

Researchers look for ways to make an emerging technology safe for environment

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The percentage of electronic waste occupying our landfills has grown at an alarming rate over the last decade, giving rise to concerns about the toxicity of components used in consumer electronics.

Researchers at the University of Florida are looking for ways to minimize [environmental hazards](#) associated with a material likely to play an increasingly important role in the manufacture of these goods in the future. The results of their most recent studies are published in the March 2012 issue of *Nanotoxicology*.

Carbon nanotubes are already being used in touch screens and to make smaller, more efficient transistors. And if current research to develop them for use in [lithium](#) ion batteries is successful, carbon nanotubes could become important technology for powering everything from smartphones to hybrid vehicles. But for all of the promise developers see in this emerging technology, there is also some concern.

"Depending on how the nanotubes are used, they can be toxic – exhibiting properties similar to asbestos in laboratory mice," said Jean-Claude Bonzongo, associate professor of environmental engineering at UF's College of Engineering. He is involved in a research collaboration with Kirk Ziegler, a UF associate professor of chemical engineering, to minimize this important material's potential for harm.

In particular, the UF team is investigating toxicity associated with aqueous solutions of carbon nanotubes that would be used in certain

manufacturing processes.

"At the nano-scale, electron interactions between atoms are restricted, and that creates some of the desirable traits like the high conductivity that manufacturers want to take advantage of with carbon nanotubes," Ziegler said. "But exploiting those properties is difficult because the nanotubes tend to clump together."

For that reason, carbon nanotubes have to be treated in some way to keep them dispersed and available for electron interactions that make them good conductors. One way to do it is to mix them with an aqueous solution that acts as a detergent and separates the tangled bundles.

"Some of the surfactants, or solutions, are toxic on their own," Bonzongo said. "And others become toxic in the presence of carbon nanotubes."

He and Zeigler are focusing their investigations on solutions that become hazardous when mixed with the carbon nanotubes. Their most recent results indicate that [toxicity](#) can be reduced by controlling the ratio of liquid to particulate.

A cost-effective means of unbundling nanotubes remains one of the last hurdles for manufacturers to clear before they can employ the technology in mass-produced electronics. Current processes used for laboratory prototypes, including mechanical homogenization or centrifugal sifting, would be too expensive for manufacturing [consumer electronics](#). For that reason, liquid suspension agents may be the way forward if we are to have nano-tech products for the masses.

"It's an [emerging technology](#)," Bonzongo said. "We want to get ahead of it and make sure that the progress is sustainable — in terms of the environment and human health."

Provided by University of Florida

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