

Science for Environment Policy

Carbon nanotubes could be released by plastic as it degrades

Carbon nanotubes (CNT) could be released into the environment as the plastic they are embedded in degrades, a new study suggests. The research found that general wear combined with exposure to UV light and moderate humidity would expose CNTs, posing a potential threat to human health.

CNTs are cylinders of carbon molecules a few tens of nanometres thick, which have a number of valuable thermal, electrical, and mechanical properties. They can also be combined with other materials, such as epoxy, to create 'nanocomposite' materials with commercial uses. For example, the high strength and low weight of some nanocomposites make them useful for aerospace and car components. Such properties can be further enhanced by adding [chemicals](#) to produce modified CNTs.

There is still some uncertainty about the hazards of different forms and preparations of CNTs to health and the environment. Evidence suggests it most probably differs; for example, some studies have shown that long rigid CNTs can have asbestos like effects on animals, but this is not necessarily so with less rigid forms. In the case of nanocomposites there are concerns that they may begin to release CNTs as they degrade, with implications for both human health and the environment.

In this study, researchers investigated the breakdown of two nanocomposite materials made up of CNTs and epoxy. One contained normal CNTs and the other chemically-modified CNTs. They found that both materials degraded significantly under the combined effects of moderate humidity and UV light. This process exposed CNTs on the surface of degraded nanocomposite particles, and increased their [risk](#) of being released into the environment.

They also compared the toxicity of the composite materials with the toxicity of normal and modified CNTs in their free form by feeding them to fruit fly larvae. Fruit flies exposed to free form modified CNTs were significantly less likely to survive. However, the 5-50 micron particles of ground encapsulated CNTs did not have this damaging effect.

The researchers suggest that a clear next step is to test even finer ground nanocomposites (high nano-size ranges) that have been even more degraded in the environment via UV, moisture and abrasion, and to determine the release and the potential toxic effect of the CNTs exposed on nanocomposite surfaces.

The study highlights that CNTs could potentially be released from nanocomposites under environmental conditions which are common in the wider environment, such as general wear and tear in sunlight. The authors note that the processes which release CNTs take time, and the rate of this is influenced by a complex interaction of the material and environmental factors, which need to be examined in further research to support future safety assessments. While the toxicology results did not show any effects of encapsulated CNTs on the fruit flies, there remains a need to confirm whether the environmentally degraded nanocomposite is non-toxic, given the observation of free form of CNTs on the degraded nanocomposite surfaces.



15 May 2014
Issue 372

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Source: Ging, J., Tejerina-Anton, R., Ramakrishnan, G., *et al.* (2014). Development of a conceptual framework for evaluation of nanomaterials release from nanocomposites: Environmental and toxicological implications. *The Science of the Total Environment*, 473-474, 9-19.
DOI:10.1016/j.scitotenv.2013.11.135.

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To cite this article/service: "Science for Environment Policy": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.