed that their peanut shell-based ink could be charged in about 1 minute and deliver enough energy to power an LED. And therein lies one of the greatest advantages of supercapacitors like this. Pound for pound, such devices can hold only a fraction of the energy of lithium-ion batteries. But their ability to charge quickly and deliver what energy they do hold just as fast could make them crucial in numerous applications—from restarting hybrid cars at stops to providing backup power for our mobile electronic devices. And with millions of tons of raw material generated every year, these new supercapacitors could help shrink the enormous carbon footprint of today's energy storage industry