

Used cigarette butts offer energy storage solution

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Credit: Vera Kratochvil/public domain

Scientists in South Korea have developed a new way to store energy that also offers a solution to a growing environmental problem.

Reporting their findings in the IOP Publishing journal *Nanotechnology*, the research team successfully converted used [cigarette butts](#) into a high performing material that could be integrated into computers, handheld

devices, electric vehicles and wind turbines to store energy.

According to the study, this material outperforms commercially available carbon, graphene and carbon nanotubes. It may someday be used to coat the electrodes of supercapacitors: electrochemical components that can store extremely large amounts of electrical energy.

"Our study has shown that used cigarette filters can be transformed into a high performing carbon-based material using a simple one step process, which simultaneously offers a green solution for meeting the energy demands of society," says co-author Professor Jongheop Yi of Seoul National University.

"Numerous countries are developing strict regulations to avoid the trillions of toxic and non-biodegradable used cigarette filters that are disposed of into the environment each year. Our method is just one way of achieving this," adds Professor Yi.

Carbon is the most common material found in supercapacitors due to its low cost, [high surface area](#), [high electrical conductivity](#) and long term stability. Scientists around the world are working to improve the characteristics of supercapacitors – such as their energy density, power density and cycle stability – while trying to reduce production costs.

In their study, Professor Yi and his colleagues demonstrated that the cellulose acetate fibres found in most cigarette filters could be transformed into a carbon-based material using a simple, one-step burning technique called pyrolysis. The resulting material contained a number of tiny pores, increasing its performance as a supercapacitive material.

"A high performing supercapacitor material should have a large surface area, which can be achieved by incorporating a large number of small

pores into the material," says Professor Yi. "A combination of different pore sizes ensures that the material has high power densities, which is an essential property in a supercapacitor."

Once fabricated, the carbon-based material was attached to an electrode and tested in a three-electrode system to see how well the material could adsorb electrolyte ions (charge) and then release them (discharge). The material stored more electrical energy than commercially available carbon, graphene and carbon nanotubes.

"Our carbon-based material has the potential for use as an electrode material in lithium ion batteries, a catalyst-supporting material in fuel cells, and pollutant adsorbents," says Professor Yi. "We hope our inventions will ultimately help reduce the environmental burden of cigarette butts while lowering the manufacturing cost of high quality carbon [materials](#)."

Using cigarette butts to combat dengue

In addition to their energy storing potential, cigarette butts may one day be used to control dengue, one of the world's most important mosquito-borne viral diseases.

Noting that cigarette butts are "impregnated with thousands of chemical compounds, many of which are highly toxic and none of which has [a] history of resistance in mosquitoes," a research team in Malaysia, Japan and Thailand examined their potential for controlling mosquitoes that harbour the dengue virus.

Reporting its findings in the journal *Acta Tropica*, the team found that female mosquitoes actually prefer laying eggs in an environment that contains cigarette butts over a butt-free environment. What's more, the

researchers observed that exposure to cigarette-butt waste has "detrimental effects on the [fertility] and longevity of [mosquito] offspring."

Provided by Seoul National University

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