

'Asbestos warning' on nanotubes

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2008/05/20

Carbon nanotubes, the poster child of the burgeoning nanotechnology industry, could trigger diseases similar to those caused by asbestos, a study suggests.

Specific lengths of the tiny fibres were found to cause "asbestos-like" inflammation and lesions in mice.

Use of asbestos triggered a "pandemic of lung disease" in the 20th Century.

There are high hopes for the tiny carbon molecules, which have remarkable properties that could be used for advanced electronics and materials.

They are already known to be incorporated into products such as tennis rackets, bicycle handlebars and baseball bats, where they are used because of their strength and light weight.

Other undocumented products may also make use of them, the researchers said, but companies did not have a duty to report their use.

"As a society, we cannot afford not to exploit this incredible material but neither can we afford to get it wrong - as we did with asbestos," said Dr Andrew Maynard the Project on Emerging Nanotechnologies at the Woodrow Wilson International Center for Scholars in Washington DC, US.

However, of the known goods there was "little risk" of exposure as the nanotubes are encased inside, the researchers said. But, they warned, there was a potential risk for workers exposed to the tubes during manufacturing and disposal.

The nanotechnology industry welcomed the findings but cautioned against drawing conclusions from a single study.

"Until now we have not had two studies that showed the same result," Dr Steffi Friedrichs, director of the Nanotechnology Industries Association (NIA) told BBC News.

"The latest study suggests there could be a reason for concern and suggests there is an effect but it needs to be validated."

Length-effect

Carbon nanotubes are often thought to epitomise the nanotechnology industry.

The global market for these tiny cylindrical molecules is expected to grow to between \$1bn and \$2bn by 2014, according to some estimates.



The inhalation of asbestos fibres can cause lung diseases and cancers

However, the nanotubes show certain superficial similarities to other fibres, such as asbestos, which are known to cause harm and diseases including cancers.

"For a fibre to be harmful, it has to be thin, long and insoluble in the lung," explained Dr Ken Donaldson, one of the authors of the paper published in Nature Nanotechnology.

Nanotubes' thinness and toughness are well established, so the researchers set out to examine the effect of their length.

In a series of experiments, the researchers injected different lengths of multi-walled nanotubes - which comprise two to 50 concentric cylinders - into the abdomen of mice.

Asbestos fibres and tiny flat sheets of carbon were injected into other mice to compare the response.

The researchers looked in particular at a membrane that forms the lining of body cavities, such as the chest and the abdomen, called the mesothelium. The lining around the lungs is known to be prone to the cancer mesothelioma after exposure to asbestos.

"What we found was that the long nanotubes were pathogenic - they caused inflammation and scar formation. The short nanotubes were not," said Dr Donaldson.

"The problem seems to be that the cells that usually deal with particles can't deal with a long, straight shape."

The lung is equipped with a network of cells that engulf foreign particles in a process known as phagocytosis.

"[The cells] can stretch to about 20 microns but beyond 20 microns they start to have trouble enclosing their membrane around a structure," explained Dr Donaldson.

"Basically, it freezes them; they can't move properly so they can't clear material from the lung. They are in a hyperactivated state which leads to inflammation, scarring and probably cancer in the long term."

Long life

However, the researchers said the link between long, straight, multi-walled carbon nanotubes and cancers was not proven.

"We are a long way from saying that any form of carbon nanotubes causes mesothelioma," said Dr Donaldson.

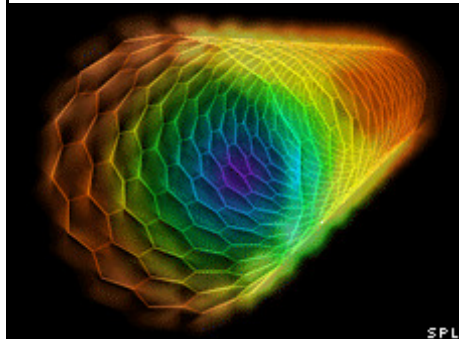
He said there were still many questions to answer, including whether the long, straight nanotubes would even reach the chest cavity lining if they were inhaled.

A recent study showed that when mice inhaled nanotubes they developed inflammation that peaked within seven days of exposure, and returned to normal within one or two months.

"Whether the material is asbestos-like is still a question to be debated," said Vincent Castranova, chief of a pathology research unit at the National Institute for Occupational Safety and Health, who conducted the study.

"Having a panic that you have the next asbestos is a little bit premature in my view," he told Associated Press.

CARBON NANOTUBES



- Sheets of carbon atoms folded into a cylinder
- Can occur as single tubes or as a series of concentric cylinders known as multi-walled nanotubes
- Members of the fullerene family, which includes buckyballs
- Demonstrate unusual strength and electrical properties
- Promise to revolutionise electronics, computers, chemistry and materials science

But other researchers still urged caution.

"These sorts of materials need to be handled very carefully," said Dr Anthony Seaton, a medical doctor and co-author of the study, who has treated a number of patients affected by asbestos.

"The Health and Safety executive in the UK needs to take appropriate measures to ensure that people are not being exposed to these things in the air."

He said this was particularly important for people involved in the manufacturing process, whether in industrial plants or academic labs, and when products were disposed of.

Many people were affected by asbestos when buildings which contained the material were demolished. Related health problems continue to be seen today.

"What happens if you demolish products, or you throw products into landfill sites or incinerate the products - is there a chance of carbon nanotubes coming out then and exposure occurring?" said Dr Maynard.

"We simply don't know the answer to that and I think it's something that needs to be addressed."

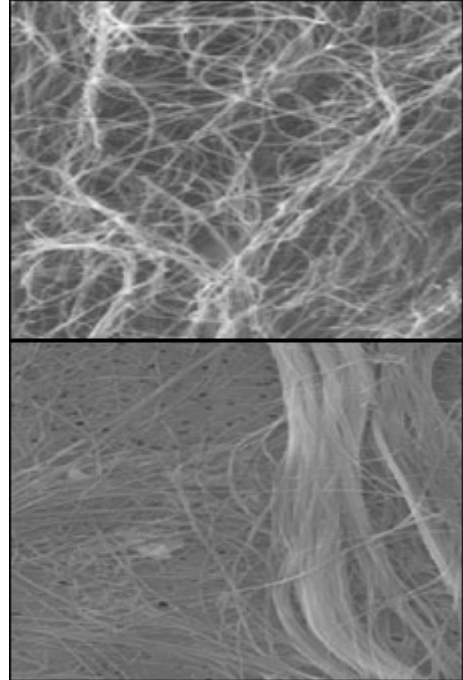
He also called for greater transparency from the nanotechnology industry.

"At the moment we don't know where carbon nanotubes are being used, what products they're appearing in, what types of nanotubes are appearing in which products," he said

"I think the bottom line here is that we still have a very clear chance of making a difference with this technology - of getting it right - if we take action now."

Story from BBC NEWS:

<http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/7408705.stm>



Carbon nanotubes (top) show similarities with asbestos (bottom)