

USHS STEM

TRACTORS ARE DOOM-ED, RADIATION IS EVERYWHERE AND THE REVOLUTION OF NANOPARTICLES

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FACT 01

Some of the most common irradiated foods include: beef, pork, poultry, eggs in shells, seafood, fresh fruits & vegetables and seasonings.

FACT 02

Carbon nanotubes are more flexible than rubber, but stronger than diamonds

FACT 03

Hackers have run the video game Doom on the digital screen of a toaster!

FROM THE WRITERS

Welcome back to 2023!

You might have noticed something new this year about the newsletter. Sadly, Centenary Heights SHS will no longer be partnering with us with our collaborative newsletter, and we wish them and Katherine the very best on the STEM endeavors!

This does mean that the newsletter is entirely run by USHS, but the same awesome content will be coming from us every couple months!

Happy reading!

- **Grace**



TRACTORS ARE DOOM-ED!

BY LACHLAN WYER

(Deer & Company, 2023)

When Australian hacker Sick Codes hacked into a John Deere 4240 tractors and installed doom on it, people were shocked! Installing doom on any device is seen as the universal symbol that the system has been completely taken over. This can be concerning as if data can be exposed, it poses the risk of a wide-scale data and privacy breach. A verge article explains that Sick Codes was able to gain upwards of 1.5 GB of data logs that are able to identify and locate that specific tractor. This data privacy breach goes along with John Deere remotely locking down tractors that the Russians stole from Ukrainian farms, in addition to doing the same thing in China's construction sites.

So how do these separate incidents have to do with us everyday consumers in Australia? It impacts us as John Deere can decide that Australians should not have access to the computer systems of their roughly \$50,000 tractor unless they pay an extra fee. In addition to this, as Sick Codes showed, a serious security breach can easily give away private information at such relative ease. As consumers, this certainty questions whether John Deere values consumer rights, and it also poses the question of what will John Deere be willing to do to win back the trust of its customers?

Relevant Articles:

Buchanan, K., 2022. Hacker Sick Codes says cybersecurity in agtech is no game after viral John Deere tractor hack. [Online]

Available at: <https://www.abc.net.au/news/rural/2022-08-19/sick-codes-hacks-john-deere-tractor-plays-video-game-doom-defcon/101345586>

[Accessed 27 April 2023].

Roth, E., 2022. Def Con hacker shows John Deere's tractors can run Doom. [Online]

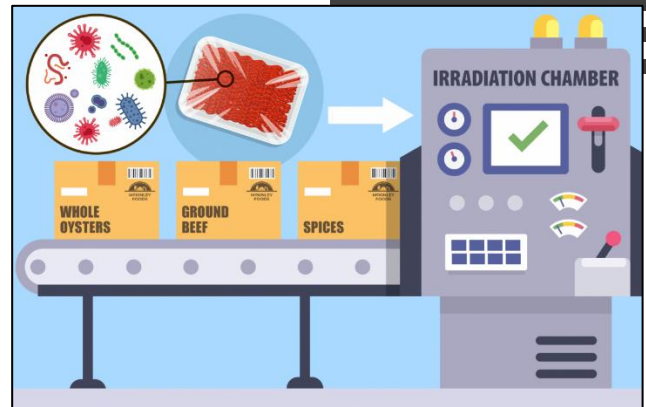
Available at: <https://www.theverge.com/2022/8/15/23306650/def-con-hacker-john-deere-tractors-run-doom-right-to-repair>

[Accessed 27 April 2023].



RADIATION IS EVERYWHERE – AND ITS NOT NECESSARILY HARMFUL!

BY ALYSSA LEWIS



(CDC, 2022)

Food irradiation is a preservation technique where a controlled amount of ionizing radiation is used to extend a product's shelf life or kill insects, moulds, bacteria, and other possibly harmful micro-organisms (Victorian Government, n.d). One of the most common sources of ionizing energy used to irradiate food products is cobalt-60. This is because it kills any insects, bacteria, or pathogens that can be found on or in the product. In turn, this makes it so they are unable to reproduce, therefore decreasing the chance of food poisoning and extending the shelf life (QLD Government, 2018). Different amounts of radiation are used on different types of foods, the most common type being Gamma radiation.

Gamma radiation is electromagnetic energy that is emitted from radioisotopes. This type of energy is the most energetic in the electromagnetic spectrum and is especially difficult to stop as it can travel through meters of materials at a time (ARPANSA, n.d). Because gamma rays are highly penetrating, they can travel through the bodies of organisms which can cause damage to cells (ARPANSA, n.d). This kills any insects, bacteria, or pathogens that can be found on or in food products. However, because it can penetrate materials easily, gamma radiation can also be dangerous for the humans working with it. Whilst in over a short period of time it is harmless, constant exposure to radiation can change the molecular structure of cells and lead to things like cancer.

To protect workers from this exposure, safety procedures set in place from the Radiation Safety Act 1999 impose strict requirements on companies that possess radioactive sources, commonly done with thick layers of lead. This ensures they can use these materials safely and the rooms that the radioactive materials are in are designed to protect workers and the external environment from the radiation (QLD Government, 2018).

So does this mean our food is radioactive???

No. Because the levels of radiation are so low, for the limited exposure of the food itself, the radiation cannot permanently alter the structure of the food. Because the structure is not altered, it is not radioactive. This makes irradiation a very useful method in not just destroying certain bacterium, but

Relevant Articles:

ARPANSA. (n.d). Gamma Radiation. <https://www.arpansa.gov.au/understanding-radiation/what-is-radiation/ionising-radiation/gamma-radiation>

Queensland Government. (2018). The Facts About Food Irradiation.

https://www.health.qld.gov.au/_data/assets/pdf_file/0028/721486/food-irradiation.pdf

Victorian Government. (n.d). Food Irradiation.

<https://www.betterhealth.vic.gov.au/health/healthyliving/food-irradiation>

THE REVOLUTION OF NANOPARTICLES

BY SALLY ZHONG

With the rising development of Nanotechnology, scientist and engineers have now developed a range of ways to improve consumerism and revolutionise medicine. In understanding how to manipulate an atom or molecule's chemical and physical properties, scientists are able to create nanomaterials at a molecular scale. Of course, there are already natural nanomaterials that exist in the world such as volcanic ash. However, the creation of artificial nanomaterials have proven to be effectively stronger and durable than their counterparts (Lozano, 2022). Take tubular fullerenes (or carbon nanotubes) for example, which are extremely flexible, but surprisingly stronger than its allotrope, diamond. Along with their small size, nanomaterials also have the benefit of appearing to be almost invisible. Scientist have used this to their advantage in the clothing industry, where clothes are coated with a thin layer of zinc oxide nanoparticles (the same found in sunscreen) for protection against the sun's UV radiation.

Interestingly, nanoparticles have been designed with a large surface area, capable of carrying bulk material. This ability is used to strip contaminated water of its toxic metals, chemicals and even viruses. This has proven to be a safe, affordable, and efficient way which could turn saltwater into freshwater (Lozano, 2022). Likewise, the food industry is also incorporating nanoparticles into their food packaging, containers and bottles to improve food quality. For example, silver nanoparticles in food containers have proven to be very effective in killing bacteria.

Advancements of nanotechnology have also opened doors of opportunities into the medical field. Nanoparticles are being used to identify certain proteins and pathogens, so they can efficiently target and deliver medication to the specific area of tissues while avoiding healthy cells (Medical Device Network, 2020). This has proven to be a successful method for the treatment for diseases such as cancer, because other cancer treatments like chemotherapy and radiation also destroy healthy tissues in the process (Lozano, 2022). Nanoparticles have also been used in vaccines, with being in some of the most recent vaccines, the Pfizer-BioNTech and Moderna Covid-19 mRNA vaccine (Sun, 2022).

Nanotechnology is a powerful tool that has a range of uses, but it can prove to be dangerous to the environment as well as humans. Nano-pollution is the waste produced in the process of creating nanomaterials. They can be quite dangerous if they enter the body unintentionally and will cause toxicity to the body (Lozano, 2022). Other nanoparticles like Doxil can be used to treat heart burn, but can risk the side effects of developing hand-foot syndrome (Medical Device Network, 2020). Further research is needed on whether exposure to these nanoparticles could cause adverse effects to the heart, lung, skin, reproductive performance or perhaps even contribute to cancer itself (Lozano, 2022). There is still so much to discover about this extraordinary particle. Who would have imagined that the invention of a particle smaller than a cell would bring so many successful achievements, yet also dangers into the food industry and medical field?

Relevant Articles

N.a. (2020, July 10). *Nanotechnology in Medicine: Technology Trends*. Medical Device Network.

<https://www.medicaldevice-network.com/comment/nanotechnology-medicine-technology/#:~:text=Nanomedicine%20refers%20to%20the%20area,to%20introduce%20into%20the%20body>

Sun.D. (2022, May 5). *Nanoparticles are the future of medicine - researchers are experimenting with new ways to design tiny particle treatments for cancer*. The Conversation.

<https://theconversation.com/nanoparticles-are-the-future-of-medicine-researchers-are-experimenting-with-new-ways-to-design-tiny-particle-treatments-for-cancer-180009>

Lozano. C. (2022, September 27). *Nanotechnology*. National Geographic.

<https://education.nationalgeographic.org/resource/nanotechnology>

PUZZLES

Once again, here are some puzzles to test your cognitive thinking!

THE RULES OF KILLER SUDOKU

- Every square must contain a single number
- Only the numbers from 1 through to 9 can be used
- Each 3x3 box can only contain each number from 1 to 9 once
- Each vertical column can only contain each number from 1 to 9 once
- Each horizontal row can only contain each number from 1 to 9 once
- In the section off box, the numbers must add to the total of that box

Have a go and see if you can crack this numerical puzzle!

Daily No. 6339

Moderate

14	20			11		15	11	19
		14						
19	21			12				
		15				23	34	
11								
11		11		13				
	11				30	29		10
11		18					6	
	16							

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