CHEMWATCH

Bulletin Board

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*** While Chemwatch has taken all efforts to ensure the accuracy of information in this publication, it is not intended to be comprehensive or to render advice. Websites rendered are subject to change.**

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ASIA PACIFIC

APVMA Special Gazette, 23 November 2023

2023-11-23

DOCUMENT

PDF 213.27 KB

DOCUMENT

DOCX 94.84 KB

Notice

The Australian Pesticides and Veterinary Medicines Authority (APVMA) advises that an error was published in the Commonwealth of Australia Gazette for Agricultural and Veterinary Chemicals, No. APVMA 19, Tuesday 19 September 2023.

The registrations and variations published under the heading Agricultural chemical products and approved labels in APVMA Gazette 19, Tuesday 19 September 2023 were those for Gazette 20, Tuesday 3 October 2023, and relate to the period 11 to 25 September 2023. This Special Gazette contains the registrations and variations for agricultural chemical products and approved labels registered or varied by the APVMA for the period 28 August 2023 to 11 September 2023.

Contents

- Erratum notice – 1
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Content last updated

23 November 2023

Content last reviewed

23 November 2023

URL

http://apvma.gov.au/node/119971

Read More

APVMA, 23-11-23

http://apvma.gov.au/node/119971

Less PFAS in Taiwan's water than in other nations

2023-11-22

Levels of per- and polyfluoroalkyl substances (PFAS) in sources of drinking water in Taiwan are lower than those in other countries, the Ministry of Environment said in response to concerns.

"PFAS are a group of chemicals used to make fluoropolymer coatings and products that resist heat, oil, stains, grease and water," the US Centers for Disease Control and Prevention Web site says.

"There has been concern over possible health effects from exposures to PFAS, including elevated risks of cancers of the kidney and testis," the US National Cancer Institute Web site says.

Japanese authorities recently announced that PFAS were found in rivers and groundwater in the Kansai region, prompting the testing of residents in the area. Blood tests of residents in Settsu, a city in Osaka Prefecture, showed that 31 of 87 people had PFAS levels exceeding US safety standards, prompting plans for expanded screening.

The ministry on Sunday said that it would refer to international practices and consider defining safe PFAS levels as part of the country's drinking water standards.

"Water purification plants in Taiwan are testing for all three of those substances, and the results are all lower than the recommended values set by various countries," said Lo Jen-chun ( ), who is in charge of the ministry's drinking water protection policies.

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Taipei Times, 22-11-23

https://www.taipeitimes.com/News/taiwan/archives/2023/11/22/2003809545

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Correction of chemical names - 23 November 2023

2023-11-23

Previous chemical name	Chemical name as varied	CAS number	Listing varied on	Reason the listing was varied
Phosphonic acid,	Phosphonic acid, *P*-(2,2,2-	52-68-6	20 November 2023	CAS has updated the name
Mercury, (nitrato-*O*) phenyl-	Mercury, (nitrato-. kappa.*O*) phenyl-	55-68-5	20 November 2023	CAS has updated the name
		137-26-8	20 November 2023	CAS has updated the name
tert-amyl peroxy(2-		686-31-7	20 November 2023	Inventory name has been updated to CAS name
4-pyrimidinol,	4-Pyrimidinol,	1603-02-7	20 November 2023	CAS has updated the name
Tris(2-ethylhexyl) orthoborate	Boric acid (H3BO3), tris(2-ethylhexyl) ester	2467-13-2	20 November 2023	Inventory name has been updated to CAS name
	3(2*H*)-Isothiazolone, 2-methyl-	2682-20-4	20 November 2023	Inventory name has been updated to CAS name
Dimethyl isosorbide	D-Glucitol,	5306-85-4	20 November 2023	Inventory name has been updated to CAS name
Hexanoic acid, 2-ethyl-,	Hexanoic acid, 2-ethyl-,	7360-38-5	20 November 2023	CAS has updated the name
ammonium	Propanoic acid, 2-mercapto-, ammonium salt (1:1)	13419-67-5	20 November 2023	Inventory name has been updated to CAS name

Previous chemical name	Chemical name as varied	CAS number	Listing varied on	Reason the listing was varied
	Acetic acid,	13887-98-4	20 November 2023	Inventory name has been updated to CAS name
Calcium xylene sulfonate		28088-63-3	20 November 2023	Inventory name has been updated to CAS name
	Zinc, bis(*O*,*O*-diisooctyl	28629-66-5	20 November 2023	CAS has updated the name
propane,	Propane,	35397-13-8	20 November 2023	CAS has updated the name
DL-Proline, 5-oxo-, monosodium salt	Proline, 5-oxo-, sodium salt (1:1)	54571-67-4	20 November 2023	CAS has updated the name
2-propenoic acid, 2-methyl-,	2-Propenoic acid, 2-methyl-, polymer with butyl 2-methyl-2-	58998-54-2	20 November 2023	Inventory name has been updated to CAS name
hexanedioic acid,		66028-25-9	20 November 2023	CAS has updated the name
Titanium, bis[[2,2′,2″-	Titanium, bis[2-[bis(2-hydroxyethyl) amino-. kappa.*N*] ethanolato-. kappa.*O*]	68631-27-6	20 November 2023	CAS has updated the name
2-Octynoic acid, 3-hexenyl ester, (*Z*)-	2-Octynoic acid, (3*Z*)-3-hexen-1-yl ester	68698-58-8	20 November 2023	CAS has updated the name
Butanoic acid, 3-methyl-, 2-hexenyl ester, (*E*)-	Butanoic acid, 3-methyl-, (2*E*)-2-hexen-1-yl ester	68698-59-9	20 November 2023	CAS has updated the name

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Previous chemical name	Chemical name as varied	CAS number	Listing varied on	Reason the listing was varied
		68954-58-5	20 November 2023	Inventory name has been updated to CAS name
	6-Octen-3-one,	74338-72-0	20 November 2023	CAS has updated the name
2-Propanol,1-amino-, compound with .alpha.-sulfo-.omega.-(dodecyloxy) poly(oxy-1,2-ethanediyl) (1:1)	2-Propanol, 1-amino-, compd. with .alpha.-sulfo-.omega.-(dodecyloxy) poly(oxy-1,2-ethanediyl) (1:1)	83016-76-6	20 November 2023	Inventory name has been updated to CAS name
Aluminate(1-), bis[3,5-bis(1,1-	Aluminate(1-), bis[3,5-bis(1,1-	118422-20-1	20 November 2023	Inventory name has been updated to CAS name
4-[4-chloro-6-(*N*-ethyl-anilino)-[1,3,5] triazin-2-ylamino]-2-[1-(2-		136213-75-7	20 November 2023	Inventory name has been updated to CAS name
		149591-38-8	20 November 2023	CAS has updated the name
2,9-bis(3-	Quino[2,3-b] acridine-2,9-	164578-11-4	20 November 2023	Inventory name has been updated to CAS name

Read More

AICIS, 23-11-23

https://www.industrialchemicals.gov.au/news-and-notices/correction-chemical-names-23-november-2023

AMERICA

RESULTS OF STATEWIDE PFAS SAMPLING IN PRIVATE WELLS NOW AVAILABLE

2023-11-03

The Wisconsin Department of Natural Resources (DNR) today announced the results of a study conducted to understand the extent of per- and polyfluoroalkyl substances (PFAS) contamination in shallow groundwater throughout Wisconsin.

PFAS are a group of human-made chemicals used for decades in numerous products, including non-stick cookware, fast food wrappers, stain-resistant sprays and certain types of firefighting foam. These contaminants have made their way into the environment in a variety of ways, including spills of PFAS-containing materials, discharges of wastewater that contain PFAS from treatment plants and use of certain types of firefighting foams.

During the summer and fall of 2022, the DNR used funding from the U.S. Environmental Protection Agency (EPA) to collect water samples from across the state and analyzed them for PFAS.

In total, 450 samples were collected voluntarily from private wells distributed throughout Wisconsin. Most private wells that were sampled had PFAS concentrations below current Wisconsin Dept. of Health Services' (DHS) health recommendations, and overall, the number of areas in Wisconsin with significant PFAS contamination were limited.

The DNR's groundwater study shows roughly 7 in 10 private wells contain one or more PFAS, but only 1 in 100 contain PFAS above DHS' current health guidelines.

The results of the DNR's groundwater study were released in the Journal of Environmental Science & Technology (ES&T).

Read More

Wisconsin Department of Natural Resources, 03-11-23

https://dnr.wisconsin.gov/newsroom/release/84721

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45-DAY PUBLIC NOTICE AND COMMENT PERIOD

2023-11-10

SAFER CONSUMER PRODUCTS REGULATIONS – Listing Laundry Detergents Containing Nonylphenol Ethoxylates as a Priority Product

Department of Toxic Substances Control reference number: 2019-01R

NOTICE IS HEREBY GIVEN that the Department of Toxic Substances Control (DTSC) proposes to amend the California Code of Regulations, title 22, division 4.5, chapter 55, section 69511, and adopt section 69511.8. This proposed amendment pertains to identification of a Priority Product under the Safer Consumer Products (SCP) regulations, approved by the Office of Administrative Law (OAL) and filed with the Secretary of State on August 28, 2013 (effective date: 10/01/2013; OAL Regulatory Action Number: Z-2012-07170-04).

WRITTEN COMMENT PERIOD

The written comment period will close on 12/31/2023. Only comments received at the DTSC office or postmarked on or before that date will be considered. Any interested person(s) or their authorized representative(s) may submit written comments relevant to the proposed regulatory action to DTSC in either electronic or hard-copy formats.

Written comments may be submitted electronically through the SCP Information Management System, CalSAFER at: https://calsafer.dtsc.ca.gov/. Please direct questions or concerns about CalSAFER to Michael Ernst at (916) 322-3385 or michael.ernst@dtsc.ca.gov. While DTSC prefers that comments be submitted through the CalSAFER system, interested persons may also submit their comments in an email to: SaferConsumerProducts@dtsc.ca.govor through the DTSC regulations email address at regs@dtsc.ca.gov. Please include the DTSC reference number for this regulation in the subject of your message. Direct hard-copy written comments to Office of Legislation and Regulatory Review, as specified below.

PUBLIC HEARING

A public hearing has not been scheduled for this rulemaking. However, DTSC will conduct a hearing if a written request for a public hearing is received from any interested person, or his or her duly authorized representative, no later than 15 days prior to the close of the written comment period, pursuant to Government Code Section 11346.8. Submit a written request for a public hearing in an email to

SaferConsumerProducts@dtsc.ca.govor to the Office of Legislation and Regulatory Review, as specified below.

Read More

US Department of Toxic Substances, 10-11-23

https://dtsc.ca.gov/

EDF Asks Federal Court to Require Industry Transparency Under Chemicals Law

2023-11-09

Environmental Defense Fund (EDF) has filed a brief with the United States Court of Appeals for the District of Columbia challenging federal regulations that will make it more difficult for the public to obtain information about chemicals the EPA reviews under the Toxic Substances Control Act (TSCA).

EDF is challenging key aspects of the new regulations, including what constitutes confidential business information and thus may be kept secret, and the lengths to which companies are allowed to go to keep the public from knowing what is in the chemicals they produce and how those chemicals may threaten people's health.

"More transparency around the chemicals we're exposed to is essential to protect our health," said Samantha Liskow, lead counsel for Healthy Communities at EDF. "That is why EDF has long advocated to maximize public access to information about chemicals. Congress wanted the public to play an important role in the evaluation and regulation of toxic chemicals. To do so, robust information about chemical risks must be accessible. We encourage EPA to carry out its responsibility under the law to ensure the public's right to know about toxic chemicals is protected."

EDF's brief asks the court to consider:

- The new regulations' narrow definitions of key terms in the law, which invites companies to withhold information relevant to evaluating chemicals' potential risks.
- The fact that the regulations limit public access to a chemical's identity (which describes the structure and composition of the chemical) whenever a company claims that identity as confidential in the health and safety documents it submits with its application to make or import a new chemical in the United States.

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- The fact that TSCA is clear on the agency's obligations to deny improper confidentiality claims and disclose non-protected information. The new regulations replace mandatory language with discretionary provisions.

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EDF, 09-11-23

https://www.edf.org/media/edf-asks-federal-court-require-industry-transparency-under-chemicals-law

US faces almost daily hazardous chemical accidents, research suggests

2023-11-09

Hazardous chemical accidents are occurring almost daily, on average, in the United States, exposing people to dangerous toxins through fires, explosions, leaks, spills and other releases, according to a new analysis by non-profit researchers.

The report, prepared by Coming Clean, in conjunction with a network of environmental and economic justice organizations in the Coalition to Prevent Chemical Disasters, documents what it calls an "alarming frequency" of accidents, and comes a month before US regulators are expected to release final rules aimed at preventing such incidents.

The research is based on capturing incidents of chemical spills via monitoring news sources; researchers say the figures should be regarded as conservative because not all of them are reported in the news media.

The report is in line with a prior analysis revealed in the Guardian in February, which reported such incidents were happening approximately every two days.

The new report shows 829 hazardous chemical incidents from 1 January 2021, through 15 October of this year, or roughly one every 1.2 days. The report includes revised higher numbers for 2021 not included in the February analysis that reflect incidents at a number of Texas facilities amid extreme cold temperatures in February of that year.

The majority of the incidents tallied are connected to the fossil fuel industry, including the use, transport, production and disposal of fossil fuels and fossil fuel products, according to the report, which is accompanied by a searchable database of chemical incidents.

Read More

The Guardian, 09-11-23

https://www.theguardian.com/us-news/2023/nov/09/how-many-chemical-accidents-spills-explosion

EUROPE

Defra Publishes Policy Paper On UK REACH Alternative Transitional Registration Model

2023-11-22

On November 9, 2023, the Department for Environment, Food and Rural Affairs (Defra) published a policy paper on a UK REACH alternative transitional registration model (ATRm). According to Defra, in response to concerns raised by the chemicals industry about the significant cost to businesses of accessing EU data packages to support UK REACH transitional registrations, Defra has been exploring options with HSE and Environment Agency (UK REACH regulators) for an ATRm.

Defra states that the government's ambition is to establish a more comprehensive picture of where and how chemicals are used in GB. Defra will tailor the requirements for GB chemical registration to focus on gathering information on the use and exposure of the chemicals, in particular those of higher concern. It will augment this by requiring any further data needed for regulatory purposes in a targeted way, as new or emerging risks are identified by the United Kingdom (UK) or other global sources. According to Defra, it has made significant progress on developing proposals on which to consult in the following areas:

- Refining what information on "use and exposure" in GB registrants will need to provide. Defra notes that this is the "critical information" that it expects industry to have to ensure they fully understand and manage risks, and that GB regulators need to prioritize regulatory action;
- Reducing to the essential minimum the "hazard" information required for transitional registrations and intermediates. This will mean that UK REACH registrants will not generally need to access and pay for data packages held by EU industry consortia;

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National Law Review, 22-11-23

https://www.natlawreview.com/article/global-regulatory-update-november-2023

EC Asks SCCS to Assess Safety of Hydroxyapatite (Nano) in View of New Information

2023-11-22

On November 20, 2023, the European Commission (EC) Scientific Committee on Consumer Safety (SCCS) announced that the EC requested that it carry out a safety assessment on hydroxyapatite (nano) in view of new information provided. As reported in our March 24, 2023, blog item, according to SCCS's March 2023 final opinion on hydroxyapatite (nano), based on the data provided, SCCS considers hydroxyapatite (nano) safe when used at concentrations up to ten percent in toothpaste, and up to 0.465 percent in mouthwash. The EC's request for a scientific opinion states that following a regulatory proposal by the EC services to restrict the use of hydroxyapatite (nano) in cosmetics, "industry submitted evidence to demonstrate its safety at higher concentrations in oral products." The EC asks SCCS to answer whether it considers hydroxyapatite (nano) safe when used in toothpaste up to a maximum concentration of 29.5 percent and in mouthwash up to a maximum concentration of ten percent according to the specifications as reported in the submission, taking into account reasonably foreseeable exposure conditions; what is the maximum concentration considered safe for use of hydroxyapatite (nano) in cosmetic products; and whether SCCS has any further scientific concerns with regard to the use of hydroxyapatite (nano) in oral cosmetic products. The deadline for SCCS's opinion is nine months.

Read More

B&C, 22-11-23

https://www.lawbc.com/ec-asks-sccs-to-assess-safety-of-hydroxyapatite-nano-in-view-of-new-information/

Conservative backlash kills off EU's Green Deal push to slash pesticide use

202311-22

Lawmakers killed off a central pillar of the European Commission's Green Deal on Wednesday, rejecting a bill to slash the use of pesticides in farming in a vote that stunned environmentalists and delighted conservatives and farming groups.

The legislation, the Sustainable Use Regulation (SUR), was already in trouble after competing versions emerged from the committee stage of scrutiny. But most lawmakers had expected it to scrape through a plenary vote and then move to the next legislative stage — agreeing on a final text with EU member countries.

In the end, MEPs rejected the bill outright, with 299 votes against, 207 in favor, and 121 abstentions.

"This is a very dark day for the society as a whole and for the environment — and also for farmers," said Austrian Green MEP Sarah Wiener, Parliament's lead on the file from the environment committee.

The bill, proposed by the EU executive in July 2022, aimed to halve the use and risk of chemical pesticides in the EU, which have been linked to increased rates of cancer and diseases like Parkinson's, as well as environmental degradation, including the decline of pollinating insects without which farmers can't grow crops.

It also promoted the uptake of nonchemical treatment methods and less toxic biological pesticides.

Read More

Politico, 22-11-23

https://www.politico.eu/article/european-parliament-kills-off-landmark-pesticide-reduction-bill/

INTERNATIONAL

ICCM5 Adopts Global Framework On Chemicals

2023-11-22

The UN Environment Programme (UNEP) announced on September 30, 2023, that the Fifth International Conference on Chemicals Management

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(ICCM5) concluded with the adoption of a "Global Framework on Chemicals — For a planet free of harm from chemicals and waste," a comprehensive global framework setting targets and guidelines for key sectors across the entire lifecycle of chemicals. UNEP states that based around 28 targets, the framework outlines a roadmap for countries and stakeholders to address collaboratively the lifecycle of chemicals, including products and waste. According to UNEP, the framework calls for the prevention of the illegal trade and trafficking of chemicals and waste, the implementation of national legal frameworks, and the phase out by 2035 of highly hazardous pesticides in agriculture. It also calls for the transition to safer and more sustainable chemical alternatives, the responsible management of chemicals in various sectors — including industry, agriculture and healthcare — and the enhancement of transparency and access to information regarding chemicals and their associated risks.

Read More

National Law Review, 22-11-23

https://www.natlawreview.com/article/global-regulatory-update-november-2023

Regulation coming for toxic tyres

2023-11-23

International pollution regulators are moving to control the use of toxic chemical compounds in motor vehicle tyres.

Modern tyres are a cocktail of chemicals that end up as shed tyre dust. These tiny particles spread to waterways, and potentially the lungs of people on, or close to, roads.

Many tyres are manufactured with a chemical called 6PPD-quinone, which helps resist degradation and cracking.

But the discovery that a compound called 6PPD is responsible for the collapse of salmon populations on the US west coast set alarm bells ringing.

Now the US Environment Protection Agency (EPA) has signalled that it is investigating the toxicity of 6PPD, a step that could lead to a ban on the substance.

Until recently regulators were focused only on the harm from tailpipe emissions.

The European Union's upcoming Euro 7 emission regulations will set standards for tyres for the first time.

Manufacturers Michelin, Continental and Pirelli are pursuing alternatives to 6PPD but want higher tyre standards so that US and Chinese tyre makers are forced to comply with any new pollution controls.

One manufacturer, Enso, is making tyres for EVs that are designed to shed less rubber/plastic.

Read More

Bicycle Network, 23-11-23

https://bicyclenetwork.com.au/newsroom/2023/11/23/regulation-coming-for-toxic-tyres/

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ECHA Identifies Research Needs For Regulating Hazardous Chemicals

2023-11-22

needed to protect people and the environment from hazardous chemicals. It also highlights where new methods, that support the shift away from animal testing, are needed. ECHA identified the following areas as priorities for research:

- Hazard identification for critical biological effects that currently lack specific and sensitive test methods (i.e., developmental and adult neurotoxicity, immunotoxicity, and endocrine disruption);
- Chemical pollution in the natural environment (bioaccumulation, impact on biodiversity, exposure assessment);
- Shift away from animal testing (read across under REACH, move away from fish testing, mechanistic support to toxicology studies (e.g., carcinogenicity)); and
- New information on chemicals (polymers, nanomaterials, analytical methods in support of enforcement).

Read More

National Law Review, 22-11-23

https://www.natlawreview.com/article/global-regulatory-update-november-2023

One in three checked biocidal products found to be non-compliant

2023-11-21

EU-wide enforcement project found about 60 active substances in biocidal products that are not allowed on the EU, EEA and Swiss markets. One in three of the checked products did not comply with at least one of the checked legal requirements.

Helsinki, 21 November 2023 – The national enforcement authorities in 29 countries checked over 3 500 biocidal products. Overall, 37 % of the checked biocides were non-compliant with at least one of the checked legal requirements.

18 % of checked products were non-compliant with fundamental requirements that affect their safe use. Most of them either lacked a product authorisation or included non-allowed active substances.

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Most biocides with such major non-compliance were disinfectants, insecticides, and repellents/attractants. Inspectors found about 60 active substances that are not allowed in these products. All products that lacked authorisation or contained non-allowed active substances were withdrawn from the market. In some cases, criminal complaints or fines were issued.

The remaining 19 % non-compliant products were found to have minor deficiencies that did not affect safe use such as missing contact information of the supplier. In these cases the national enforcement authorities gave advice or administrative orders.

Much non-compliance was found in disinfectants sold to consumers. 265 disinfectants out of nearly 1 900 that were checked (14 %) were found to be non-compliant. This included serious compliance deficiencies such as lacking authorisation or incorrect labelling that usually led to the withdrawal of the disinfectants from the market.

The inspectors focused on disinfectants because new manufacturers entered the market with biocidal products at the early stages of the COVID-19 pandemic. Many of those disinfectants were not fully compliant with the EU's Biocidal Products Regulation (BPR) and the related national transitional requirements for biocides.

Read More

ECHA, 21-11-23

https://echa.europa.eu/-/one-in-three-checked-biocidal-products-found-to-be-non-compliant#msdynttrid=0kKZ08fBpbvDAVMlB6-ADIiiyoFROQ74WqDq7YO9qLY

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Janet's Corner

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No!

2023-12-01

https://twitter.com/chem_jokes

~dHazard Alert

Tungsten

2023-12-01

USES [2,3]

Tungsten is used in filaments in incandescent light bulbs, it is also used in electric contacts and arc-welding electrodes. Tungsten is used in alloys, such as steel, to which it imparts great strength. Cement carbide is the most important use for tungsten: its main component is tungsten carbide (WC). It has the strength to our cast iron and it makes excellent cutting tools for the machining of steel. X-ray tubes for medical use have a tungsten emitter coil and the screen used to view X-rays rely on calcium and magnesium tungstate phosphors to convert X-rays into blue visible light. Tungsten is also used in microchip technology and liquid crystals displays.

EXPOSURE SOURCES & ROUTES OF EXPOSURE [3]

Exposure Sources

General Populations

The general population may be exposed to tungsten in ambient air and food.

Occupational Populations

Occupational exposure to tungsten and its compounds occurs during the production of tungsten metal from the ore and preparation of tungsten carbide powders.

Exposure to cemented tungsten carbide can occur during the manufacturing and grinding of cemented tungsten carbide hard metal parts.

Workers can also be exposed to dusts and mists of tungsten and its compounds or cemented tungsten carbide during crushing, mixing, ball milling, loading and unloading, and grinding operations.

Tungsten, also known as wolfram, is a chemical element with symbol W and atomic number 74. [1]

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Routes of Exposure

- **Inhalation (breathing)** – A route of typically low exposure for the general population. Predominant route of exposure for tungsten and hard metal workers.
- **Oral (mouth)** – A route of typically low exposure to tungsten is via ingestion of food and water.
- **Dermal** – Minor route of exposure.

HEALTH EFFECTS [4]

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to phenanthrene:

- Irritating to the skin and eyes on contact.
- Inhalation will cause irritation to the lungs and mucus membrane.
- Irritation to the eyes will cause watering and redness.
- Reddening, scaling, and itching are characteristics of skin inflammation.

Chronic Effects

- Tungsten has no known chronic effects.
- Repeated or prolong exposure to this compound is not known to aggravate medical conditions.

SAFETY

First Aid Measures [5]

- **Eye Contact:** Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.
- **Skin Contact:** If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands- gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

- **Serious Skin Contact:** Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.
- **Inhalation:** Allow the victim to rest in a well ventilated area. Seek immediate medical attention.
- **Serious Inhalation:** Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.
- **Ingestion:** Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Workplace Controls & Practices [4]

Control measures include:

- Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits.
- If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protective Equipment [5]

The following personal protective equipment is recommended when handling tungsten:

- Splash goggles;
- Synthetic apron;
- Dust respirator (be sure to use an approved/certified respirator or equivalent);
- Gloves.

Personal Protection in Case of a Large Spill:

- Splash goggles;
- Full suit;
- Dust respirator;
- Boots;
- Gloves;

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- A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

REGULATION

United States

OSHA: The Occupational Safety & Health Administration has set the following Permissible Exposure Limit (PEL):

- Construction Industry: 5 mg/m3 TWA

ACGIH: The American Conference of Governmental Industrial Hygienists (has set a Threshold Limit Value (TLV)for tungsten of 5 mg/m3 TWA; 10 mg/m3 STEL

NIOSH: The National Institute for Occupational Safety and Health has set a Recommended Exposure Limit (REL) for tungsten of 5 mg/m3 TWA; 10 mg/m3 STEL

REFERENCES

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'Most slippery surface ever' inspired by new understanding of surface roughness

2023-11-24

The slipperiness of surfaces is sensitive to topographic heterogeneity or roughness and some studies have shown that this sensitivity persists all the way down to the molecular level. Nevertheless, droplets do not readily slide on most hydrophilic surfaces, with some exceptions such as those based on polyethylene glycol. 'There are just a few reported, but [researchers] don't really explain the origin,' says Robin Ras at Aalto University.

Ras and colleagues decided to systematically study how water slippage varied with hydrophobicity by placing pristine hydrophilic silicon dioxide in a vacuum chamber and using vapour deposition to form a partial hydrophobic octyltrichlorosilane monolayer on the surface. By varying the deposition time, they created surfaces that ranged from nearly entirely hydrophilic to a patchwork of hydrophilic and hydrophobic islands to almost completely hydrophobic.

When they tested the slipperiness of the surfaces, they found that water slid easily off surfaces densely covered with the hydrophobic octyltrichlorosilane. But water droplets slid just as easily off highly hydrophilic surfaces with very little coverage with this chemical. At intermediate coverage, water droplets experienced much higher friction than either the principally hydrophilic or hydrophobic surfaces. The researchers then turned to molecular dynamics simulations to explain why.

In the highly hydrophobic case, a water droplet touches the surface at a very steep angle, so only a relatively small area of the droplet made contact and slides off easily. This principle of texturing a surface to reduce a droplet's contact area is well known and routinely exploited in superhydrophobic surfaces. The other cases surprised the researchers more. In the low-coverage, hydrophilic case, water spread out to form a thin film that covered the surface. Other water droplets formed large interfacial contacts with this layer, but as it was highly mobile it lubricated their passage across the surface. In the intermediate case, however, this hydrophilic surface effect was broken up by the hydrophobic islands. Instead of skating across the surface of a contiguous layer of water or skimming on a hydrophobic surface, water droplets were repeatedly puddling. 'We actually had not expected this when we did the work,

The slipperiness of a surface can be tuned by tweaking its molecular-scale roughness, researchers in Finland have shown. This helps to explain why water droplets can easily slide off hydrophilic surfaces if they are chemically homogeneous, and also opens up new possibilities for the design of low-friction surfaces – allowing the researchers to produce what they believe is the most slippery surface ever created. Such surfaces could be used in self-cleaning coatings.

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but looking back it fits very well with the idea that the heterogeneity is connected to the friction, so it's kind of logical,' says Ras.

Chemistry World, 24 November 2023

https://chemistryworld.com

Rheumatoid Arthritis Drugs May Prevent Thyroid Disease

2023-11-22

Anti-rheumatic drugs used for rheumatoid arthritis might prevent the development of autoimmune thyroid disease, according to a new observational study by researchers from Karolinska Institutet published in the Journal of Internal Medicine.

It is well known that patients with rheumatoid arthritis (RA) are at increased risk of autoimmune thyroid diseases such as Hashimoto's disease and Graves' disease. While patients with RA are usually treated with immunomodulatory drugs that affect the immune system, such drugs are rarely used in autoimmune thyroid diseases.

Instead, such patients are treated with thyroid hormone to compensate for the changes in normal thyroid function that accompany autoimmune thyroid disease.

The researchers in the current study wanted to investigate whether immunomodulatory drugs that reduce inflammation in the joints of patients with RA might also reduce the risk of these patients developing autoimmune thyroid disease.

Previous studies in mice suggest that so-called DMARDs, a type of immune-modulatory drugs used to treat rheumatoid arthritis, can reduce inflammation in the thyroid gland. Still, knowledge of whether this effect also applies to humans is limited, according to the research team.

46 per cent lower risk with DMARD

The researchers used data between 2006 and 2018 on over 13,000 patients with rheumatoid arthritis and their treatment, as well as data from over 63,000 individuals in a matched control group without rheumatoid arthritis.

Technology Networks, 22 November 2023

https://technologynetworks.com

Anti-rheumatic drugs used for rheumatoid arthritis might prevent the development of autoimmune thyroid disease.

Coffee grounds transform into quantum dots to treat dementias

2023-11-23

Carbon quantum dots, made from caffeic acid in used coffee, have shown promise in lab-based tests to protect brain cells from substances that can cause these diseases.

While still in its early stages, the research could herald an environmentally friendly way to neurodegenerative diseases that have been caused by environmental factors, like age or exposure to toxins (like the pesticide paraquat).

"Caffeic-acid based carbon quantum dots have the potential to be transformative in the treatment of neurodegenerative disorders," says Jyotish Kumar, a doctoral student at the University of Texas at El Paso and lead author on a paper published in Environmental Research.

"This is because none of the current treatments resolve the diseases; they only help manage the symptoms. Our aim is to find a cure by addressing the atomic and molecular underpinnings that drive these conditions."

Quantum dots, a concept which won this year's Nobel Prize in Chemistry, are crystals the size of nanometres (on the same scale as molecules). The team made these quantum dots with purchased caffeic acid, but they point out it's been made before by extraction from used coffee grounds.

In their early stages, many neurodegenerative diseases share chemical features, particularly if they've been caused by environmental factors. People have higher levels of molecules called free radicals in their system, and they also have a build up of a type of protein (amyloid proteins) in the brain.

Caffeic acid is an antioxidant, which neutralises free radicals. It's also capable of getting from our blood stream into our brains (crossing the "blood-brain barrier"), so the researchers thought it could be an effective medication.

"It is critical to address these disorders before they reach the clinical stage," says co-author Professor Mahesh Narayan, also at the University of Texas at El Paso.

"At that point, it is likely too late. Any current treatments that can address advanced symptoms of neurodegenerative disease are simply beyond the means of most people.

Scientists have turned old coffee grounds into a substance that could prevent Alzheimer's, Parkinson's and other neurodegenerative diseases.

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"Our aim is to come up with a solution that can prevent most cases of these conditions at a cost that is manageable for as many patients as possible."

The researchers tested their quantum dots on cell lines that had had Parkinson's disease induced by paraquat. The caffeic acid both removed free radicals and prevented amyloid proteins building up.

The researchers are now seeking funding to see if they can take the substance to pre-clinical trials – the first step on the long road towards a medication.

Cosmos, 23 November 2023

https://cosmosmagazine.com

Cheap drugs may be within reach thanks to copper chemistry discovery

2023-11-23

Using ozone, a form of oxygen, as a reagent and the metal as a catalyst, the scientists were able to break the carbon-carbon bonds of different types of organic molecules. The ozone broke the bonds into hydrocarbons called alkenes, and the copper catalyst coupled the broken bonds with nitrogen, forming carbon-nitrogen bonds, or molecules known as amines.

This process, known as aminodealkenylation, makes good use of an inexpensive metal that is in abundance, as opposed to other similar catalysts that would traditionally be used to develop amines.

"This has never been done before," said organic chemistry professor Ohyun Kwon. "Traditional metal catalysis uses expensive metals such as platinum, silver, gold and palladium, and other precious metals such as rhodium, ruthenium and iridium. But we are using oxygen and copper, one of the world's most abundant base metals."

Amines have strong interactions with molecules found in plants and animals, so are used heavily in the production of pharmaceuticals, plus agricultural chemicals like fertilizers. And, as their name suggests, amphetamine and dopamine are also amines.

Through this versatile combination, the team was able to modify hormones, pharmaceutical reagents, peptides and nucleosides into amines, indicating that this new method has broad application.

Copper is not new to medicine, having been used in infection-fighting nanoparticles and implants, among many other innovations.

Though, for Kwon, its biggest drawcard may be the potential for far cheaper medicines. Where a chemical used in some anti-cancer drugs can cost pharmaceutical companies $3,200 per gram, the researchers managed to produce the same drug molecule using a chemical that cost around $3 per gram to produce.

The team produced the anti-cancer c-Jun N-terminal kinase inhibitor in three chemical steps, instead of the usual dozen it currently requires.

In another experiment, the method took one step to convert adenosine – a neurotransmitter and DNA building block that costs less than 10 cents per gram – into the N6-methyladenosine amine. This amine plays an important role in controlling gene expression in cells, disease processes and development. Currently, it costs around $103 per gram to produce.

With copper currently abundant and at less than $4 per pound, the scientists are hopeful this new protocol could open up a much more affordable market for a wide range of amine-based pharmaceuticals and other organic materials.

The research was published in the journal Science.

New Atlas, 23 November 2023

https://newatlas.com

Molecular Glue Degraders Could Target "Undruggable" Proteins

2023-11-17

Cells contain molecular machinery that targets and disposes of unwanted proteins and keeps the cell functioning normally. Scientists would like to hijack this process to control proteins involved in cancer and other diseases, using a type of molecule called a molecular glue degrader that acts as a matchmaker between target protein and the disposal machinery.

But only a few of these glue degraders have been discovered so far — mostly by chance. To remedy this, Zuzanna Kozicka, a Ph.D. student at Friedrich Miescher Institute in Basel, Switzerland, embarked on a deliberate search for these glues with her team. She has now identified a new class of molecular glue degraders with more than 40 chemically diverse members.

For this discovery, Kozicka is the grand prize winner in molecular medicine of the 2023 Science & SciLifeLab Prize for Young Scientists.

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Scientists have now identified a new class of molecular glue degraders with more than 40 chemically diverse members.

"Molecular glue degraders have the potential to target many proteins now considered undruggable, but finding them is challenging," said Science Executive Editor Valda Vinson. "The judges were impressed that Zuzanna creatively combined bioinformatics, cell biology, biophysics and structural biology to not only identify more than 40 molecular glue degraders, but also provide a blueprint both to harness existing small molecule glues and to design new ones."

One of the ways cells dispose of unwanted proteins is through the action of enzymes called E3 ligases — what Kozicka refers to in her winning essay as "garbage patrols" — that mark cellular offenders for destruction. Molecular glue degraders could be one of the best ways to bring together E3 ligases with specific disease-causing proteins.

There are more traditional methods for inactivating disease-causing proteins, by blocking or altering the active sites where their natural molecular partners bind, for example. But not all proteins have functions that can be blocked in this way, which makes them very hard to modulate with conventional drugs.

"This is why hijacking the degradation machinery to degrade an offender of interest is such an exciting strategy," writes Kozicka, now a postdoctoral fellow at the Dana Farber Cancer Institute. "It circumvents these limitations and makes the entire target protein disappear from the cell."

Transcription factor proteins, for instance, are high-priority drug targets in many cancers, she said. "However, most transcription factors are considered undruggable by conventional small molecules due to their structural disorder and lack of discrete … binding cavities."

Glues could bridge the gap between these undruggable proteins and the cell's garbage patrols, but until now few glue degraders have been discovered. The drug thalidomide, for instance, became infamous in the late 1950s for causing deadly birth defects and fetal limb deformities. But analogs of the drug have found new life as a treatment for multiple myeloma working via the molecular glue degrader mechanism.

To find more glue degraders, Kozicka and her colleagues analyzed databases of drug toxicity and correlated those with levels of E3 ligase activity in hundreds of cancer cell lines. They were looking for small molecules whose toxicity depended on the ligases, which would suggest they are hijacking the cellular garbage disposal process for their activity.

Their research first identified CR8, a glue degrader of cyclin K, which is a potential drug target in several cancers. Through further studies, Kozicka's team has identified more than 40 different molecular glue degraders.

The scientists have also mapped out the structures of molecular complexes induced by many of these glues, which helps them determine exactly how they interact with ligases and offenders to bring them together.

These findings offer hints on how glues could be rationally tweaked and designed, said Kozicka. "The challenge now is to take this further, to say, 'oh, I want to degrade the oncogenic transcription factor Myc' and be able to come up with libraries of chemical matter that could do that. While we're not there just yet, researchers in the field are moving full steam ahead to make this a reality."

"Every year, the Science & SciLifeLab Prize for Young Scientists brings to light groundbreaking science and exceptional young scientists who push the boundaries of our understanding," said SciLifeLab Director Olli Kallioniemi. "For example, Zuzanna Kozicka's work on molecular glue degraders is reflecting innovative scientific discovery. It is great for us at SciLifeLab to recognize her achievements and I believe this research will contribute significantly to the future of molecular medicine."

Technology Networks, 17 November 2023

https://technologynetworks.com

Researchers develop irreversible inhibitor to address proteins that have acquired drug-resistant mutations

2023-11-29

Current covalent inhibitors have reactive groups known to induce a single reaction in target proteins, irreversibly turning them off. Sometimes, however, mutations can occur more easily with specific amino acids, interfering with this deactivation.

Now, a team of researchers at Kyoto University has developed a new reactant demonstrating efficacy on proteins that have acquired drug-resistant mutations.

"In Bruton-type tyrosine kinase (BTK), an important drug target, a mutation involving amino acids cysteine to serine—called C481S—is known, but we have not yet seen any for our lysine target," remarks Tomonori Tamura of the Graduate School of Engineering.

The idea of irreversible inhibitors adhering permanently to a target protein has gained increasing attention for application in potential drug development.

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"Still, it is significant that our irreversible inhibitor can at least address the C481S problem," Tamura adds.

Conventional irreversible inhibitors used in clinical practice react only with protein cysteine residues.

In addition, cysteine—the most reactive among the 20 amino acids—is not abundant at reaction or binding sites. This amino acid can be mutated into a different amino acid, making the cysteine-targeting irreversible inhibitors ineffective against drug-resistant proteins.

In contrast, N-acyl-N-arylsulfonamide, or ArNASA, can react with lysine residues and is highly stable in serum-containing media and other physiological environments.

"Utilizing this reaction property, we developed the first irreversible inhibitor of BTK, which has drug-resistant mutations," adds Tamura.

The Tamura team's hunt for useful reactive groups may come to fruition with ArNASA. Importantly, its electrophiles remove limiting factors by minimizing hydrolytic inactivation and unintended reactions with off-target proteins.

Once the target engages with the irreversible inhibitor, the reactive group chemically reacts with the protein's amino acids to form a covalent bond. An unrelenting binding site results, irreversibly inhibiting protein activity.

Tamura's team improved upon an earlier NASA group—similar in efficacy as ArNASA but ineffective in serum-containing media—by synthesizing the new reactive group using aromatic amines as starting materials. The researchers applied the ArNASA group to BTK, an important therapeutic target for blood cancers such as chronic lymphocytic leukemia.

"Our study will extend beyond cell-based research to in vivo, paving the way for developing drugs with diverse reactant groups acting on specific amino acids," concludes Tamura.

The research is published in the Journal of the American Chemical Society.

Phys Org, 29 November 2023

https://phys.org

Greener solution powers new method for lithium-ion battery recycling

2023-11-29

The conventional process recovers few of the battery materials and relies on caustic, inorganic acids and hazardous chemicals that may introduce impurities.

It also requires complicated separation and precipitation to recover the critical metals.

However, recovering metals such as cobalt and lithium could reduce both pollution and reliance on foreign sources and choked supply chains.

Researchers at the Department of Energy's Oak Ridge National Laboratory have improved on approaches that dissolve the battery in a liquid solution in order to reduce the amount of hazardous chemicals used in the process.

This simple, efficient and environmentally-friendly solution developed by ORNL researchers overcomes the main obstacles presented by previous approaches.

The spent battery is soaked in a solution of organic citric acid -- which occurs naturally in citrus fruits -- dissolved in ethylene glycol, an antifreeze agent commonly used in consumer products like paint and makeup.

Citric acid comes from sustainable sources and is much safer to handle than inorganic acids.

This green solution produced a strikingly efficient separation and recovery process for the metals from the positively-charged electrode of the battery, called the cathode.

"Because the cathode contains the critical materials, it is the most expensive part of any battery, contributing more than 30% of the cost," said Yaocai Bai, a member of the ORNL battery research team.

"Our approach could reduce the cost of batteries over time." The research was conducted in ORNL's Battery Manufacturing Facility, the country's largest open-access battery manufacturing research and development center.

The recycling technique developed there leached nearly 100% of the cobalt and lithium from the cathode without introducing impurities in the system.

Used lithium-ion batteries from cell phones, laptops and a growing number of electric vehicles are piling up, but options for recycling them remain limited mostly to burning or chemically dissolving shredded batteries.

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It also enabled efficient separation of the metal solution from other residues.

Most importantly, it served a second function by recovering over 96% of the cobalt in a matter of hours, without the typical addition of more chemicals in what is usually a tricky process of manually balancing acid levels.

"This is the first time one solution system has covered the functions of both leaching and recovery," said lead researcher Lu Yu. "It was exciting to find that the cobalt would precipitate and settle out without further interference. We were not expecting that."

Eliminating the need for extra chemicals reduces costs and avoids creating byproducts or secondary wastes.

"We are glad this recycling process developed by our scientists can pave the way for greater recovery of battery critical materials," said Ilias Belharouak, corporate fellow and head of the ORNL's electrification section.

The leaching performance of citric acid and ethylene glycol has been explored before, but that approach used more acid and a lower temperature, which proved less effective, Bai said.

"We were surprised by how quickly the leaching happened in our solution," Bai said. "With an organic acid, it usually takes 10-12 hours, but this took only one." Conventional solutions using inorganic acid are also slower because they include water, which has a boiling point that limits the temperature of the reaction.

Science Daily, 29 November 2023

https://sciencedaily.com

Hemoglobin discovered in skin, found to assist with damage protection

2023-11-22

Hemoglobin is best known for binding with oxygen in the bloodstream and carrying it from the lungs to the tissues. However, a new study has discovered that hemoglobin has another role: protecting our skin from damage.

New research has, for the first time, discovered hemoglobin in the uppermost layer of human skin, and found that it helps protect against damage.

The researchers were keen to see how the epidermis – the skin's outermost layer – protects us from environmental challenges such as UV light exposure, so they examined what was going on in the skin on a molecular level.

"The epidermis consists of keratinized stratified squamous epithelium, which is primarily comprised of keratinocytes," said the study's corresponding author, Masayuki Amagai. "Previous studies have identified the expression of various genes with protective functions in the keratinocytes during their differentiation and formation of the outer skin barrier. However, other barrier-related genes escaped prior protection because of difficulties obtaining adequate amounts of isolated terminally differentiated keratinocytes for transcriptome analysis."

Epidermal keratinocytes originate from the deepest layer of the skin (stratum basale), differentiate, and move upward to form several layers. The expression of various genes with protective barrier functions has been identified in keratinocytes during their differentiation phase, with disorders such as atopic dermatitis arising from genetic variants.

To determine unidentified molecules involved in the skin's barrier mechanism, the researchers analyzed highly expressed genes in the whole and upper epidermis of healthy human skin, taken from the thigh and upper arm of three individuals, and mouse skin. Unexpectedly, they found that HBA1/2 genes encoding the protein alpha-globin, one of the subunits of hemoglobin, were highly expressed in the upper epidermis of human skin. Similarly, in mouse skin, Hba-a1/a2, which corresponds to HBA1/2 in humans, was highly expressed in the upper epidermis.

"We conducted a comparative transcriptome analysis of the whole and upper epidermis, both of which were enzymatically separated as cell sheets from human and mouse skin," said Amagai. "We discovered that the genes responsible for producing hemoglobin were highly active in the upper part of the epidermis. To confirm our findings, we used immunostaining to visualize the presence of hemoglobin alpha protein in keratinocytes of the upper epidermis."

The researchers applied UVA and UVB irradiation separately to the skin and found that UVA, but not UVB, induced HBA1/2 expression in epidermal keratinocytes. UVA irradiation is a major contribution to reactive oxygen species (ROS)-mediated damage in keratinocytes. Intracellular ROS levels significantly increased in HBA-knockout keratinocytes compared to controls, suggesting that HBA expression is induced to suppress UVA-inducted ROS generation in epidermal keratinocytes.

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Mitochondria – the cell's energy producers – are particularly sensitive to excessive UV-radiation-generated ROS and UV radiation-induced mitochondrial dysfunction directly contributes to skin damage, also called photoaging.

"Our study showed that epidermal hemoglobin was upregulated by oxidative stress and inhibited the production of reactive oxygen species in human keratinocyte cell cultures," said Amagai. "Our findings suggest that hemoglobin alpha protects keratinocytes from oxidative stress derived from external or internal sources such as UV radiation and impaired mitochondrial function, respectively. Therefore, the expression of hemoglobin by keratinocytes represents an endogenous defense mechanism against skin aging and skin cancer."

The researchers say their findings provide important insights into ROS-related skin diseases such as aging and cancers.

The study was published in the Journal of Investigative Dermatology.

New Atlas, 22 November 2023

https://newatlas.com

Researchers discover how to prevent formaldehyde from inhibiting hydrogen-producing enzymes

2023-11-29

A team from the work group Photobiotechnology at Ruhr University Bochum, Germany, was able to elucidate and switch off this underlying mechanism. The researchers have reported their findings in the Journal of the American Chemical Society on 20 November 2023.

Formaldehyde is known as a preservative, among other things, but it also occurs as a natural metabolite in living cells. Twelve years ago, scientists from the University of Oxford, U.K., and Ruhr University Bochum, Germany, showed that this omnipresent molecule inhibits a certain class of biocatalysts, namely the particularly efficient hydrogen-generating hydrogenases of the two-iron type—so-called [FeFe]-hydrogenases.

"This was an interesting discovery, because formaldehyde could inhibit both the natural H2 metabolism of microorganisms and isolated hydrogenases in biotechnological applications," explains Dr. Jifu Duan, first author of the study.

Enzymes from microorganisms can produce hydrogen (H2) under certain conditions, which makes them potential biocatalysts for biobased H2 technologies.

After various theoretical studies had hypothesized how the formaldehyde molecule might influence [FeFe]-hydrogenases, a team of researchers led by Duan and Professor Eckhard Hofmann at Ruhr University has now succeeded in elucidating the molecular mechanism experimentally. Using structures of formaldehyde-treated [FeFe]-hydrogenases obtained by protein crystallography, they were able to show that formaldehyde reacts with the so-called active center of the biocatalysts—an inorganic protein part where protons and electrons are converted to H2.

In addition, however, formaldehyde combines with another very important protein part, which is necessary for the transport of protons to the active center by means of a sulfur-containing chemical group. When the scientists replaced this part with another, formaldehyde was hardly able to exert its inhibitory effect.

"Future biotechnological applications of [FeFe]-hydrogenases may well involve the presence of formaldehyde, so that our modified formaldehyde-resistant biocatalysts could be used here," explains Duan. "We also believe that our findings can be transferred to other biocatalysts." This could play a role for bio-based industrial processes, but also for understanding metabolic pathways in living organisms.

Phys Org, 29 November 2023

https://phys.org

Cannabis Doesn't Reduce Long-Term Opioid Use, Suggests 20-Year Study

2023-11-29

A 20-year Australian study has found no evidence to suggest cannabis reduces illicit opioid use, and it may not be an effective long-term method of reducing harm for those with an opioid use disorder or problematic use of opioids.

Published in the American Journal of Psychiatry, the University of Sydney led study is one of the longest of its kind.

Between 2001 to 2022, the study involved a group of 615 people with heroin dependence, many of whom also used cannabis.

Additional analysis also found no consistent evidence between cannabis and other opioid use, including opioids that were prescribed.

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A 20-year study has found no evidence to suggest that cannabis use reduces illicit opioid use.

Opioid use is currently responsible for more death and disability than any other illicit drug. Opioid and cannabis use disorders make up approximately 77 percent of all illicit drug disorders.

The researchers say clinicians and policymakers should be cautious about relying on cannabis to reduce problematic opioid use or as a potential strategy to help manage the opioid crisis, especially given a global shift towards cannabis legalisation and recognition as a therapeutic product.

In the United States, some states have policies that allow patients to substitute their prescribed opioids with cannabis.

The Canadian Government is currently reviewing the Cannabis Act in the context of medicinal cannabis for opioid dependence.

To examine the impact of cannabis on opioid use, and vice versa, researchers used a recently developed statistical technique. This allowed them to account for influential factors on opioid and cannabis use in the data such as age and made it possible to focus on individual changes in substance use over time.

"Our investigation shows that cannabis use remains common among this population, but it may not be an effective long term strategy for reducing opioid use ," says lead author Dr Jack Wilson, from The Matilda Centre for Research in Mental Health and Substance Use, at the University of Sydney.

"There are claims that cannabis may help decrease opioid use or help people with opioid use disorders keep up with treatment.

"But it's crucial to note those studies examine short- term impact, and focus on treatment of chronic pain and pain management, rather than levels of opioid use in other contexts."

Another key finding was cannabis use is common among those with an opioid use disorder, and so there needs to be clinical services that offer additional support for people who would like to reduce cannabis use.

"Opioid use disorders are complex and unlikely to be resolved by a single treatment," says Dr Wilson.

"The best way to support them is evidence-based holistic approaches that look at the bigger picture, and include physical, psychological, and pharmacotherapy therapies."

Technology Networks, 29 November 2023

https://technologynetworks.com

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Recycling cigarette butts may reduce biodiesel production costs

2023-11-27

Made from biological sources like edible and non-edible oils, animal fats and waste restaurant grease, biodiesel is a renewable, biodegradable fuel, an alternative to conventional 'fossil' diesel with low harmful greenhouse gas emissions. It sounds good on paper, however, the high cost of biodiesel production is the main barrier to its worldwide marketing.

An effective solution is to mix biodiesel with an additive like the triglyceride triacetin. Studies have shown that triacetin can contribute to reducing air pollution and increase biodiesel's combustibility. The problem is that triacetin is generally produced chemically, which consumes a lot of chemicals and produces a lot of waste and toxic residue. This means that an alternative, eco-friendly source of triacetin is needed.

Researchers from Kaunus University of Technology (KTU), Lithuania, have collaborated with the Lithuanian Energy Institute to develop a way of extracting triacetin from an ample supply of waste products: cigarette butts.

"In our research group, we are working on the topics of recycling and waste management, therefore we are always looking for the waste, which is present in huge amounts and has a unique structure," said Samy Yousef, lead and corresponding author of the study. "Cigarettes are made of three components – tobacco, paper and a filter made of cellulose acetate fibers – and are a good source of raw materials and energy. Plus, cigarette butts are easy to collect as there are many systems and companies for collecting this waste in place."

Previous attempts have been made using pyrolysis to extract raw materials from cigarette waste, but here, the researchers adopted an original approach by not trying to separate the cigarette into its components.

"There are studies which, similarly to us, are using pyrolysis as a method, but they are applying it to filter components only," Yousef said. "In this case, the pre-treatment of the material is needed to separate all components. Since tobacco is a toxic waste, the disposal of it requires special care, and due to the technologically complicated process to separate the components of the cigarette waste, this is not economically feasible."

The researchers conducted a series of experiments using pyrolysis to thermally decompose cigarette butts at temperatures of 1,202, 1,292 and

In an effort to drive down the production cost of biodiesel, researchers have developed an eco-friendly way of extracting triacetin, a combustion-enhancing additive, from an abundant waste source: cigarette butts.

1,382 °F (650, 700 and 750 °C). They could extract varying amounts of triacetin-rich oil, char and gas, depending on the temperature used. The maximum amount of triacetin compound (43%) was extracted at 1,382 °F (750 °C), with yields estimated at 38 wt% oil, 25.7 wt% char, and 36.4 wt% gas. At the same temperature, the char product had a calcium-rich, porous structure that could be used as an adsorbent.

"All the products have real applications," Yousef said. "Char, which, in our case, is porous and very rich in calcium, can be used for fertilizers or wastewater treatment as an absorbent and energy storage. Gas can be used for energy purposes. Last but not least is oil, rich in triacetin, which can be used as an additive to biodiesel to reduce the cost."

It's estimated that 4.5 trillion individual cigarette butts are polluting our global environment. Recycling them in the way proposed by the researchers would not only clear the waste, it would provide a sustainable use for it.

The study was published in the Journal of Analytical and Applied Pyrolysis.

New Atlas, 27 November 2023

https://newatlas.com

Italy bans cultivated meat products

2023-11-23

'In defence of health, of the Italian production system, of thousands of jobs, of our culture and tradition, with the law approved today, Italy is the first nation in the world to be safe from the social and economic risks of synthetic food,' Italy's minister of agriculture, Francesco Lollobrigida, announced on Facebook on 16 November. The measure also prohibits the use of meat-related terms, like 'salami' or 'steak', for plant-based meat substitutes.

When the ban was proposed earlier this year, Lollobrigida had indicated that its main goal was to protect Italian farmers. Other government officials also questioned the quality of such synthetic foods and suggested that they threatened Italy's culinary heritage. The new law includes fines of between €10,000 (£8716) and €60,000 for each violation.

'We've known it was coming for months, but that doesn't make it less silly, short-sighted or in breach of EU law,' stated Robert Jones, vice president of Dutch food technology company Mosa Meat and president of Cellular Agriculture Europe.

Italy has become the first country to ban the production, distribution and import of cultivated meat, which is cultured from animal-derived cells and requires no slaughter. The Italian parliament passed the new law after months of consideration.

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Novel food products must be authorised by the European Commission and member states, after a thorough safety assessment by the European Food Safety Authority, before they can enter the EU market, Cellular Agriculture Europe notes. The organisation argues that there is no legal reason for Italy to pre-empt this risk assessment and risk management process.

Italy's decision to reject cultivated meat sets it apart from other nations. Such products have been sold in Singapore since late 2020, and in June the US Department of Agriculture approved two companies – Upside Foods and Good Meat – to make and distribute cultivated meat, following initial safety approvals from the US Food and Drug Administration. These two firms are now selling their chicken products at restaurants in San Francisco and Washington DC, respectively.

Meanwhile, in the absence of EU action, the Netherlands became the first European country to allow pre-approved tasting of cultivated meat in July. The Dutch government has worked with cultivated meat companies like Mosa Meat and the Dutch biotech industry association HollandBIO to create a 'code of practice' that makes such tasting possible in a controlled environment.

In Romania, however, the Senate has voted to prohibit the sale of cultivated meat, and this measure awaits approval by the lower house of parliament. If enacted, it would mean fines of between €40,000 and €60,000 for violations.

One state in the US, Florida, is also trying to clamp down in the face of federal action. Republican state congressman Tyler Sirois has introduced legislation that would make it illegal to produce, sell and distribute cultivated meat in the state, with the goal of helping to protect Florida's cattle and farming industries. Under the proposed law, violators would reportedly face a second-degree misdemeanour charge, as well as a fine of between $500 (£400) and $1000. If enacted, the bill is expected to come into force in July next year.

Chemistry World, 23 November 2023

https://chemistryworld.com

Hospitals are meant to heal people, but there's an increasing risk of patients picking up a superbug or two during their stay.

Antimicrobial textile coating makes superbug-squashing hospital curtains

2023-11-29

Despite the best efforts of medical staff, hospitals can be hotbeds of pathogen exchange. And while smooth surfaces like door handles or railings can be fairly easy to disinfect, it's harder to clean materials like textiles. For the new study, scientists at Empa, BASF, Spiez Laboratory and the Technical University of Berlin have developed a new treatment to make fabrics antimicrobial.

The team concocted a new formula of disinfectant that contained benzalkonium chloride, then applied it to fabric samples by soaking them in a primer solution then running them through coater rolls. The technique was carefully optimized so that just the right concentration, exposure time, pressure and drying were applied to ensure the coating stuck to the fabric just right.

To test the antimicrobial power of the coating, the team then incubated common hospital bacteria like staphylococcus and pseudomonas with the samples. After just 10 minutes the bacteria were significantly reduced or killed. The coating also fared well against viruses, killing 99% of them.

That's a good start, but it's no use being effective at killing bacteria and viruses if the effect is short-lived. So the team also conducted experiments to investigate how durable the fabric coating would be. Samples stored for six months were found to have the same antibacterial profile as fresh ones, and artificial aging tests suggested that the coating would remain stable on fabric for up to five years.

The coating is easily washed away however, so it wouldn't be suitable for applications like staff uniforms, patient gowns or bedding. But the team says the coating could be useful for things like curtains around beds or air filters. Combined with other weapons like antimicrobial lights or materials, the coating could eventually help curb the spread of superbugs in hospitals.

The research was published in the journal Scientific Reports.

New Atlas, 29 November 2023

https://newatlas.com

The material can not only speed up bone healing, it also reduces the risk of infections.

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Novel Implant Material Reduces Bacterial Infection, Speeds Up Bone Healing

2023-11-29

Researchers at RCSI University of Medicine and Health Sciences and Advanced Materials and Bioengineering Research Centre (AMBER) have developed a new surgical implant that has the potential to transform the treatment of complex bone infections.

When implanted on an injured or infected bone, the material can not only speed up bone healing, it also reduces the risk of infections without the need for traditional antibiotics.

The newly published paper in the journal Advanced Materials tackles the complex clinical problem of bone infection, or osteomyelitis, which affects one in around 5,000 people within the US only year.

When a bone is infected, the priority is to heal it quickly. Standard clinical treatment, including several weeks with antibiotics and often removal of the infected portion of bone tissue, can be slow. Already around half of bone infections are caused by MRSA, which is resistant to antibiotics, and prolonged antibiotic treatment pushes up the risk of infections becoming tolerant to the treatments we have at our disposal, making infections harder to control.

To help patients to heal well, researchers at RCSI created a material from a substance that is similar to our bones. The scaffold-like structure of this material means that when it is implanted onto injured or diseased bone, it encourages the bone to regrow.

In this case, the RCSI researchers infused the scaffold with tiny nanoparticles of copper, which are known to kill the bacterium that causes most bone infections. Furthermore, they also incorporated a specific genetic molecule, an inhibitor of microRNA-138, into the scaffold to stimulate the formation of new bone at the site where the material is implanted.

Bone regrowth

In the study, the researchers describe how preclinical lab tests showed the implanted scaffolds with the copper nanoparticles and microRNA could stimulate bone regrowth in a fortnight, and that the scaffold stopped 80% of potentially harmful bacteria from attaching to the site.

They also saw that the implants stimulated a good blood supply to cells on the scaffold, which is crucial for the health and viability of the newly formed bone.

"Overall, we combined the power of antimicrobial implants and gene therapies, leading to a holistic system which repairs bone and prevents infection," says first author of the study Dr Joanna Sadowska, a Marie Skłodowska-Curie Postdoctoral Fellow at the RCSI Tissue Engineering Research Group (TERG).

"This makes a significant step forward in treating complex bone injuries, and the timescale we saw in our preclinical studies suggest our approach could revolutionise treatment times for patients in the future."

Professor of Bioengineering and Regenerative Medicine at RCSI, Prof. Fergal O'Brien, principal investigator on the paper and Head of TERG, sees many potential benefits to the implant.

"This implant can deliver the antimicrobial treatment directly to the infected bone so it can be a local and targeted approach, as opposed to exposing more of the body to long-term antibiotics," he says.

"Add to this that our implant incorporates copper particles that can stop bacteria from establishing an infection at the site and at the same time they stimulate blood vessel formation in bone. The nature of the implant also means that the body can naturally break down the material when the bone heals, so there is no need to remove it surgically."

An important step

Professor O'Brien, who is Deputy Director of Opens in new windowAMBER, the SFI Centre for Advanced Materials and BioEngineering Research, sees the implant as an important future step mode of targeted delivery for more precise and effective treatments of injured and diseased bone.

"This is a first-of-its-kind implant that integrates different solutions to encourage bone regrowth and address infections, and the new study is an important step to bringing it towards patients for faster and more effective treatments," he said.

The novel nature of this research was recognised earlier this year during the annual meeting of the Orthopaedic Research Society in Dallas, Texas, where Dr Sadowska was awarded a New Investigator Recognition Award for outstanding scientific paper. This is one of the most prestigious global

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international orthopaedic awards for early-career researchers in the musculoskeletal field.

Technology Networks, 29 November 2023

https://technologynetworks.com

Researchers identify dynamic behavior of key SARS-CoV-2 accessory protein

2023-11-29

While many countries across the world are experiencing a reprieve from the intense spread of SARS-CoV-2 infections that led to tragic levels of sickness and multiple national lockdowns at the start of the decade, cases of infection persist.

A better understanding of the mechanisms that sustain the virus in the body could help find more effective treatments against sickness caused by the disease, as well as arming against future outbreaks of similar infections. With this in mind, there has been a lot of interest in the accessory proteins that the virus produces to help it thrive in the body.

"Similar to other viruses, SARS-CoV-2 expresses an array of accessory proteins to re-program the host environment to favor its replication and survival," explain Richard Wong at Kanazawa University and Noritaka Nishida at Chiba University and their colleagues in this latest report. Among those accessory proteins is ORF6.

Previous studies have suggested that ORF6 interferes with the function of interferon 1 (IFN-I), a particular type of small protein used in the immune system, which may explain the instances of asymptomatic infection with SARS-CoV2. There is also evidence that ORF6 causes the retention of certain proteins in the cytoplasm while disrupting mRNA transport from the cell, which may be a means for inhibiting IFN-I signaling. However, the mechanism for this protein retention and transport disruption was not clear.

To shed light on these mechanisms, the researchers first looked into what clues various software programs might give as to the structure of ORF6. These indicated the likely presence of several intrinsically disordered regions. Nuclear magnetic resonance measurements also confirmed the presence of a very flexible disordered segment.

Although the machine learning algorithm AlphaFold2 has proved very useful for determining how proteins fold, the presence of these

Researchers at Kanazawa University report in the Journal of Physical Chemistry Letters high-speed atomic force microscopy studies that shed light on the possible role of the open reading frame 6 (ORF6) protein in COVID-19 symptoms.

intrinsically disordered regions limits its use for establishing the structure of ORF6 so the researchers used high-speed atomic force microscopy (HS-AFM), which is able to identify structures by detecting the topography of samples the way a record player needle traverses the grooves in vinyl.

Using HS-AFM the researchers established that ORF 6 is primarily in the form of ellipsoidal filaments of oligomers—strings of repeating molecular units but shorter than polymers. The length and circumference of these filaments was greatest at 37°C and least at 4°C, so the presence of fever could be beneficial for producing larger filaments. Substrates made of lipids—fatty compounds—also encouraged the formation of larger oligomers.

Because HS-AFM captures images so quickly it was possible to grasp not just the structures but also some of the dynamics of the ORF6 behavior, including circular motion, protein assembly and flipping. In addition, further computer analysis also revealed that the filaments were prone to aggregate into amyloids as found in some neurodegenerative diseases, and which can lead to complications in COVID-19 symptoms. As the researchers point out this aggregation works "to effectively sequester a vast numbers of host proteins, particularly transcription factors involved in IFN-I signaling."

Since these filaments break up in the presence of certain alcohols, urea, or sodium dodecyl sulfate Wong, Nishida and their colleagues conclude that the protein is largely held together by hydrophobic interactions. "Potential druggable candidates that dissociate ORF6 aggregates by disrupting hydrophobic interactions should be considered and tested in the near future to evaluate their therapeutic value in COVID-19 management and treatment," state the researchers.

Phys Org, 29 November 2023

https://phys.org

Fatty acid in beef & dairy found to boost immune cells' cancer response

2023-11-28

Diet has been shown to provide a range of health benefits, including preventing cancer spread or boosting treatment of the disease. However, less is known about how specific nutrients affect human physiological and pathological processes owing to the vast diversity of foods and the complexity of diet metabolism.

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A new study has found that trans-vaccenic acid, a fatty acid found in dairy products and the meat of grazing animals, may boost the cancer-killing abilities of the immune system's T cells.

Researchers at the University of Chicago approached this dilemma by assembling a blood nutrient compound library and screening its contents to identify nutrients that influence the development of cancer and its response to treatments.

"There are many studies trying to decipher the link between diet and human health, and it's very difficult to understand the underlying mechanisms because of the wide variety of foods people eat," said Jing Chen, the study's corresponding author. "But if we focus on just the nutrients and metabolites derived from food, we begin to see how they influence physiology and pathology."

The researchers' library contained 255 bioactive nutrient-derived molecules, which they screened for their ability to influence anti-tumor activity by activating the immune system's effector CD8+ T cells. When a naïve T cell encounters an antigen, it differentiates into an effector T cell. Cytotoxic CD8+ T cells, responsible for killing cancer cells or cells infected by pathogens, are a type of effector T cell. From their 'top six,' they identified trans-vaccenic acid (TVA) as the best performer.

"By focusing on nutrients that can activate T cell responses, we found one that actually enhances anti-tumor immunity by activating an important immune pathway," Chen said.

TVA is a natural trans fatty acid that comes mainly from the meat fat of ruminants, grazing animals like cows and sheep, and dairy products like milk and butter; the body can't produce its own. Fun fact: TVA gets its name from the Latin for cow, vacca. Only about 20% of TVA is broken down into other byproducts, which leaves the remaining 80% circulating in the blood.

"That means there must be something else it does, so we started working on it more," Chen said.

Conducting experiments on cells and mouse models of diverse tumor types, the researchers found that feeding mice a TVA-enriched diet significantly reduced the tumor growth potential of melanoma and colon cancer cells compared to mice fed a control diet. TVA diet, but not control diet, resulted in an increased CD8+ T cell population in tumor-infiltrating lymphocytes (TILs), cells that recognize cancer cells as abnormal and penetrate the tumor's microenvironment to kill them. Dietary TVA reduced CD8+ T cell exhaustion in tumors and promoted cell function, including survival. TVA diet did not affect CD8+ T cell population and function in

mice without tumors, suggesting that the effects of dietary TVA on T cells were probably dependent on generating an immune response.

The researchers performed molecular and genetic analyses to identify the effect of TVA on T cells, including a new technique for monitoring the transcription of single-stranded DNA (ssDNA) called kethoxal-assisted single-stranded DNA sequencing, or KAS-seq. iThe analysis showed that TVA inactivated the surface receptor on immune cells, GPR43, which is usually activated by short-chain fatty acids often produced by gut microbiota. Overpowering the short-chain fatty acids, TVA activates the CREB pathway, a cellular signaling pathway involved in a variety of functions, including cellular growth, survival, and differentiation. The researchers also found that mouse models with the GPR43 receptor removed from CD8+ T cells lacked their improved tumor-fighting ability.

The final step in the study involved analyzing blood samples from patients receiving chimeric antigen receptor (CAR)-T cell immunotherapy treatment for lymphoma. CAR-T cell therapy uses genetically modified T cells to locate and destroy cancer cells more effectively. The researchers found that patients with higher TVA levels tended to respond better to treatment than those with lower levels. They also tested leukemia cell lines, finding that TVA enhanced the ability of blinatumomab, an immunotherapy drug that engages T cells, to kill leukemia cells.

The findings suggest that TVA could be used as a dietary supplement to improve the effectiveness of T cell-based cancer treatments. However, the researchers are quick to point out that it's the nutrient itself that's important and not the food source, advising against consuming too much red meat and dairy to boost TVA levels, which could be detrimental to health.

The research highlights the importance of the emerging field of metabolomics, the large-scale study of the products of cell metabolism, to understanding how our diet's building blocks affect our health.

"After millions of years of evolution, there are only a couple hundred metabolites derived from food that end up circulating in the blood, so this means they could have some importance in our biology," said Chen. "To see that a single nutrient like TVA has a very targeted mechanism on a targeted immune cell type, with a very profound physiological response at the whole organism level – I find that really amazing and intriguing."

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The study was published in the journal Nature.

New Atlas, 28 November 2023

https://newatlas.com

Google DeepMind adds nearly 400,000 new compounds to open-access database

2023-11-29

The Materials Project, an open-access database founded at the Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) in 2011, computes the properties of both known and predicted materials. Researchers can focus on promising materials for future technologies—think lighter alloys that improve fuel economy in cars, more efficient solar cells to boost renewable energy, or faster transistors for the next generation of computers.

Now, Google DeepMind—Google's artificial intelligence lab—is contributing nearly 400,000 new compounds to the Materials Project, expanding the amount of information researchers can draw upon. The dataset includes how the atoms of a material are arranged (the crystal structure) and how stable it is (formation energy).

"We have to create new materials if we are going to address the global environmental and climate challenges," said Kristin Persson, the founder and director of the Materials Project at Berkeley Lab and a professor at UC Berkeley. "With innovation in materials, we can potentially develop recyclable plastics, harness waste energy, make better batteries, and build cheaper solar panels that last longer, among many other things."

To generate the new data, Google DeepMind developed a deep learning tool called Graph Networks for Materials Exploration, or GNoME. Researchers trained GNoME using workflows and data that were developed over a decade by the Materials Project, and improved the GNoME algorithm through active learning.

GNoME researchers ultimately produced 2.2 million crystal structures, including 380,000 that they are adding to the Materials Project and predict are stable, making them potentially useful in future technologies. The new results from Google DeepMind are published in the journal Nature.

Some of the computations from GNoME were used alongside data from the Materials Project to test A-Lab, a facility at Berkeley Lab where artificial intelligence guides robots in making new materials. A-Lab's first paper,

New technology often calls for new materials—and with supercomputers and simulations, researchers don't have to wade through inefficient guesswork to invent them from scratch.

also published in Nature, showed that the autonomous lab can quickly discover novel materials with minimal human input.

Over 17 days of independent operation, A-Lab successfully produced 41 new compounds out of an attempted 58—a rate of more than two new materials per day. For comparison, it can take a human researcher months of guesswork and experimentation to create one new material, if they ever reach the desired material at all.

To make the novel compounds predicted by the Materials Project, A-Lab's AI created new recipes by combing through scientific papers and using active learning to make adjustments. Data from the Materials Project and GNoME were used to evaluate the materials' predicted stability.

"We had this staggering 71% success rate, and we already have a few ways to improve it," said Gerd Ceder, the principal investigator for A-Lab and a scientist at Berkeley Lab and UC Berkeley. "We've shown that combining the theory and data side with automation has incredible results. We can make and test materials faster than ever before, and adding more data points to the Materials Project means we can make even smarter choices."

The Materials Project is the most widely used open-access repository of information on inorganic materials in the world. The database holds millions of properties on hundreds of thousands of structures and molecules, information primarily processed at Berkeley Lab's National Energy Research Science Computing Center.

More than 400,000 people are registered as users of the site and, on average, more than four papers citing the Materials Project are published every day. The contribution from Google DeepMind is the biggest addition of structure-stability data from a group since the Materials Project began.

"We hope that the GNoME project will drive forward research into inorganic crystals," said Ekin Dogus Cubuk, lead of Google DeepMind's Materials Discovery team. "External researchers have already verified more than 736 of GNoME's new materials through concurrent, independent physical experiments, demonstrating that our model's discoveries can be realized in laboratories."

The Materials Project is now processing the compounds from Google DeepMind and adding them into the online database. The new data will be freely available to researchers, and also feed into projects such as A-Lab that partner with the Materials Project.

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"I'm really excited that people are using the work we've done to produce an unprecedented amount of materials information," said Persson, who is also the director of Berkeley Lab's Molecular Foundry.

"This is what I set out to do with the Materials Project: To not only make the data that I produced free and available to accelerate materials design for the world, but also to teach the world what computations can do for you. They can scan large spaces for new compounds and properties more efficiently and rapidly than experiments alone can."

By following promising leads from data in the Materials Project over the past decade, researchers have experimentally confirmed useful properties in new materials across several areas. Some show potential for use:

- in carbon capture (pulling carbon dioxide from the atmosphere)
- as photocatalysts (materials that speed up chemical reactions in response to light and could be used to break down pollutants or generate hydrogen)
- as thermoelectrics (materials that could help harness waste heat and turn it into electrical power)
- as transparent conductors (which might be useful in solar cells, touch screens, or LEDs)

Of course, finding these prospective materials is only one of many steps to solving some of humanity's big technology challenges.

"Making a material is not for the faint of heart," Persson said. "It takes a long time to take a material from computation to commercialization. It has to have the right properties, work within devices, be able to scale, and have the right cost efficiency and performance. The goal with the Materials Project and facilities like A-Lab is to harness data, enable data-driven exploration, and ultimately give companies more viable shots on goal."

Phys Org, 29 November 2023

https://phys.org

Ozempic, Wegovy active ingredient may reduce heart risk

2023-11-12

These were the findings of a US study funded by the product manufacturer, Novo Nordisk, in a randomised double-blind trial

Semaglutide – the active ingredient in diabetes-cum-weightloss drugs Ozempic and Wegovy – might reduce the risk of death from heart disease in overweight people.

investigating the effect of the Wegovy dosage in preventing major adverse cardiovascular events in overweight people with cardiovascular disease.

This investigation took more than 17,600 patients with stage 1 obesity – an average body mass index (BMI) of 33 – split into groups receiving either semaglutide or a placebo over a 2-4-year period.

People with high BMI scores are more likely to experience a range of heart conditions. While the BMI isn't necessarily an accurate indicator of a person's health picture, at a population level it is a good predictor of these issues, particularly in large studies.

In this study, those who were given semaglutide were less likely to suffer an 'endpoint' event, such as a nonfatal heart attack or stroke, or death from a cardiovascular cause.

However, that margin is small. 6.5% of those administered semaglutide experienced an endpoint, compared to 8% on the placebo.

Dr Garron Dodd, head of the metabolic neuroscience research lab at the University of Melbourne who wasn't involved in the research, described the findings as "exciting" but urged caution in inferring a definitive health outcome.

"The observed effects, while statistically significant, are relatively modest," Dodd says.

"The mechanism through which semaglutide protects against cardiovascular-related death remains unclear, with questions arising about whether the observed benefits are solely attributed to weight loss, given the 8.5% greater reduction in body weight in the semaglutide treated group.

"Furthermore, the study's focus on patients with mild or stage 1 obesity prompts scrutiny regarding the potential applicability of these effects in severely obese patients, who arguably face the highest risk of cardiovascular death."

There is currently a global shortage of both Ozempic and Wegovy. Both are the subject of an upcoming episode of the Cosmos podcast Debunks.

Cosmos, 12 November 2023

https://cosmosmagazine.com

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Blasts to clear World War II munitions could contaminate the ocean

2023-11-29

After World War II, according to research estimates, up to 385,000 metric tons of unexploded munitions -- including 40,000 tons of chemical munitions -- were dumped into the Baltic Sea.

These discarded weapons remain dangerous: They have the potential to jet plumes of water and sediment upward, send shock waves through the ocean, and punch holes in ships' hulls.

In addition, the mines' metal shells can corrode in seawater, leaking potentially toxic explosive compounds, such as TNT, into the environment over time.

Technicians typically clear historic munitions with controlled explosions, but there is debate among scientists about whether weak or strong blasts are better.

World War II concluded decades ago, but live mines lurking on the ocean floor still pose threats, potentially spewing unexpected geysers or releasing contaminants into the water.

While smaller blasts minimize shock waves and physical damage, Edmund Maser and coworkers suspected that these weaker ones release more toxic residue than strong blasts.

To test whether this is true, the team wanted to measure the explosive residues near underwater mines after controlled detonations of the two different intensities.

The researchers -- working in close collaboration with the Royal Danish Navy -- first identified World War II mines near a busy shipping route off the coast of Denmark, choosing the sites of two intact and two corroded devices.

Divers from the Navy collected ocean water and ocean floor sediment around the mines, and researchers then used mass spectrometry to measure the samples' levels of TNT.

As the researchers expected, chemical contamination was higher near the corroded mines than the intact ones.

Then, using either a low-powered detonation or a high-powered detonation, the team destroyed the leaking mines and assessed the TNT released from the blasts.

Sediment contained up to 100 million times more TNT after the weaker explosion than before, and only 250 times more TNT after the stronger blast.

Similarly, the TNT levels in water after the weaker blast far exceeded those around the stronger one.

The researchers say that the pollution released by the low-power blast meets or exceeds levels previously reported to be toxic to microalgae, sea urchins and fish.

Because of the potential threats to nearby marine life, the researchers encourage less invasive methods to remediate submerged World War II relics -- like robotic techniques to open and remove abandoned mines' explosive contents -- to prevent unwanted explosions and contamination.

The authors acknowledge funding from the Interreg North Sea Region's North Sea Wrecks project.

Science Daily, 29 November 2023

https://Sciencedaily.com

Revolutionizing Cancer Care With Bendable X-Ray Detectors

2023-11-07

Traditionally, X-ray detectors are made of heavy, rigid materials such as silicon or germanium. New, flexible detectors are cheaper and can be shaped around the objects that need to be scanned, improving accuracy when screening patients and reducing risk when imaging tumors and administering radiotherapy.

Breakthrough in X-ray Detector Technology

Dr. Prabodhi Nanayakkara, who led the research at the University of Surrey, said: "This new material is flexible, low-cost, and sensitive. But what's exciting is that this material is tissue equivalent. This paves the way for live dosimetry, which just isn't possible with current technology."

Most of the X-ray detectors on the market today are heavy, rigid, energy-consuming, and expensive if a large area needs to be covered.

Substances built up of hydrogen and carbon, known as organic semiconductors, offer a more flexible solution, but until now, did not allow as detailed an X-ray image to be produced as traditional detectors.

New tissue-equivalent materials developed at the University of Surrey could pave the way for a new generation of flexible X-ray detectors, with potential applications ranging from cancer treatment to better airport scanners.

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Innovative Developments and Applications

To solve this challenge, scientists at the University of Surrey's Advanced Technology Institute created devices based on an ink by adding low quantities of high atomic number elements to an organic semiconductor.

Building on the team's previous research in this field, their new detector behaves more like human tissue under X-rays, which could lead to new, safer techniques for administering radiotherapy, mammography, and radiography. Their findings are published in the journal Advanced Science.

Professor Ravi Silva, director of Surrey's Advanced Technology Institute, said: "This new technology could be used in a variety of settings, such as radiotherapy, scanning historical artifacts and in security scanners. The University of Surrey together with its spin-out SilverRay Ltd continues to lead the way in flexible X-ray detectors – we're pleased to see the technology shows real promise for a range of uses."

Co-author, Professor Martin Heeney, Imperial College London, commented: "We have been developing heavy analogs of traditional organic semiconductors for some time, and we were intrigued when Dr. Imalka Jayawardena suggested their application in X-ray detectors. These results are very exciting, especially considering this was the first material investigated, and there is plenty of scope for further improvements."

Sci Tech Daily, 07 November 2023

https://scitechdaily.com

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Technical Notes

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(NOTE: OPEN YOUR WEB BROWSER AND CLICK ON HEADING TO LINK TO SECTION)

CHEMICAL EFFECTS

Use of a Polymeric Implant System to Assess the Neurotoxicity of Subacute Exposure to 2,2′,5,5′-Tetrachlorobiphenyl-4-ol, a Human Metabolite of PCB 52, in Male Adolescent Rats

Coenzyme Q10-Loaded Albumin Nanoparticles Protect against Redox Imbalance and Inflammatory, Apoptotic, and Histopathological Alterations in Mercuric Chloride-Induced Hepatorenal Toxicity in Rats

Evaluating Manganese, Zinc, and Copper Metal Toxicity on SH-SY5Y Cells in Establishing an Idiopathic Parkinson's Disease Model

ENVIRONMENTAL RESEARCH

Leaching and transformation of chemical additives from weathered plastic deployed in the marine environment

Air pollutants contribute to epithelial barrier dysfunction and allergic diseases

Environmental Causes of Idiopathic Pulmonary Fibrosis

PHARMACEUTICAL/TOXICOLOGY

Prevalence of Multidrug-Resistant Pseudomonas aeruginosa Isolated from Dairy Cattle, Milk, Environment, and Workers' Hands

Amphidinium spp. as a Source of Antimicrobial, Antifungal, and Anticancer Compounds

OCCUPATIONAL

Effects of a workplace-based exercise program on shoulder pain and function in fruit workers: A randomized controlled trial

Bisphenol derivatives in cord blood and association between thyroid hormones and potential exposure sources