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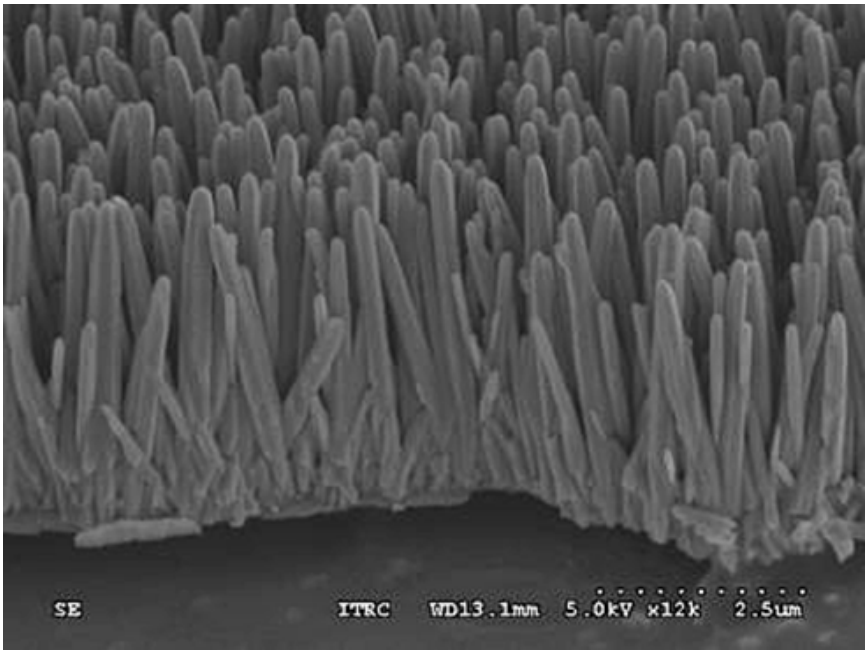
Plastic bags and old CDs find new life in nanosphere

While Australian researchers have developed a process for turning waste plastic bags into a high-tech nanomaterial, scientists in Taiwan have come up with an ingenious application for old audio CDs – using them to grow 'nanorods' for breaking down sewage.



Credit: Din Ping Tsai, National Taiwan University

The University of Adelaide-developed nanotechnology uses non-biodegradable plastic grocery bags to make carbon-nanotube membranes – highly sophisticated and expensive materials that could be used in filtration, sensing, energy storage and a range of biomedical innovations.

'Non-biodegradable plastic bags are a serious menace to natural ecosystems and present a problem in terms of disposal,' says Professor Dusan Losic, ARC Future Fellow and Research Professor of Nanotechnology in the University's School of Chemical Engineering.

'Transforming these waste materials through "nanotechnological recycling" provides a potential solution for minimising environmental pollution at the same time as producing high-added value products.'

Carbon nanotubes are tiny cylinders of carbon atoms, one nanometre in diameter (1/10,000 the diameter of a human hair). They are the strongest and stiffest materials yet discovered – hundreds of times stronger than steel but six times lighter – and their unique mechanical, electrical, thermal and transport properties present exciting opportunities for research and development.

Nanotubes are already used in a variety of industries including in electronics, sports equipment, long-lasting batteries,

sensing devices and wind turbines.

The University of Adelaide's Nanotech Research Group has 'grown' the carbon nanotubes onto nanoporous alumina membranes using pieces of grocery plastic bags vaporised in a furnace to produce carbon layers that line the pores in the membrane to make the tiny nanotubes.

The new process was conceived by PhD student Tariq Altalhi. Current methods for synthesising nanotubes usually involve complex processes and equipment, and most companies on the market measure production output in only several grams per day.

The process is catalyst- and solvent-free, which means the plastic waste can be used without generating poisonous compounds.

Meanwhile, researchers in Taiwan have come up with an ingenious application for old audio CDs – using them to grow ‘nanorods’ to facilitate the breakdown sewage under UV light.

‘Optical discs are cheap, readily available, and very commonly used,’ says Din Ping Tsai, a physicist at National Taiwan University. Close to 20 billion discs are manufactured annually, the researchers note, so using old discs for water treatment might even be a way to cut down on waste.

Tsai and his colleagues used the large surface area of optical discs as a platform to grow tiny, upright zinc oxide nanorods (structures made up of nanotubes) about 1/1000 the width of a human hair.

Zinc oxide is an inexpensive semiconductor that can function as a photocatalyst, breaking apart organic molecules like the pollutants in sewage when illuminated with UV light.

Because the CDs are durable and able to spin quickly, contaminated water that drips onto the device spreads out in a thin film that light can easily pass through, speeding up the degradation process.

In addition to the zinc oxide-coated optical disc, the Taiwanese device consists of a UV light source and a system that recirculates the water to further break down the pollutants.

The spinning-disc reactor is small, consumes little power, and processes contaminated water more efficiently than other photocatalytic wastewater-treatment methods, Tsai says. The device could be used on a small scale to clean water contaminated with domestic sewage, urban run-off, industrial effluents, and farm waste.

Source: University of Adelaide/EurekAlert

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