

Article Tools

Printer-friendly

E-mail this article

Comment on this article

Daily News Email Digest

Subscribe to Spotlight

Nanowerk News Feeds

SHARE

Most Recent Spotlights

Nitrogen-doped carbon nanotube catalyst systems for low-cost fuel cells
Posted: Feb 5th, 2009

Are nanotechnology machines a match for nature's biomotors?
Posted: Feb 4th, 2009

One route to nanomanufacturing leads through nanocrystal synthesis
Posted: Feb 2nd, 2009

DNA nanotechnology goes 3D
Posted: Jan 29th, 2009

Insight into nature's protein factory could lead to radically new materials design
Posted: Jan 27th, 2009

Building walls with bottom-up nanotechnology
Posted: Jan 26th, 2009

Synthesizing colloidal 'molecules' of various shapes
Posted: Jan 23rd, 2009

Cross-border nanotechnology - toxic effects of nanoparticles penetrating cells
Posted: Jan 22nd, 2009

Nanotechnology tools could lead to new uses for collagen
Posted: Jan 21st, 2009

Governing the risk of nanotechnology in food and cosmetics
Posted: Jan 20th, 2009

Swallowing a nanotechnology pill
Posted: Jan 19th, 2009

Morphology control of organic structures leads to better nanotechnology bomb sniffers
Posted: Jan 16th, 2009

Advanced nanotechnology: A memo to President-elect Obama
Posted: Jan 15th, 2009

A new class of radiation detection materials
Posted: Jan 14th, 2009

Nanoengineered vaccine capsules for the stimulation of immune responses
Posted: Jan 13th, 2009

Nano-welding facilitates bottom-up nanotechnology fabrication
Posted: Jan 12th, 2009

Nanotechnology safety for success dialogue
Posted: Jan 9th, 2009

Nanotechnology puts your nose on a carbon nanotube
Posted: Jan 8th, 2009

Characterizing the electronic properties of carbon nanotubes
Posted: Jan 7th, 2009

Invisible electronics made with carbon nanotubes
Posted: Jan 6th, 2009

Investigating potential nanotechnology risks at the

A-Z Nanoparticle Supplier

Metal, Oxide, Carbide, Nitride
Nanowire, dispersion, carbon nanotube

Identify Unknown Material

Powders, fibers, plastics, liquids polymers, contaminations

Ads by Google

News > Nanowerk Spotlight >

Posted: January 19, 2009

Swallowing a nanotechnology pill

(*Nanowerk Spotlight*) Typically, nanoparticles have been used for drug delivery and it is only recently that carbon nanotubes (CNTs) have gained attention as potential drug delivery vehicles (see: "[Nanotechnology's magic bullet](#)"). Carbon nanotubes offer a number of advantages which suggest that they may provide an improved result over nanoparticles. They have a larger inner volume which allows more drug molecules to be encapsulated, and this volume is more easily accessible because the end caps can be easily removed, and they have distinct inner and outer surfaces for functionalization. Current research has shown the ability of CNTs to carry a variety of molecules such as drugs, DNA, proteins, peptides, targeting ligands etc. into cells – which makes them suitable candidates for targeted delivery applications. Despite these advantages, a suitable delivery system has not been developed yet for the targeted delivery of CNTs to specific sites.

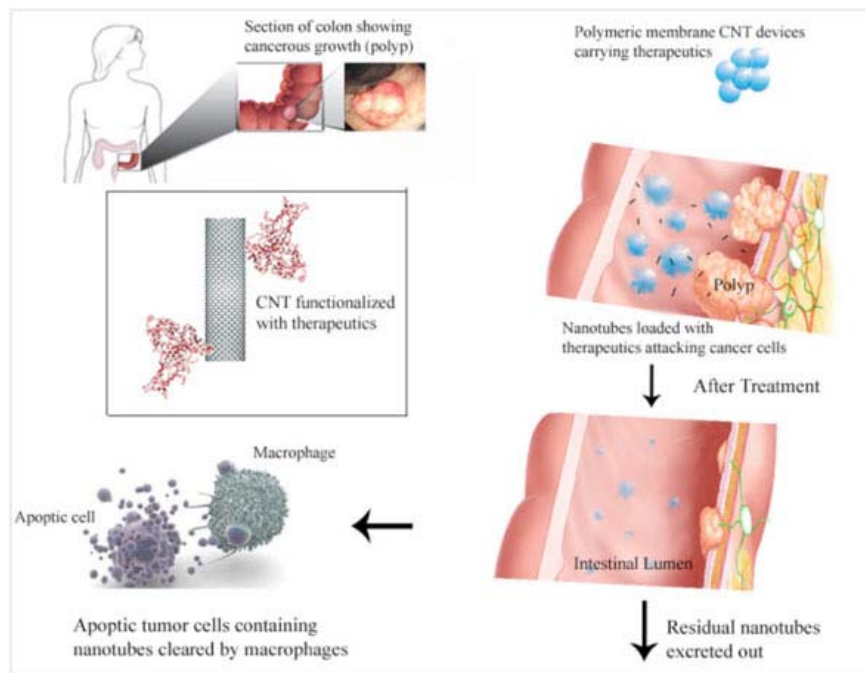
A research team from various Canadian and U.S. universities has now demonstrated, for the first time, the design and development of a novel microcapsule carbon nanotube targeted delivery device.

"Our results have shown that carbon nanotubes functionalized with therapeutic molecules can be embedded into the core or at the surface of different types of alginate capsules to form novel polymeric membrane CNT microcapsules," Satya Prakash tells Nanowerk. "The membrane offers protection to the drug being carried, while the CNTs help achieve targeted delivery of the therapeutic."

As CNTs can be functionalized with drugs and biomarkers specific to a disease, this device can be targeted for a specific site for optimal clinical benefits and it can easily limit the exposure of the drug to healthy tissues of the body to overcome potential drug induced toxic side-effects.

Prakash, an associate professor in biomedical engineering, at McGill University and director of the university's [Biomedical Technology and Cell Therapy Research Laboratory](#), and his collaborators expect their device to have great potential in the delivery of drugs, genes, proteins and other therapeutic molecules. Together with scientists from Rensselaer Polytechnic Institute, Southern Illinois University, and Rice University he has published the team's findings in the January 14, 2009 print edition of *Nanotechnology* ("[Microcapsule carbon nanotube devices for therapeutic applications](#)").

"There is abundant literature in the area of functionalizing CNTs with a variety of therapeutics" says Prakash. "However, almost all studies so far have been focusing on the systemic delivery of the CNTs. Oral delivery is the most convenient route of administration for therapeutics and also offers the advantage of achieving targeted delivery, specifically for diseases of the gastrointestinal tract. There was a need to combine the advances in carbon nanotube research with those in drug delivery systems. Our study, for the first time, investigates the feasibility of designing a polymeric membrane microcapsule CNT device that can be used in oral delivery applications."



Example of a polymeric membrane CNT device in colon targeted delivery applications. (Image: Dr. Prakash, McGill University)

So far, the use of CNTs in oral drug delivery – which is one of the most common and convenient route of therapeutics administrations – has not been possible to achieve. During oral delivery a drug must survive the harsh conditions of the gastrointestinal tract and retain its potency to be effective, and CNTs must be released with their cargo at a specific gastrointestinal site.

cypher
scanning probe microscope

Unbreakable NanoCode?

Crack it with the new Cypher™ AFM

ASYLUM RESEARCH

Ads by Google

Identify Unknown Material

Powders, fibers, plastics, liquids polymers, contaminations
www.EMSL.com

low cost carbon nanotubes

high quality, low cost SWNTs, MWNTs
Purified, Short, OH & COOH CNTs
www.cheaptubes.com/cntpricelist.

What is Nanotechnology?

Find out all about nanotechnology and raise your "nano IQ."
www.NanotechProject.org

Carbon nanotubes

Field emission grade CNT powder. High emission current.
www.xintek.com/products

Carbon Nanotubes

High quality, low cost single-wall (SWCNT) & multi-walled (MWCNTs)
www.helixmaterial.com

The team used single-walled CNTs, which they functionalized with hydrophilic carboxylic acid and hydroxyl groups, and then embedded them in the core of alginate microcapsules or coated them on their surface. By using an automated microencapsulator they were able to obtain highly uniform capsules.

"The nanotubes on the capsule surface can be functionalized with antibodies to promote adhesion of the capsules to specific target sites *in vivo*, thereby facilitating targeted delivery while the embedded CNTs can be functionalized with suitable biomolecules for drug/gene delivery at the site of adhesion upon degradation of the capsule at the target site," explains Prakash. "The biocompatibility of the nanotubes and the encapsulation materials, which has been already established through various studies, makes it possible to use this device for therapeutic purposes."

A particular challenge for the medical application of carbon nanotubes will be their biocompatibility, something which currently is a considerable area of concern, especially with conflicting reports on their toxicity (see: "[Comparing apples with oranges - the problem of nanotubes risk assessment](#)"). Long term toxicity studies will have to be conducted in order to establish the safety of this device.

By Michael Berger. Copyright 2009 Nanowerk LLC

[Leave a comment](#)



Click here
for more
information on our
products and solutions

Bruker AXS Microanalysis

Comments

The author says "functionalization", I presume the meaning was use. Is s/he so illiterate that it's impossible to say a simple, declarative sentence?

#1 - [star guyot](#) - 01/19/2009 - 21:16

No, the meaning was "functionalization". I suggest you look it up in a dictionary. It's funny that you accuse someone else of being illiterate...

#2 - [Michael](#) - 01/19/2009 - 21:45

Name

E-mail (Will not appear online)

Comment

To prevent automated Bots from spamming, please enter the text you see in the image below in the appropriate input box. Your comment will only be submitted if the strings match. Please ensure that your browser supports and accepts cookies, or your comment cannot be verified correctly.

