IIT-M develops nano-cocoons

Tiny biomaterials hold much promise as a drug-delivery mechanism

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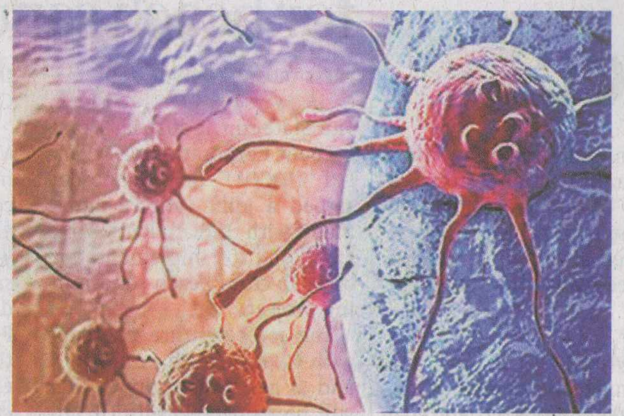
New Delhi, November 29

Indian scientists have designed ultra-small cocoons that can serve as a potential drug delivery system in future using a commercially available polymer and tiny carbon fibres that are thinner than human hair as ingredients.

These oval-shaped nano-cocoons, as small as 100 to 200 nanometres in size (one nanometre is one-billionth of a metre), developed by researchers from the Indian Institute of Technology (IIT) Madras are found to be structurally stable effective in carrying drug molecules. Also contributing to the research published last week in the journal, *Nano-Structures & Nano-Objects*, were their counterparts from the Sree Chitra Tirunal Institute of Medical Science and Technology in Thiruvananthapuram.



Has turmeric ingredients with anti-cancerous properties to deliver them inside lab-bred brain cancer tissues

Ingredients

The scientists used bio-compatible polymer, polyethylene glycol (PEG), used not just in healthcare and cosmetics but also as coating and paint material, and multi-walled carbon nanotubes to these nano biomaterials, which are structurally similar to silk cocoons, but ;much smaller in size.

"This is an interesting material. Firstly, PEG is a tried and tested material that finds applications in many areas. More importantly, it accommodates carbon nanotubes as it encapsulates them," said Prathap Haridoss, professor of metallurgical and materials engineering at IIT, who led the study.

The scientists could not only insert curcumin, the active ingredient of turmeric that is found to have anti-cancerous properties, in these nano-cocoons, but also deliver them inside lab-bred brain cancer tissues.

"When we tried to deliver curcumin molecules of similar size directly into the tissue, they failed to do so. Instead, they aggregated outside the tissue. But when these nano-cocoons were used as a vehicle, they were internalised by the tissue," said Hindumathi R, a graduate student of Haridoss and the first author of the study.

She was quick to add that there was much more to be done before finding out whether they could be used in real life conditions. Apart from exploring the optimum drug loading and drug release, there is the need to find out whether these cocoons are suitable for targeting different cells in the human body, she said.

Significantly, the procedure followed by the scientists in synthesising the bio-materials also reduce toxicity known to be associated with carbon nanotubes.

A toxic-free process

A recent study by a team of researchers in the UK reported that carbon nanotubes, hailed as a wonder material that could revolutionise a range of fields including electronics, could pose cancer risk very similar to asbestos.

According to Haridoss, the method adopted by the scientists cleaved carbon nanotubes into much smaller sizes in which they are less or toxic-free. "Carbon nanotubes of 100 to 200 nanometre long are known to be safe for biomedical use," said Hindumathi.

The scientists carried out toxicity studies with the help of their counterparts from the Thiruvananthapuram-based institute.

As the next step, the scientists said, they intend to study whether these tiny biomaterials can cross the blood-brain barrier so as to deliver drugs to brain tumour sites.

Haridoss was also hopeful that the structural integrity of these novel biomaterial may find applications in other areas where carbon nanotubes will find application.

Business Line 30.11.17