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NEWSLETTER

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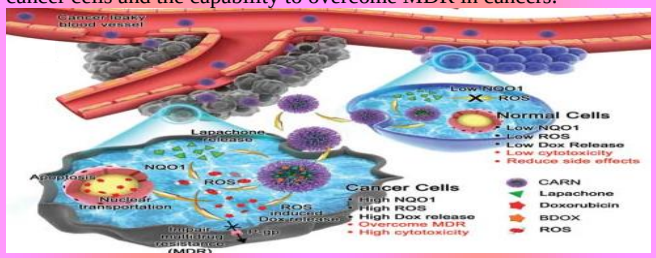
ADVANCEMENTS IN NANO TECHNOLOGY

Cascade amplification release nanoparticle to overcome tumor drug resistance

Researchers have developed a cascade amplification release nanoparticle (CARN) by simultaneously loading a high drug content of Lapa and an ROS-responsive doxorubicin (DOX) prodrug (BDOX) in a novel block copolymer, poly(ethylene glycol)–poly[2-(methylacryloyl)ethylnicotinate] (PEG–PMAN), micelle. The low toxicity and high hydrophobicity of ROS-responsive BDOX, which is derived from doxorubicin by incorporating a boronate moiety, could reduce its toxicity to normal cells and improve its stability in the nanoparticles, thus avoiding undesired extracellular release until ROS activation. After endocytosis by cancer cells, the CARNs would first release Lapa, which would then produce a remarkable increase in the ROS level via NQO1 (NAD(P)H:quinone oxidoreductase-1) catalysis. The generated ROS would subsequently activate the BDOX prodrug, leading to a sequential and amplified drug release process. More importantly, as the scientists point out, Lapa could synergize with DOX and dramatically reverse drug resistance in cancer cells by preventing drug efflux and promoting nuclear transportation. Moreover, Lapa had relatively low cytotoxicity and induced an insignificant ROS increase in normal cells because of their low NQO1 expression, interrupting the cascade DOX release process and resulting in a low cytotoxicity of the CARNs against normal cells. Integrating multiple mechanisms into a single CARN would reduce the side effects of the encapsulated anticancer drug, reverse drug resistance, and substantially enhance therapeutic efficacy. With its high and selective cytotoxicity against MDR cancer cells and improved pharmacokinetics, CARN remarkably enhanced the in vivo antitumor efficacy against MCF-7 ADR xenograft tumors with an IRT of 92.8%, which was much higher than of DOX (50.3%) or P-Lapa (64.4%), and decreased the side effects of DOX and Lapa as well. This cascade amplification drug release system has provided a new therapeutic strategy for developing DDSs with high selectivity for cancer cells and the capability to overcome MDR in cancers.



Researchers identify cheaper, greener biofuels processing nanocatalyst

Fuels that are produced from nonpetroleum-based biological sources may become greener and more affordable. Researchers examined the use of a processing catalyst made from palladium metal and bacteria. Biofuels are made from renewable materials such as plants or algae, and offer an alternative to petroleum-based sources. However, many biofuels are costly to produce because the precursor product, bio-oil, must be processed before it is sent to the refinery to be turned into liquid fuel. Researchers have identified and tested a new processing method. Bio-oil forms from the same chemical reaction that forms petroleum," Sharma said. But what takes millions of years naturally in the ground takes only minutes in the lab using a process that is very similar to pressure cooking. The bio-oil produced in the lab from algae contains impurities like nitrogen and oxygen, but treating it with palladium as a catalyst during processing helps remove those impurities to meet clean-air requirements. For the palladium to do its job, the bio-oil needs to flow past it during processing. Previous studies have shown that allowing the oil flow through porous carbon particles infused with palladium is an effective method, but those carbon particles are not cheap. Instead of using commercially produced carbon particles, we can use bacteria cell masses as a sort of biologic scaffolding for the palladium to hold on to. The oil can flow through the palladium-decorated bacteria masses as it does through the carbon particles. Researchers have shown the potential of making refinery-ready crude oil from algae bio-oil using a catalyst that can be prepared from low-grade recycled metals and green and economical bacterial biomass proves that this is a very promising advancement. In addition, this bio-catalyst would work equally well in petrochemical processing.

NANO PRODUCTS

NanoConcept Textile Sealing

The product is from the company Nanoconcept from Germany. NanoConcept textile sealing an organic, watery coating material based on the chemical nano technology. The coating solvent generates a transparent, ultra-fine layer and covers each single fiber on textiles and leather. These provide textiles with insensitivity against watery, oily and other dirt. With our sealing (impregnation), dirt, oil, coffee, dirt-water, red wine and fat spots belong to the past.

Home Nano Tio2 Air Purification

This is the product of the company Jita Enterprise,USA. Much of indoor air pollution come from chemical detergent, carbon monoxide, voc, formaldehyde, acetaldehye, benzene, toluene, mold spores, bacteria and viruses. When Photocatalyst tio2 is in the presence of light; its decompose unwanted organic compound to sickness from spreading. This is great for bedrooms, hotel rooms, gyms, rest room and toilet seats.

Nanotechnology delivers medicine to cancer cells while protecting healthy cells

Cancer treatments, including chemotherapy, have helped many of those who have been diagnosed with the disease to go on to live healthy lives. Nevertheless, chemotherapy takes a toll on the body. During treatment, chemotherapy attacks all of the body's cells, not just cancer cells. The result destroys healthy cells, causing many patients to suffer major side effects during and after treatment. And because current treatments aren't specifically targeted to cancer cells, only 0.01 percent of chemotherapy drugs actually reach the tumor and its diseased cells. Instead of being injected straight into the bloodstream and transported randomly to both sick and healthy cells, the chemotherapy medicine is encapsulated in nanoparticles. When nanoparticles containing the cancer drugs are injected into the bloodstream, the nanoparticles are so large that they remain in the blood vessels in most types of healthy tissues. This prevents the chemotherapy from harming healthy cells. Blood vessels in the tumor, however, have porous walls, so that the nanoparticles containing the chemotherapy can work their way into the cancerous cells. However, the nanoparticles can only reach cells that are closest to the blood vessels that carry the drug-laden particles, she said. That means that cancer cells that are far from the blood vessels that supply the tumour do not get the chemotherapy drugs. The particles are unusual because they can form small bubbles. The nanoparticles are in the surface of the bubbles. These bubbles are an important part of the cancer treatment. Another essential part is the use of ultrasound. To make the bubbles behave the way they wanted, the researchers tested many different ultrasound treatments, and measured how many of the nanoparticles were delivered to cancerous tissues in mice. The bubbles that contain the chemotherapy-laden nanoparticles are injected into the bloodstream. Ultrasound is then applied to the tumor. The ultrasound causes the bubbles to vibrate and eventually burst, so that the nanoparticles are released. The vibrations also massage the blood vessels and tissues to make them more porous. This helps push the nanoparticles further into the cancerous tumor, instead of only reaching the cancer cells closest to the blood vessels. Researchers have seen that the nanoparticles camouflage the chemotherapy drug, allowing the cancer cells to take them up. But for the treatment to work, the nanoparticles have to release the cancer drug exactly when and where it is needed. This combination of bubbles, nanoparticles and ultrasound also opens the door on the possibility of treating brain diseases.