Carbon nanotube absorption measured in worms, cancer cells

March 28 2006

University of Michigan researchers have discovered how to measure the absorption of multi-walled carbon nanoparticles into worms and cancer cells, a breakthrough that will revolutionize scientists' understanding of how the particles impact the living environment.

A team led by U-M chemical engineering professor Walter J. Weber Jr. tagged multi-walled carbon nanotubes—one of the most promising nanomaterials developed to date—with the carbon-14 radioactive isotope, which enabled the nanotubes to be tracked and quantified as they were absorbed into living cells. Researchers used cancer cells called HeLa cells, and also measured nanotube uptake in an earthworm and an aquatic type of worm.

The findings were presented Sunday at the 231st American Chemical Society National Meeting in Atlanta. Co-authors of the presentation are graduate student Elijah Petersen and postdoctoral research assistant Qingguo Huang.

Carbon nanotubes were discovered in 1991, and hold great promise in several areas, including pharmacology and for hydrogen storage in fuel cells, Weber said. But despite their promise, a big problem is that it's not known how multi-walled carbon nanotubes will impact the living environment, Weber said.

"While everyone is concerned about this issue, there has been no really adequate way before this development to examine the extent to which

they may get into human cells, and what will result if they do," Weber said. "Nobody has been able to do quantitative research on this because no method to measure them has existed until now. We were able to detect them, but had no way to determine how much was there."

In tagging the nanotubes with the isotope, researchers found that about 74 percent of the nanotubes added to a culture of cancer cells were assimilated by the cells after 15 minutes, and 89 percent of nanotubes assimilated after six hours, according to the paper. And the uptake was nearly irreversible, with only about 0.5 percent of the nanotubes releases from the cell after 12 hours.

It's important to understand if and how the multi-walled carbon nanotubes accumulate in living cells, because before the materials can become widely used in society scientists must understand if they'll pass through the food webs and possibly threaten the health of ecosystems and lead to uptake by humans, Petersen said.

"This approach has virtually limitless potential for facilitating important future investigations of the behaviors of carbon nanotubes in environmental and biomedical applications," Petersen said.

Source: University of Michigan