In Study, Researchers Find Nanotubes May Pose Health Risks Similar to Asbestos

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Nanotubes, one of the wonder materials of the new age of nanotechnology, may carry a health risk similar to that of asbestos, a wonder material of an earlier age that turned into a scourge after decades of use when its fibers were found to cause lung disease, researchers said Tuesday.

This time, the warning comes long before anyone has fallen ill, and experts say the findings call for caution, not alarm, in handling nanotubes, which are tiny, superstrong carbon fibers.

Although nanotubes are already found in some products, like tennis rackets, researchers say the fibers appear to pose little risk to consumers.

Nanotubes, discovered in 1991, are essentially rolled-up sheets of carbon that can be used to produce materials that are far lighter and stronger than steel, for example. But scientists have also long wondered whether the needle-shaped nanotubes might cause the same types of disease as needle-shaped asbestos fibers.

An article published Tuesday on the Web site of the journal Nature Nanotechnology suggests that the answer may be yes. A team of researchers reported that injecting nanotubes into the abdomens of mice induced lesions similar to those that appear on the outer lining of the lungs after the inhalation of asbestos.

In the case of asbestos, the lesions eventually become mesothelioma, a deadly cancer.

The researchers, though, portrayed their results as good news by providing people who work with nanotubes with knowledge of how to minimize the dangers.

“In a sense, we’re forewarned and forearmed now with respect to nanotubes,” said Anthony Seaton, a professor of environmental and occupational medicine at the University of Aberdeen in Scotland.

Vicki Colvin, a professor of chemistry at Rice University in Houston, who was not involved with the research, said that she saw no need to restrict the use of nanotubes in products, but that their use should be better labeled.

“But it seems we should have better information about where it is and how it’s being used.”
When foreign particles like smoke or dust land in the lungs, cells known as macrophages engulf the particles and clear them away. Some asbestos fibers are too long for the macrophages to handle, resulting in lesions. The researchers hypothesized that nanotubes would cause similar problems if they were long, but not if they were short or tangled into a ball.

In their study, the researchers injected four groups of mice: one with short nanotubes about 5 microns in length, one with long nanotubes about 20 microns in length, one with asbestos and one with small carbon clumps. Some of the mice were killed and dissected the next day. Some were dissected a week later.

The mice injected with the short nanotubes or small carbon clumps did not develop disease. Those injected with long nanotubes or asbestos developed lesions on the tissue lining.

“Long ones are harmful, and short ones are not,” said Ken Donaldson, a professor of respiratory toxicology at the University of Edinburgh in Scotland and one of the authors of the Nature Nanotechnology article.

Dr. Donaldson said he was sure that given more time, the lesions caused by the long nanotubes would have developed into mesothelioma.

The study did not look at how easily nanotubes become airborne or whether they become lodged in the lungs if inhaled. The scientists said more research was needed to determine the extent of the risk posed by nanotubes.

Vince Castranova, chief of the pathology and physiology research branch of the National Institute for Occupational Safety and Health, in Morgantown, W.Va., said the new study was “very well done,” but added, “So far, we haven’t done the studies long enough to determine the long-term pathology.”

The people in greatest danger would most likely be those working in laboratories or at nanotube manufacturers.

“I think there is clear evidence for caution in how they are used and handled,” said Andrew D. Maynard, chief science adviser to the Project on Emerging Nanotechnologies at the Woodrow Wilson International Center for Scholars in Washington and another author of the Nature Nanotechnology paper.

Dr. Maynard said nanotubes should be subject to the same rules and regulations as asbestos.

“That gives you a good baseline starting point,” Dr. Maynard said. The rules could be relaxed if nanotubes turned out to be less toxic, he said.

Consumers would probably not be able to inhale nanotubes embedded in a golf club or bicycle frame, for instance. But Dr. Maynard said there could be a concern that nanotubes in products could be released later, much as asbestos in concrete or automobile brake pads was inhaled by construction workers or mechanics.