CHEMWATCH

Bulletin Board

Contents

NOV. 03, 2023

(click on page numbers for links)

CONTACT US

subscribers@chemwatch.net
tel +61 3 9572 4700
fax +61 3 9572 4777

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

*** 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.**

CHEMWATCH

Bulletin Board

Contents

NOV. 03, 2023

CHEMWATCH

Bulletin Board

Contents

NOV. 03, 2023

ASIA PACIFIC

Chemicals added to the Inventory 5 years after issue of assessment certificate – 24 October 2023

2023-10-24

CAS Number	28770-01-6
Chemical Name	3-Oxazolidineethanol, 2-(1-methylethyl)-
Molecular Formula	C8H17NO2
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	17 October 2023

CAS Number	1965307-26-9
Chemical Name	Propanoic acid, 3-hydroxy-2-(hydroxymethyl)-2-methyl-, polymer with .alpha.-hydro-.omega.-hydroxypoly[oxy(methyl-1,2-ethanediyl)] and 5-isocyanato-1-(isocyanatomethyl)-1,3,3-trimethylcyclohexane, potassium salt, methanol-blocked, compds. with triethanolamine
Molecular Formula	Unspecified
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	17 October 2023

CAS Number	337906-36-2
Chemical Name	1,4-Benzenediamine, 2-(methoxymethyl)-
Molecular Formula	C8H12N2O
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	19 October 2023

CHEMWATCH
Bulletin Board
Regulatory Update
NOV. 03, 2023

CAS Number	28770-01-6	
CAS Number	1001161-63-2	
Chemical Name	1H,3H,5H-Oxazolo[3,4-c]oxazole, dihydro-3,5-bis(1-methyldecyl)-	
Molecular Formula	C27H53NO2	
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.	
Listing date	19 October 2023	
CAS Number	345910-11-4	
Chemical Name	2,5-Furandione, polymer with 2-(chloromethyl) oxirane, .alpha.-hydro-.omega.-hydroxypoly(oxy-1,2-ethanediyl) ether with 2-ethyl-2-(hydroxymethyl)-1,3-propanediol	
Molecular Formula	Unspecified	
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.	
Listing date	19 October 2023	

CAS Number	156105-38-3
Chemical Name	2-Propanone, reaction products with 5-amino-1,3,3-trimethylcyclohexanem ethanamine, reduced
Molecular Formula	Unspecified

CAS Number	156105-38-3
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	19 October 2023

Published date: 24 October 2023

Read More

AICIS, 24-10-23

https://www.industrialchemicals.gov.au/news-and-notices/chemicals-added-inventory-5-years-after-issue-assessment-certificate-24-october-2023

FSANZ public consultations

2023-10-23

Application A1275 - Transglutaminase from GM Bacillus licheniformis as a processing aid

FSANZ invites submissions on amending the Australia New Zealand Food Standards Code (the Code) to permit transglutaminase from genetically modified Bacillus licheniformis to be used as a processing aid for numerous food products. **Submissions close 6pm (AEDT) 21 November 2023.**

A1277 - 2'-FL from GM Escherichia coli K-12 (gene donor: Helicobacter enhydrae) in infant formula products

FSANZ invites submissions on amending the Code to permit a new genetically modified source organism for the production of a human identical milk oligosaccharide used in infant formula products. **Submissions close 6pm (AEDT) 21 November 2023.**

A1278 - Beta-Fructofuranosidase from GM Trichoderma reesei as a processing aid

FSANZ invites submissions on amending the Code to permit a new enzyme processing aid from a genetically-modified (GM) microbial source to be used in the production of short-chain fructooligosaccharides and

CHEMWATCH
Bulletin Board
Regulatory Update
NOV. 03, 2023

to reduce sugar (sucrose) levels in treated fruit and vegetable products. **Submissions close 6pm (AEDT) 21 November 2023.**

Application A1272 – Food derived from herbicide-tolerant and insect-protected corn line DP915635

FSANZ invites submissions on amending the Code regarding the sale and use of food derived from corn line DP915635, genetically modified for herbicide-tolerance and protection from insect pests. **Submissions close 6pm (AEDT) 20 October 2023.**

Application A1274 – Food derived from disease-resistant banana line QCAV-4

FSANZ invites submissions on amending the Code to approve food derived from banana line QCAV-4, genetically modified for resistance against the fungal disease fusarium wilt tropical race 4. **Submissions close 6pm (AEDT) 6 November 2023.**

Application A1271 – Cellulase from GM Aspergillus niger as a processing aid

FSANZ invites submissions on amending the Code to permit cellulase from genetically modified Aspergillus niger to be used as a processing aid in the brewing of beer and distilled alcohol production. **Submissions close 6pm (AEDT) 3 November 2023.**

Read More

Food Standards Australia New Zealand, 25-10-23

https://www.foodstandards.gov.au/Pages/default.aspx

New applications and proposals

2023-10-25

Application A1281 – Food derived from herbicide-tolerant and insect-protected corn line DP910521

This application seeks to amend the Code to approve the sale and use of food derived from corn line DP910521, genetically modified for herbicide-tolerance and protection from insect pests.

Application 1282 – Subtilisin from GM Bacillus subtillis as a processing aid

This application seeks to amend Schedule 18 of the Code to permit the use of subtilisin from genetically modified Bacillus subtillis as a processing aid.

Read More

https://www.foodstandards.gov.au/Pages/default.aspx

https://www.foodstandards.gov.au/Pages/default.aspx

Decision Regulation Impact Statement: Prohibition on the use of engineered stone

2023-10-27

This Decision Regulation Impact Statement (Decision RIS) provides an analysis of the impact of a prohibition on the use of engineered stone under the model WHS laws. It builds on the evidence and analysis previously considered by WHS ministers in, and should be read in conjunction with, the Decision Regulation Impact Statement: Managing the risks of respirable crystalline silica at work.

The Decision RIS was informed by an independent expert review of scientific evidence, an independent economic impact analysis, and stakeholder feedback on a Consultation paper released in March 2023. Submissions to the consultation were received from workers, persons conducting a business or undertaking (PCBUs), employer and worker representatives, WHS professionals, medical professionals, academics, government agencies, industry and peak bodies.

The Office of Impact Analysis assessed the Decision RIS as compliant with the Regulatory Impact Analysis Guide for Ministers' Meetings and National Standard Setting Bodies (June 2023).

Safe Work Australia provided the Decision RIS to Commonwealth, state and territory WHS ministers on 16 August 2023 for their consideration. WHS ministers have now agreed Safe Work Australia publish the Decision RIS, ahead of their decision later this year.

Questions and answers

- About respirable crystalline silica and engineered stone
- About Safe Work Australia
- Decision RIS: Background
- Decision RIS: Impact analysis and recommendations
- Decision RIS: Consultation
- Decision RIS: Next steps
- I work with engineered stone, or previously did…

CHEMWATCH
Bulletin Board
Regulatory Update
NOV. 03, 2023

- Information for businesses
- Information for consumers and the general public

Information from WHS regulators

Go to information and resources on silica and engineered stone from your state or territory work health and safety regulator.

Supporting information

- Crystalline silica and silicosis
- Crystalline silica and silicosis – Impact analysis and consultation
- Crystalline silica and silicosis – Recommendation on a prohibition on the use of engineered stone
- Decision Regulation Impact Statement: Managing the risks of respirable crystalline silica at work
- Prohibition on the use of engineered stone - Engage consultation
- Prohibition on the use of engineered stone – report published
- Prohibition of engineered stone: Literature review and gap analysis
- Department of Employment and Workplace Relations - Work Health and Safety Ministers' Meetings

Publication Date:

27 Oct 2023

Last updated:

27 Oct 2023

Publication type:

Regulatory impact statement

Read More

Safe Work Australia, 27-10-23

https://www.safeworkaustralia.gov.au/doc/decision-regulation-impact-statement-prohibition-use-engineered-stone

AMERICA

Argentina restricts three substances in hair, eyelash dyes

2023-10-19

Argentina's National Administration of Medicines, Food and Medical Technology (ANMAT) has restricted the use and marketing of three chemicals in hair and eyelash dyes.

Under provision 5978/2023, manufacturers in the country are prohibited from using in their products the following substances:

The restrictions entered into force on 4 August.

Companies have 90 days from that date, until 2 November, to reformulate their products.

Read More

Chemical Watch, 19-10-23

https://chemicalwatch.com/863569/argentina-restricts-three-substances-in-hair-eyelash-dyes

California Food Safety Act Bans Use of Four Chemical Food Additives Likely to Impact the Nation

2023-10-26

Interview with Susan Little, senior advocate, California government affairs with the Environmental Working Group, conducted by Melinda Tuhus

On Oct. 7, California Gov. Gavin Newsom signed Assembly Bill (AB 418), known as the California Food Safety Act. The law bans the use of four chemical food additives: red dye #3, potassium bromate, brominated vegetable oil and propyl paraben, which have been linked in tests to cancer, reproductive health issues and neurobehavioral problems, such as hyperactivity.

The European Union, as well as the United Kingdom, Canada, Australia, New Zealand, China and Japan have all previously banned the use of these four additives in food. After the effective date of 2027, the manufacture, sale or distribution of food products containing these additives will be subject to hefty fines in California.

CHEMWATCH
Bulletin Board
Regulatory Update
NOV. 03, 2023

Between The Lines Melinda Tuhus spoke with Susan Little, senior advocate for California government affairs with the Environmental Working Group, which was the driving force behind passage of the bill. Here she talks about food industry opposition to the legislation and the impact the new law will have on California and the rest of the nation.

Read More

Between the Lines, 26-10-23

https://btlonline.org/california-food-safety-act-banning-use-of-four-chemical-food-additives-likely-to-impact-the-nation/

Pennsylvania Frackers Used 80,000 Tons of Secret Chemicals Over Past Decade

2023-10-27

Oil and gas producers in Pennsylvania used some 160 million pounds of chemicals that they are not required by law to publicly identify in more than 5,000 gas wells between 2012 and 2022, according to research published on Tuesday.

The chemicals may have included per- and polyfluoroalkyl substances (PFAS), a toxic and pervasive class of chemicals, according to the report from Physicians for Social Responsibility, an activist group that last week co-published a new compilation of studies on the harms of hydraulic fracturing for oil and gas.

The industry is required to disclose the chemicals to state regulators in the database FracFocus. But operators are allowed by state law to keep from publicly disclosing them if doing so would put their operations at a competitive disadvantage.

Although the FracFocus data does not identify which substances were among the chemicals, the new report says that at least one kind of PFAS was used by two oil and gas operators in eight Pennsylvania wells during the study period—information that was first reported by PSR in 2021.

PFAS were used by one company at four wells in Washington County and one in Beaver County. Another operator used the chemicals in three wells in Lawrence County, according to the report.

"Eight wells may just be the tip of the iceberg because we also found that there were 160 million pounds of trade-secret chemicals injected into

thousands of unconventional gas wells over the same period," said Dusty Horwitt, who wrote the report.

Read More

Mother Jones, 27-10-23

https://www.motherjones.com/politics/2023/10/pennsylvania-fracking-chemicals-undisclosed-proprietary/

EPA Rebuilds Endocrine Disruptor Screening Program to Better Assess Human Endocrine Effects of Pesticides

2023-10-27

WASHINGTON – Today, the U.S. Environmental Protection Agency (EPA) is announcing a strategic plan to ensure that its assessments of pesticides more closely, quickly, and effectively evaluate the potential for endocrine effects in humans. These strategies will also improve EPA's ability to protect against those effects as part of its pesticide decisions under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and to implement the Endocrine Disruptor Screening Program (EDSP) under section 408(p) of the Federal Food, Drug, and Cosmetic Act (FFDCA).

"This plan is a major milestone in our efforts to ensure that pesticide decisions continue to protect human health," said Deputy Assistant Administrator for Pesticide Programs for the Office of Chemical Safety and Pollution Prevention Jake Li. "Starting with our highest priority chemicals, EPA will communicate more transparently our endocrine findings for humans, pulling from existing data when possible, and requesting new data when necessary to evaluate potential estrogen, androgen, and thyroid effects."

Endocrine systems, also referred to as hormone systems, are found in all mammals, birds, fish, and many other living organisms. The systems regulate many biological processes in the body from conception through adulthood and into old age, including the development of the brain and nervous system, the growth and function of the reproductive system, and metabolism and blood sugar levels.

CHEMWATCH
Bulletin Board
Regulatory Update
NOV. 03, 2023

Read More

US EPA, 27-10-23

https://www.federalregister.gov/public-inspection/2023-23721/endocrine-disruptor-screening-program-near-term-strategies-for-implementation

EUROPE

Upcoming GB active substance expiry dates

2023-10-24

Biocidal products must be phased off the GB market

The active substance/product type combinations listed below are due to expire under the GB BPR on the following dates:

- 2,2-dimethyl-1,3-benzodioxol-4-yl methylcarbamate (Bendiocarb) (CAS 22781-23-3 EC 245-216-8) in product type 18

31 January 2024

- 1-(4-chlorophenyl)-3-(2,6-difluorobenzoyl)urea (Diflubenzuron) (CAS 35367-38-5 EC 252-529-3) in product type 18

31 January 2025

- Formaldehyde (CAS 50-00-0 EC 200-001-8) in product type 2

31 January 2025

- Powdered corn cob (CAS n/a EC n/a) in product type 14

31 January 2025

- Thiamethoxam (CAS 153719-23-4 EC 428-650-4) in product type 18

31 January 2025

Once the approvals expire, the active substances can no longer be used in biocidal products of the relevant product types in GB.

If you hold an affected GB BPR product authorisation or Control of Pesticides Regulations (COPR) product approval, we will contact you about cancelling or revoking your authorisation or approval. You will have an opportunity to submit comments or additional information and we will take account of these when finalising our decision.

If you are aware of any disproportionate negative impacts that are likely to arise from the expiry of any of the active substance/product type combinations listed above, please contact us.

Read More

HSE, 24-10-23

https://www.hse.gov.uk/biocides/uk-article-95-list.htm

Upcoming GB active substance renewal submission deadlines

2023-10-24

Apply for active substance renewal by the deadlines to keep products on the GB market

Under the GB BPR, active substance approvals will expire unless a renewal application is submitted at least 550 days before their expiry date.

The 550-day deadlines are coming up for the following active substance/ product type combinations under GB BPR:

- 2,3,5,6-tetrafluorobenzyl trans-2-(2,2-dichlorovinyl)-3,3-dimethylcyclopropanecarboxylate (Transfluthrin) (CAS 118712-89-3 EC 405-060-5) in product type 18

29 April 2024

- 3-(N-acetyl-N-butyl)aminopropionic acid ethyl ester (Ethyl butylacetylaminopropionate (IR3535)) (CAS 52304-36-6 EC 257-835-0) in product type 19

29 April 2024

- Lauric acid (CAS 143-07-7 EC 205-582-1) in product type 19

29 April 2024

- methyl (E)-2-{2-[6-(2-cyanophenoxy)pyrimidin-4-yloxy]phenyl}-3-methoxyacrylate (Azoxystrobin) (CAS 131860-33-8 EC 603-524-3) in product types 7, 9 and 10

29 April 2024

- Synthetic amorphous silicon dioxide (nano) (CAS 112926-00-8 EC 231-545-4) in product type 18

CHEMWATCH
Bulletin Board
Regulatory Update
NOV. 03, 2023

29 April 2024

- 3-phenoxybenzyl (1RS,3RS;1RS,3SR)-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Permethrin) (CAS 52645-53-1 EC 258-067-9) in product types 8 and 18

27 October 2024

- Polyhexamethylene biguanide hydrochloride with a mean number-average molecular weight (Mn) of 1415 and a mean polydispersity (PDI) of 4.7 (PHMB (1415;4.7)) (CAS 1802181-67-4 / 32289-58-0 EC n/a) in product types 2 and 4

29 April 2025

Read More

HSE, 24-10-23

https://www.hse.gov.uk/biocides/uk-article-95-list.htm

Carbon Border Adjustment Mechanism (CBAM) starts to apply in its transitional phase

2023-10-29

CBAM is the EU's landmark tool to fight carbon leakage and one of the central pillars of the EU's ambitious Fit for 55 Agenda. It will equalise the price of carbon between domestic products and imports. This will ensure that the EU's climate policies are not undermined by production relocating to countries with less ambitious green standards or by the replacement of EU products by more carbon-intensive imports. CBAM is a WTO-compatible measure that encourages global industry to embrace greener and more sustainable technologies.

In its transitional phase, CBAM will only apply to imports of cement, iron and steel, aluminium, fertilisers, electricity and hydrogen. EU importers of those goods will have to report on the volume of their imports and the greenhouse gas (GHG) emissions embedded during their production, but without paying any financial adjustment at this stage. While importers are asked to collect data for the fourth quarter of 2023, their first report will only have to be submitted by 31 January 2024. Furthermore, a number of flexibilities have been built into the CBAM's structure for the first year of application, such as the use of default values for the reporting of embedded emissions and the possibility to use the monitoring, reporting and verification rules of the country of production.

The transitional phase will serve as a learning period for all stakeholders (importers, producers and authorities). It will allow the European Commission to collect useful information on embedded emissions in order to refine the methodology for the definitive period, which starts in 2026. As of that date, importers will need to buy and surrender the number of "CBAM certificates" corresponding to the GHGs embedded in imported CBAM goods.

To help EU importers and non-EU installations in the practical implementation of the new rules, a new CBAM transitional registry will become available on 1 October to help importers perform and report these calculations. The Commission is also gradually making available detailed written guidance, online training materials and webinars, sector-specific factsheets and a step-by-step checklist to support businesses as the transitional mechanism begins. Reviews of the CBAM's functioning and product scope during its transitional phase will be concluded before the start of the definitive period, as well as the feasibility of extending the scope of CBAM to other goods produced in ETS sectors.

For more information

Carbon Border Adjustment Mechanism

Read More

European Commission, 29-10-23

https://ec.europa.eu/commission/presscorner/detail/en/ip_23_4685

Protection from asbestos at work: Council votes to reduce exposure limits

2023-10-23

Today, the Council formally adopted new rules on protecting workers from the risks related to exposure to asbestos at work. This directive updates the existing rules in line with the latest scientific and technological developments.

The updated rules significantly lower the current asbestos limits and provide for more accurate ways to measure exposure levels to asbestos based on electron microscopy, a more modern and sensitive method.

They also provide for strengthened preventive and protective measures, such as obtaining special permits for asbestos removal and checking if there is asbestos in older buildings before starting demolition or

CHEMWATCH
Bulletin Board
Regulatory Update
NOV. 03, 2023

maintenance work. That is all the more important given the EU's goal to boost energy renovation in the EU, which could lead to 35 million buildings being renovated by 2030.

Read More

Council of the EU, 23-10-23

https://www.consilium.europa.eu/en/press/press-releases/2023/10/23/protection-from-asbestos-at-work-council-votes-to-reduce-exposure-limits

INTERNATIONAL

To ban or not to ban: Fixing the EU's global plastic waste mess

2023-10-19

The EU has vowed to clean up its act and cut back on dumping its waste elsewhere. For communities in low-income countries bearing the brunt of Europe's trash, that can't come fast enough.

A joint investigation by POLITICO, Lighthouse Reports and other global media partners highlights what an uphill climb that effort will be, as legal loopholes and a lack of transparency facilitate the flow of illegal exports to countries like Myanmar, where local communities are confronted with the pollution caused by ever-growing mounds of trash.

The investigation — backed by on-the-ground reporting and interviews with policymakers and waste experts — comes as EU lawmakers and countries consider an all-out ban on plastic waste exports as part of a broader revamp of the bloc's waste rules.

As part of the revision, the European Commission has suggested tightening the conditions under which recyclable plastic waste can be exported to non-OECD countries, suggesting they must express consent and prove they're able to properly treat the waste. But environmental campaigners and members of the European Parliament say a lack of traceability and transparency in the global waste trade mean those tweaks will do little to fix the issue.

Read More

Politico, 19-10-23

https://www.politico.eu/article/ban-fix-eu-pollution-plastic-waste-myanmar/

NanoHarmony publishing a White Paper on OECD Test Guideline development From Science to Regulation

2023-10-23

The NanoHarmony project, funded through Horizon 2020, has the mission to support the development of Test Guidelines and Guidance Documents for eight endpoints where nanomaterial-adapted test methods have been identified as a regulatory priority.

NanoHarmony coordinates the collection and use of available data and information to support the finalisation of the test method development and to organise a sustainable network for the needed exchange, also for future regulatory development needs.

The 3.5-year project started on 1 April 2020 and brings together 14 expert partners from 10 European Countries and works alongside OECD and ECHA in accelerating the development of priority Test guidelines and Guidance Documents for nanomaterials.

Read More

Nanoharmony, 23-10-23

https://nanoharmony.eu/2023/10/13/nanoharmony-publishing-a-white-paper-on-oecd-test-guideline-development-from-science-to-regulation/

The EU's Glitter Ban Goes Into Effect

2023-10-25

The EU chemical legislation REACH aims to reduce emissions of intentional microplastics that are insoluble and degradation-resistant particles below five millimeters.

As of October 17, 2023, loose plastic glitter for uses without a transitional period — such as arts and crafts toys — is banned in 27 European countries.

However, the legislation affects only products made of non-biodegradable, insoluble plastic. This means that friendly alternatives like biodegradable, soluble, natural, or inorganic glitter can continue being sold.

Loose plastic glitter used as a cosmetic product and cosmetics containing glitter will be sold until the end of the specific transitional periods granted to different products.

For instance, glitter in rinse-off cosmetics will be available until October 16, 2027, while glitter in leave-on cosmetics has until October 16, 2029.

Beauty products like makeup, lip, and nail cosmetics that include glitter will be sold until October 16, 2035, but will need to bear a label indicating they contain microplastics from October 17, 2031.

Despite the ban, retailers are allowed to sell out their remaining supply of glitter and products containing it.

In 2015, the U.S. Food and Drug Administration (FDA) prohibited the use of microplastic beads in manufacturing exfoliating or cleansing products, such as fluoride toothpastes, acne scrubs, antibacterial soaps, and anti-dandruff shampoos.

The EU's glitter ban is estimated to prevent the release of about half a million tonnes of microplastics into the environment, making a positive impact on the planet and possibly human health.

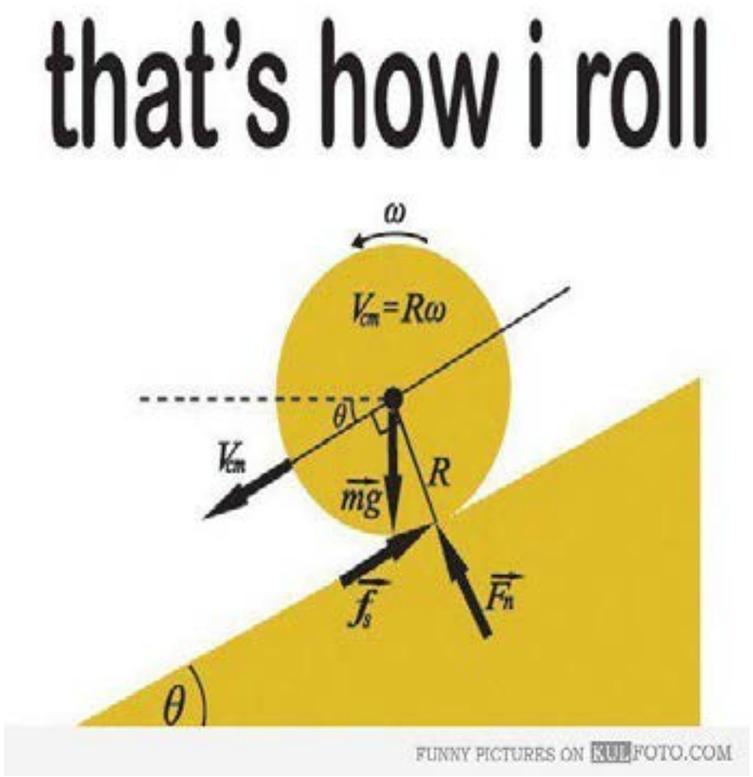
Read More

Health News, 25-10-23

https://healthnews.com/news/the-eus-glitter-ban-goes-into-effect/

That's How I Roll

2023-11-03



Naphthlene

2023-11-03

USES [2,3]

Naphthalene is used mainly as a precursor in producing other chemicals. The single largest use of naphthalene is the industrial production of phthalic anhydride, although more phthalic anhydride is made from o-xylene. Other naphthalene-derived chemicals include alkyl naphthalene sulphonate surfactants, and the insecticide 1-naphthyl-N-methylcarbamate (carbaryl). Naphthalenes substituted with combinations of strongly electron-donating functional groups, such as alcohols and amines, and strongly electron-withdrawing groups, especially sulfonic acids, are intermediates in the preparation of many synthetic dyes. The hydrogenated naphthalenes tetrahydronaphthalene (tetralin) and decahydronaphthalene (decalin) are used as low-volatility solvents. In addition, naphthalene is used in the synthesis of 2-naphthol, a precursor for various dyestuffs, pigments, rubber processing chemicals and other miscellaneous chemicals and pharmaceuticals. Naphthalene sulfonic acids are used in the manufacture of naphthalene sulphonate polymer plasticisers (dispersants), which are used to produce concrete and plasterboard (wallboard or drywall). They are also used as dispersants in synthetic and natural rubbers, and as tanning agents (syntans) in leather industries, agricultural formulations (dispersants for pesticides), dyes and as a dispersant in lead–acid battery plates. Naphthalene sulphonate polymers are produced by reacting naphthalene with sulphuric acid and then polymerising with formaldehyde, followed by neutralisation with sodium hydroxide or calcium hydroxide. These products are commercially sold in solution (water) or dry powder form. Alkyl naphthalene sulphonates (ANS) are used in many industrial applications as nondetergent wetting agents that effectively disperse colloidal systems in aqueous media. The major commercial applications are in the agricultural chemical industry, which uses ANS for wettable powder and wettable granular (dry-flowable) formulations, and the textile and fabric industry, which utilises the wetting and defoaming properties of ANS for bleaching and dyeing operations. The most familiar use of naphthalene is as a household fumigant, such as in mothballs although 1,4-dichlorobenzene (or p-dichlorobenzene) is now more widely used. In a sealed container containing naphthalene pellets, naphthalene vapours build up to levels toxic to both the adult and larval forms of many moths that attack textiles. Other fumigant uses of naphthalene include use in soil as a fumigant

Naphthalene is an organic compound with the formula C10H8. It is the simplest polycyclic aromatic hydrocarbon, and is a white crystalline solid, which is flammable with a characteristic odour that is detectable at concentrations as low as 0.08 ppm by mass. [1,2]

pesticide, in attic spaces to repel animals and insects, and in museum storage-drawers and cupboards to protect the contents from attack by insect pests. Naphthalene is also used in pyrotechnic special effects such as the generation of black smoke and simulated explosions. In the past, naphthalene was administered orally to kill parasitic worms in livestock. Naphthalene and its alkyl homologues are the major constituents of creosote. Naphthalene is used in engineering to study heat transfer using mass sublimation.

EXPOSURE SOURCES & ROUTES OF EXPOSURE [3]

Exposure Sources

Exposure to naphthalene can occur in the following ways:

- Breathing low levels in outdoor air.
- Breathing air contaminated from industrial discharges or smoke from burning wood, tobacco, or fossil fuels.
- Using or making moth repellents, coal tar products, dyes or inks could expose you to these chemicals in the air.
- Drinking water from contaminated wells.
- Touching fabrics that are treated with moth repellents containing naphthalene.
- Exposure to naphthalene, 1-methylnaphthalene and 2-methylnaphthalene from eating foods or drinking beverages is unlikely.

HEALTH EFFECTS [4]

Acute Health Effects

Acute exposure of humans to naphthalene by inhalation, ingestion, and dermal contact is associated with haemolytic anaemia, damage to the liver, and, in infants, neurological damage. Symptoms of acute exposure include headache, nausea, vomiting, diarrhoea, malaise, confusion, anaemia, jaundice, convulsions, and coma. Cataracts have been reported in humans acutely exposed to naphthalene by inhalation and ingestion.

Carcinogenicity

Workers occupationally exposed to vapours of naphthalene and coal tar developed laryngeal carcinomas or neoplasms of the pylorus and caecum. However, this study is inadequate because there were no controls,

CHEMWATCH
Bulletin Board
Hazard Alert
NOV. 03, 2023

exposure levels were not determined, and subjects were exposed to complex mixtures containing other demonstrated carcinogens. Di-, tri-, and tetramethyl naphthalene contaminants of coal tar were found to be carcinogenic when applied to the skin of mice, but naphthalene alone was not. EPA has classified naphthalene as a Group C, possible human carcinogen.

Other Effects

Haemolytic anaemia has been reported in infants born to mothers who "sniffed" and ingested naphthalene (as mothballs) during pregnancy. The mothers themselves were anaemic, but to a lesser extent than the infants.

SAFETY

First Aid Measures [5]

- **Eye Contact:** Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.
- **Skin Contact:** After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.
- **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. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. 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]

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]

Use the following personal protective equipment when handling naphthalene:

- Splash goggles
- Lab coat
- 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
- A self contained breathing apparatus should be used to avoid inhalation of the product.

Note: Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

CHEMWATCH
Bulletin Board
Hazard Alert
NOV. 03, 2023

REGULATION

United States

Exposure Limit	Limit Values	HE Codes	Health Factors and Target Organs
OSHA Permissible Exposure Limit (PEL) - General Industry See 29 CFR 1910.1000 Table Z-1	10 ppm (50 mg/m³) TWA	HE3	Cataracts, jaundice, bloody urine, kidney and liver damage
		HE7	Headache, tiredness, confusion Target organs: Brain, central nervous system
		HE12	Haemolytic anaemia
		HE14	Marked eye and skin irritation
OSHA PEL - Construction Industry See 29 CFR 1926.55 Appendix A	10 ppm (50 mg/m³) TWA	HE3	Cataracts, jaundice, bloody urine, kidney and liver damage
		HE7	Headache, tiredness, confusion Target organs: Brain, central nervous system
		HE12	Haemolytic anaemia
		HE14	Marked eye and skin irritation

Exposure Limit	Limit Values	HE Codes	Health Factors and Target Organs
OSHA PEL - Shipyard	10 ppm (50 mg/m^3) TWA	HE3	Cataracts, jaundice, bloody urine, kidney and liver damage
		HE7	Headache, tiredness, confusion Target organs: Brain, central nervous system
		HE12	Haemolytic anaemia
		HE14	Marked eye and skin irritation Target organs: Eyes, skin
National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL)	10 ppm (50 mg/m^3) TWA 15 ppm (75 mg/m^3) STEL	HE3	Jaundice, blood in urine, renal shutdown, optical neuritis, corneal damage
		HE7	Headache, confusion, excitement Target organs: Brain, central nervous system
		HE14	Eye irritation

CHEMWATCH
Bulletin Board
Hazard Alert
NOV. 03, 2023

Exposure Limit	Limit Values	HE Codes	Health Factors and Target Organs
American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) (2001)*	10 ppm (52 mg/m^3) TWA 15 ppm (79 mg/m^3) STEL Skin; A4	HE3	Ocular toxicity (cataracts, optical neuritis, lens opacities, retinal degeneration), jaundice, renal failure
		HE7	Headache Target organs: Brain, central nervous system
		HE12	Haemolytic anaemia
		HE14	Marked eye and respiratory tract irritation
CAL/OSHA PELs	10 ppm (50 mg/m^3) TWA 15 ppm (75 mg/m^3) STEL	HE3	Ocular toxicity (cataracts, optical neuritis, lens opacities, retinal degeneration), jaundice, renal failure
		HE7	Headache Target organs: Brain, central nervous system
		HE12	Haemolytic anaemia
		HE14	Marked eye and respiratory tract irritation

References

1. http://en.wikipedia.org/wiki/Naphthalene
2. http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1203084377836
3. http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=239&tid=43
4. http://www.epa.gov/ttn/atw/hlthef/naphthal.html
5. http://www.sciencelab.com/msds.php?msdsId=9927671
6. https://www.osha.gov/dts/chemicalsampling/data/CH_255800.html

7. http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/772/Workplace-exposure-standards-airborne-contaminants.pdf

"Superatomic" material beats silicon for fastest semiconductor ever

2023-10-31

Semiconductors are the beating heart of electronic devices, and silicon reigns supreme. These materials form the basis of transistors and integrated circuits, which themselves lay the foundation for smartphones to supercomputers and everything in between.

Now, scientists at Columbia University have found a new semiconductor material that seems to outperform all the rest. Known as Re6Se8Cl2, the material is made up of a mix of rhenium, selenium and chlorine, the atoms of which cluster together and behave like one big atom – a "superatom." And this is where it gets its speed.

In any material, the atomic structure gives off tiny vibrations that travel as quantum particles called phonons, which can scatter energy-carrying particles like electrons or excitons. This energy is quickly lost as heat, and managing it is a constant hurdle in designing electronic chips and systems.

But Re6Se8Cl2 has a neat little trick up its sleeve. Its excitons don't scatter when they're hit by phonons but actually bind to them, creating another form of quasiparticle called acoustic exciton-polarons. These can still carry energy, but travel much more slowly than regular excitons – and counterintuitively, this ultimately leads to faster speeds than in silicon.

The team compares it to the old story of the tortoise and the hare. Electrons can travel very quickly through silicon, but they tend to bounce all over the place, which isn't the most efficient travel path. The polarons in Re6Se8Cl2, on the other hand, are slower and aren't affected by other phonons, so they move farther and more consistently over time.

In effect, the team found that the polarons in Re6Se8Cl2 moved about twice as fast as electrons in silicon. Taking into account that they can be controlled by light instead of electricity, the team estimates that theoretical electronic devices made using the material could end up six orders of magnitude faster than existing ones.

"In terms of energy transport, Re6Se8Cl2 is the best semiconductor that we know of, at least so far," said Milan Delor, an author of the study.

Unfortunately, don't expect blistering-fast processors using the material in your computer any time soon – the team says it's unlikely this particular concoction will ever make it to market. Rhenium is just too rare and expensive for consumer goods. But having proved the concept, the

Scientists have found that a "superatomic" material is the fastest and most efficient semiconductor ever. Taking advantage of a tortoise-and-hare mechanism, the new material can transport energy much faster than silicon.

researchers believe similar, hopefully cheaper materials might exhibit the same behavior.

"We can now start to predict what other materials might be capable of this behavior that we just haven't considered before," said Delor. "There is a whole family of superatomic and other 2D semiconductor materials out there with properties favorable for acoustic polaron formation."

The research was published in the journal Science.

New Atlas, 31 October 2023

https://newatlas.com

We built a 'brain' from tiny silver wires. It learns in real time, more efficiently than computer-based AI

2023-11-01

However, current AI systems rely on computers running complex algorithms based on artificial neural networks. These use huge amounts of energy, and use even more energy if you are trying to work with data that changes in real time.

We are working on a completely new approach to "machine intelligence". Instead of using artificial neural network software, we have developed a physical neural network in hardware that operates much more efficiently.

Our neural networks, made from silver nanowires, can learn on the fly to recognise handwritten numbers and memorise strings of digits. Our results are published in a new paper in Nature Communications, conducted with colleagues from the University of Sydney and the University of California, Los Angeles.

A random network of tiny wires

Using nanotechnology, we made networks of silver nanowires about one thousandth the width of a human hair. These nanowires naturally form a random network, much like the pile of sticks in a game of pick-up sticks.

The nanowires' network structure looks a lot like the network of neurons in our brains. Our research is part of a field called neuromorphic computing, which aims to emulate the brain-like functionality of neurons and synapses in hardware.

Our nanowire networks display brain-like behaviours in response to electrical signals. External electrical signals cause changes in how

The world is in-fatuated with artificial intelligence (AI), and for good reason. AI systems can process vast quantities of data in a seemingly superhuman way.

CHEMWATCH
Bulletin Board
Gossip
NOV. 03, 2023

electricity is transmitted at the points where nanowires intersect, which is similar to how biological synapses work.

There can be tens of thousands of synapse-like intersections in a typical nanowire network, which means the network can efficiently process and transmit information carried by electrical signals.

Learning and adapting in real time

In our study, we show that because nanowire networks can respond to signals that change in time, they can be used for online machine learning.

In conventional machine learning, data is fed into the system and processed in batches. In the online learning approach, we can introduce data to the system as a continuous stream in time.

With each new piece of data, the system learns and adapts in real time. It demonstrates "on the fly" learning, which we humans are good at but current AI systems are not.

The online learning approach enabled by our nanowire network is more efficient than conventional batch-based learning in AI applications.

In batch learning, a significant amount of memory is needed to process large datasets, and the system often needs to go through the same data multiple times to learn. This not only demands high computational resources but also consumes more energy overall.

Our online approach requires less memory as data is processed continuously. Moreover, our network learns from each data sample only once, significantly reducing energy use and making the process highly efficient.

Recognising and remembering numbers

We tested the nanowire network with a benchmark image recognition task using the MNIST dataset of handwritten digits.

The greyscale pixel values in the images were converted to electrical signals and fed into the network. After each digit sample, the network learned and refined its ability to recognise the patterns, displaying real-time learning.

Using the same learning method, we also tested the nanowire network with a memory task involving patterns of digits, much like the process of

remembering a phone number. The network demonstrated an ability to remember previous digits in the pattern.

Overall, these tasks demonstrate the network's potential for emulating brain-like learning and memory. Our work has so far only scratched the surface of what neuromorphic nanowire networks can do.

The Conversation, 01 November 2023

https://theconversation.com

High Insulin Levels Linked to Pancreatic Cancer Risk

2023-11-01

A new study from researchers at the University of British Columbia's Faculty of Medicine reveals a direct link between high insulin levels, common among patients with obesity and Type 2 diabetes, and pancreatic cancer.

The study, published in Cell Metabolism, provides the first detailed explanation of why people with obesity and Type 2 diabetes are at an increased risk of pancreatic cancer. The research demonstrates that excessive insulin levels overstimulate pancreatic acinar cells, which produce digestive juices. This overstimulation leads to inflammation that converts these cells into precancerous cells.

"Alongside the rapid increase in both obesity and Type 2 diabetes, we're seeing an alarming rise in pancreatic cancer rates," said co-senior author Dr. James Johnson, a professor in the department of cellular and physiological sciences and interim director of the Life Sciences Institute at UBC. "These findings help us understand how this is happening, and highlights the importance of keeping insulin levels within a healthy range, which can be accomplished with diet, exercise and in some cases medications."

The study focused on pancreatic ductal adenocarcinoma (PDAC), the most prevalent pancreatic cancer, and one that is highly aggressive with a five-year survival rate of less than 10 per cent. The incidence of pancreatic cancer is on the rise. By 2030, PDAC is expected to become the second leading cause of cancer-related deaths.

While obesity and Type 2 diabetes had previously been established as risk factors for pancreatic cancer, the exact mechanisms by which this occurred remained unclear. This new study sheds light on the role of insulin and its receptors in this process.

High insulin levels, common among patients with obesity and Type 2 diabetes, have been linked to pancreatic cancer risk.

CHEMWATCH
Bulletin Board
Gossip
NOV. 03, 2023

"We found that hyperinsulinemia directly contributes to pancreatic cancer initiation through insulin receptors in acinar cells," said Dr. Anni Zhang, the study's first author who recently graduated with their PhD from UBC. "The mechanism involves increased production of digestive enzymes, leading to heightened pancreatic inflammation."

While insulin is widely recognized for its role in regulating blood sugar levels, the study underscores its importance in pancreatic acinar cells. The findings show that insulin supports the physiological function of these cells in producing digestive enzymes that break down fat-rich foods, but at high levels, its increased action can inadvertently foster pancreatic inflammation and the development of precancerous cells.

The findings may pave the way for new cancer-prevention strategies and even therapeutic approaches that target insulin receptors in acinar cells.

"We hope this work will change clinical practice and help advance lifestyle interventions that can lower the risk of pancreatic cancer in the general population," said co-senior author Dr. Janel Kopp, assistant professor in the department of cellular and physiological sciences at UBC. "This research could also pave the way for targeted therapies that modulate insulin receptors to prevent or slow the progression of pancreatic cancer."

In collaboration with researchers at BC Cancer and the Pancreas Centre BC, the team has initiated a clinical trial to help patients diagnosed with PDAC control their blood sugar and circulating insulin levels with the help of an endocrinologist.

The researchers say the findings may have implications for other cancers associated with obesity and Type 2 diabetes, where elevated insulin levels may also play a contributing role in disease initiation.

"Colleagues in Toronto have shown similar connections between insulin and breast cancer," said Dr. Johnson. "In the future, we hope to determine whether and how excess insulin might contribute to other types of obesity- and diabetes-driven cancers."

Technology Networks, 01 November 2023

https://technologynetworks.com

Lending new meaning to the phrase 'cat burglar', a single feline hair left at a crime scene can be traced back to an individual animal through a new method that can highlight a unique, rare genetic 'fingerprint'.

New DNA tech uses a single cat hair to hone in on crime suspects

2023-10-31

"Hair shed by your cat lacks the hair root, so it contains very little useable DNA," said lead author of the study, Emily Patterson, a researcher at the University of Leicester. "In practice we can only analyze mitochondrial DNA, which is passed from mothers to their offspring, and is shared among maternally related cats."

As such, existing methods of DNA analysis makes it incredibly hard to zone-in on an individual, as much as Hollywood would have us believe otherwise. So even if forensics locate a single hair at a crime scene, it cannot provide any usable, specific information; even if it matches a cat associated with a person of interest, it will also match many other cats.

"In a previous murder case, we applied the earlier technique but were fortunate that the suspect's cat had an uncommon mitochondrial variant, as most cat lineages couldn't be distinguished from each other," said study co-lead Jon Wetton, from the university's Department of Genetics and Genome Biology. "But with our new approach, virtually every cat has a rare DNA type and so the test will almost certainly be informative if hairs are found."

The University of Leicester researchers have described an analysis process that amplifies the cat mitogenome in 60 overlapping amplicons (mean length 360 bp), followed by Nanopore sequencing. When treating a single cat hair that lacks nuclear DNA, this approach provided "a highly discriminating source of forensic genetic evidence."

The method proved to be 10 times more discriminating than an earlier method looking at a shorter fragment of mitochondrial DNA.

Because of the nature of cat hair, which belongs to a coat that is shed on average three times a year, it's very easy for this to travel on clothing and be left on site – even if someone is being incredibly careful to not leave their own DNA.

"In criminal cases where there is no human DNA available to test, pet hair is a valuable source of linking evidence, and our method makes it much more powerful," said study co-lead Mark Jobling, Professor of Genetics at the university. "The same approach could also be applied to other species – in particular, dogs."

CHEMWATCH
Bulletin Board
Gossip
NOV. 03, 2023

Cats are the second-most popular pet in the US, behind dogs, with at least one kitty reigning over some 46.5 million households, according to 2023 data research.

It's the latest advancement in forensics that may provide more avenues of crime scene investigation. A study published in July looked at finding effective methods of extracting human DNA from dog hair, which could potentially provide important information of an event the animal may have been present at.

The research was published in the journal Forensic Science International: Genetics.

New Atlas, 31 October 2023

https://newatlas.com

Engineers Develop Efficient Process To Make Fuel From Carbon Dioxide

2023-11-01

The approach directly converts the greenhouse gas into formate, a solid fuel that can be stored indefinitely.

The search is on worldwide to find ways to extract carbon dioxide from the air or from power plant exhaust and then make it into something useful. One of the more promising ideas is to make it into a stable fuel that can replace fossil fuels in some applications. But most such conversion processes have had problems with low carbon efficiency, or they produce fuels that can be hard to handle, toxic, or flammable.

Now, researchers at MIT and Harvard University have developed an efficient process that can convert carbon dioxide into formate, a liquid or solid material that can be used like hydrogen or methanol to power a fuel cell and generate electricity. Potassium or sodium formate, already produced at industrial scales and commonly used as a de-icer for roads and sidewalks, is nontoxic, nonflammable, easy to store and transport, and can remain stable in ordinary steel tanks to be used months, or even years, after its production.

The new process, developed by MIT doctoral students Zhen Zhang, Zhichu Ren, and Alexander H. Quinn; Harvard University doctoral student Dawei Xi; and MIT Professor Ju Li, is described this week in an open-access paper in Cell Reports Physical Science. The whole process — including capture and electrochemical conversion of the gas to a solid formate powder, which is then used in a fuel cell to produce electricity — was demonstrated at a small, laboratory scale. However, the researchers expect

it to be scalable so that it could provide emissions-free heat and power to individual homes and even be used in industrial or grid-scale applications.

Other approaches to converting carbon dioxide into fuel, Li explains, usually involve a two-stage process: First the gas is chemically captured and turned into a solid form as calcium carbonate, then later that material is heated to drive off the carbon dioxide and convert it to a fuel feedstock such as carbon monoxide. That second step has very low efficiency, typically converting less than 20 percent of the gaseous carbon dioxide into the desired product, Li says.

By contrast, the new process achieves a conversion of well over 90 percent and eliminates the need for the inefficient heating step by first converting the carbon dioxide into an intermediate form, liquid metal bicarbonate. That liquid is then electrochemically converted into liquid potassium or sodium formate in an electrolyzer that uses low-carbon electricity, e.g. nuclear, wind, or solar power. The highly concentrated liquid potassium or sodium formate solution produced can then be dried, for example by solar evaporation, to produce a solid powder that is highly stable and can be stored in ordinary steel tanks for up to years or even decades, Li says.

Several steps of optimization developed by the team made all the difference in changing an inefficient chemical-conversion process into a practical solution, says Li, who holds joint appointments in the departments of Nuclear Science and Engineering and of Materials Science and Engineering.

The process of carbon capture and conversion involves first an alkaline solution-based capture that concentrates carbon dioxide, either from concentrated streams such as from power plant emissions or from very low-concentration sources, even open air, into the form of a liquid metal-bicarbonate solution. Then, through the use of a cation-exchange membrane electrolyzer, this bicarbonate is electrochemically converted into solid formate crystals with a carbon efficiency of greater than 96 percent, as confirmed in the team's lab-scale experiments.

These crystals have an indefinite shelf life, remaining so stable that they could be stored for years, or even decades, with little or no loss. By comparison, even the best available practical hydrogen storage tanks allow the gas to leak out at a rate of about 1 percent per day, precluding any uses that would require year-long storage, Li says. Methanol, another widely explored alternative for converting carbon dioxide into a fuel usable in fuel cells, is a toxic substance that cannot easily be adapted to use in situations where leakage could pose a health hazard. Formate,

CHEMWATCH
Bulletin Board
Gossip
NOV. 03, 2023

on the other hand, is widely used and considered benign, according to national safety standards.

Several improvements account for the greatly improved efficiency of this process. First, a careful design of the membrane materials and their configuration overcomes a problem that previous attempts at such a system have encountered, where a buildup of certain chemical byproducts changes the pH, causing the system to steadily lose efficiency over time. "Traditionally, it is difficult to achieve long-term, stable, continuous conversion of the feedstocks," Zhang says. "The key to our system is to achieve a pH balance for steady-state conversion."

To achieve that, the researchers carried out thermodynamic modeling to design the new process so that it is chemically balanced and the pH remains at a steady state with no shift in acidity over time. It can therefore continue operating efficiently over long periods. In their tests, the system ran for over 200 hours with no significant decrease in output. The whole process can be done at ambient temperatures and relatively low pressures (about five times atmospheric pressure).

Another issue was that unwanted side reactions produced other chemical products that were not useful, but the team figured out a way to prevent these side reactions by the introduction of an extra "buffer" layer of bicarbonate-enriched fiberglass wool that blocked these reactions.

The team also built a fuel cell specifically optimized for the use of this formate fuel to produce electricity. The stored formate particles are simply dissolved in water and pumped into the fuel cell as needed. Although the solid fuel is much heavier than pure hydrogen, when the weight and volume of the high-pressure gas tanks needed to store hydrogen is considered, the end result is an electricity output near parity for a given storage volume, Li says.

The formate fuel can potentially be adapted for anything from home-sized units to large scale industrial uses or grid-scale storage systems, the researchers say. Initial household applications might involve an electrolyzer unit about the size of a refrigerator to capture and convert the carbon dioxide into formate, which could be stored in an underground or rooftop tank. Then, when needed, the powdered solid would be mixed with water and fed into a fuel cell to provide power and heat. "This is for community or household demonstrations," Zhang says, "but we believe that also in the future it may be good for factories or the grid."

"The formate economy is an intriguing concept because metal formate salts are very benign and stable, and a compelling energy carrier," says Ted Sargent, a professor of chemistry and of electrical and computer engineering at Northwestern University, who was not associated with this work. "The authors have demonstrated enhanced efficiency in liquid-to-liquid conversion from bicarbonate feedstock to formate, and have demonstrated these fuels can be used later to produce electricity," he says.

Technology Networks, date

https://technologynetworks.com

Archaeologists Find the First Red Paint Made From Plants

2023-10-25

Countless prehistoric artifacts are colored red with ochre, a mineral product that was the world's first red paint, but something made this hue look very different—and Davin set out to discover what it was.

Analysis with high-tech spectroscopy techniques revealed a novel source behind Davin's suspicions. The beads, originally found in Kebara Cave, on Israel's Mount Carmel, are the oldest known example of humans using plants to manufacture red pigment. The bright red color adorning them was produced from the roots of Rubiaceae plants, commonly known as the madder family, according to research published Wednesday in PLOS One.

The creators of this 15,000-year-old paint were part of the Natufian culture. They were the first hunter-gatherers to start settling down to more sedentary lifestyles across the Levant, in what is now Israel, Jordan, Lebanon, Syria and the Palestinian territories. They utilized wild plants for much more than food, including processing them to make pigment, before they domesticated them. The ornamental use of these organic dyes may be an example of a growing need for expression as human societies gradually shifted over the centuries. "You try to look at your environment differently, and you have time to look at it differently, so probably over a long period of time they were looking at things like plants and animals differently and learning a lot," says Davin, an archaeologist at the Hebrew University of Jerusalem and at a prehistoric technology laboratory at the French National Center for Scientific Research.

The shell beads originated in the Mediterranean Sea—some from just 10 miles away from Mount Carmel, and some from much farther afield in the Red Sea, around 250 miles away. But many of the beads from Kebara Cave are now located even further away. British archaeologists first undertook excavations at the site in the 1930s and sent many artifacts to museum collections around the world.

The flash of bright red caught Laurent Davin's eye. He was looking at an array of 15,000-year-old shell beads and other artifacts, which have been displayed in a case at Jerusalem's Rockefeller Archaeological Museum since before World War II. Many people had viewed them, but Davin was struck by this detail. "If you look at it, it's like blood, a really vivid red," he says, "and I had to wonder, 'What's that color?'"

Previously, the earliest known examples of plant-based red pigment had appeared around 6,000 years ago. But humans—and our relatives—have long expressed ourselves with the color red, which appears to have psychological impacts on the human mind. Our ancestors produced pigments from rocks and minerals like iron oxide (which is contained in red ochre) and used them to color everything from stones and bones to cave walls—with first uses documented in Africa as far back as 500,000 years ago. Shell tooth and bone ornaments in Kebara Cave were also colored with ochre. Blocks of it were found at the cave, along with ochre-adorned artifacts such as beads and burial textiles, making it clear that this older color was still very commonly used.

But the Natufian culture may have used the new plant-based red color to grab attention. What messages or meanings the bright red pigment's ornamental use might have conveyed are lost in time. But the ways Natufian people expressed themselves creatively represent a distinct shift from older cultures in the region, Davin says. Where older sites might yield a few hundred beads, he explains, Natufian sites have many thousands, in a wide diversity of materials—bone, teeth, shell, clay and even feathers. "Probably it means that their need to express their identity is really different from previous periods," he says. "Probably they wanted to add something more, another message, another meaning, and probably the use the organic red pigment is part of that."

Davin and colleagues unearthed the pigment's plant origins by performing several analyses. Advanced scanning studies showed no iron in the pigment, ruling out an ochre source, but showed a high carbon content that instead pointed to an organic origin. To narrow down exactly what that was, the team then used Raman spectroscopy, a chemical analysis that observes how a substance scatters light, to characterize its molecular composition. The Raman spectroscopy patterns produced by the dye were the same across all ten beads, and among possible candidate species they most closely matched signatures from compounds isolated from roots of plants from the Rubiaceae family—already known from prehistoric pollen analysis to have grown at Mount Carmel during the end of the Pleistocene period.

Copyright Chemwatch 2023 ©

The Natufians' exact recipe for producing the pigment isn't known, and Davin and his team hope to try their hand at reproducing similar substances with ancient techniques. They theorize that the Natufians dug up plants, cleaned and dried their roots, crushed them, and boiled them in water to dissolve the dye, which was then fermented.

Their use of madder was a very good choice, and one that was often repeated later in history because of the outstanding color that can be produced by its roots. Red pigments made with madder have been found in King Tut's tomb, on the Shroud of Turin and in the paintings of Vincent van Gogh. This red was a go-to up until organics were largely replaced by synthetic pigments in the 19th century.

The transition from hunter-gatherer lifestyles to settled agriculture wasn't a sudden change but a long and gradual process that began with more intensive plant gathering as early as 23,000 years ago. Wild plants were also exploited and cultivated for thousands of years before they became fully domesticated and thus dependent on humans. The production of pigments is another example of how the relationships between people and plants changed, and became more intertwined, during that period.

Natufian culture foragers living between 11,650 and 15,000 years ago were in the late stages of a hunter-gatherer lifestyle and extensively harvesting wild cereal plants for food. Previous research has shown that hunter-gatherers and early agriculturalists also used plants as key sources for making clothing, baskets, string and ornaments. Some of the earliest cultivar plants, like flax, were likely used primarily to make clothes. While non-food plant use was likely widespread, the hard evidence for it remains relatively scarce. Plant products and organic materials simply haven't stood the test of time, fading away after so many thousands of years.

"People weren't just hunting animals and eating raw meat. They really were already knowing very well what plants could do and what they could use them for," says Tobias Richter, an archaeologist at the University of Copenhagen who was not involved in the new study. Richter believes that we probably underestimate Stone Age humans' knowledge of how to use their landscape. "I think these people were absolute experts in knowing what to do with plants," he says.

Hundreds of artifacts from Kebara Cave, including bone pendants, teeth, beads and more, were sent to museums across the United Kingdom and North America. Almost all of them, like artifacts from many other sites, have never been analyzed to see what types of plant- or animal-based pigments and dyes they might display. Using such techniques to delve into their origins could reveal much more about early relationships between humans and other species.

Davin also hopes that future research will shed further light on the domestication of plants. Tools from the Kebara Cave could hold residues from processing plants, and that residue could yield genetic material. With enough samples, scientists could analyze the ancient genome and compare it to modern plants to trace the history of madder plant domestication. Beyond these species' longstanding role as a source of pigment, their stems and leaves are still prized in the region, including in neighboring Jordan, for their antioxidant, antibacterial and even aphrodisiac qualities.

To Richter, the plant-based pigments are another clear example that humans were using their imaginations to explore the resources available to them, and then used those resources creatively to elaborate their own ornamentations and rituals.

"I think we tend to imagine the Stone Age past to be sort of bleak and rough and difficult to survive," he says. "But it was also a lot more colorful and a lot more diverse than I think we often give it credit for."

Smithsonian Magazine, 25 October 2023

https://smithsonianmag.com

Chemists make breakthrough in drug discovery chemistry: Two methods to replace carbon with a nitrogen atom in a molecule

2023-11-01

But two studies from chemists at the University of Chicago, published in Science and Nature, offer two new methods to address this wish. The findings could make it easier to develop new drugs.

"This is the grand-challenge problem that I started my lab to try to solve," said Mark Levin, an associate professor of chemistry and the senior author on both papers. "We haven't totally solved it, but we've taken two really big bites out of the problem, and these findings lay a clear foundation for the future."

Body swap

In chemistry, a single atom can make a huge difference in a molecule. Swap out one carbon atom for a nitrogen atom, and the way the drug

For years, if you asked the people working to create new pharmaceutical drugs what they wished for, at the top of their lists would be a way to easily replace a carbon atom with a nitrogen atom in a molecule.

molecule interacts with its target can dramatically change. It might make the drug easier to get to the brain, for example, or less likely to grab onto the wrong proteins on its way. So when scientists are creating new pharmaceutical drugs, they often want to try swapping out one particular atom.

The trouble is, this is much easier said than done. To build a molecule, you have to go step by step. If you get to the end, but then start testing and think the drug might work better if you changed just one atom, you have to go back to the beginning and re-invent the entire process.

"There's a cost-benefit analysis that comes into play. Is it worth it to start over? Or do you just go with what you have?" explained Tyler Pearson, a postdoctoral researcher who is the first author on one of the studies.

Levin's lab seeks to find new ways to make tiny changes to the skeleton of a molecule without going back to the start line.

In this case, they wanted to find a way to swap a carbon atom for a nitrogen atom—a specific swap that comes up extremely frequently in pharmaceutical chemistry.

But the existing methods to do this have limited success. "You might accidentally delete the wrong carbon in the molecule, and this causes the rest of the molecule to shift," said Jisoo Woo, a graduate student and the first author on the other study. "This can have a huge impact on how well the final molecule works."

The same principle that makes changing one atom potentially very useful, also has its flip side: If the reaction has even one unintended side effect of moving a different atom, the molecule can become useless for its intended purpose.

The lab came up with two different, complementary ways to approach the problem.

Remove the right one

One approach, outlined in a paper in Nature led by graduate student Jisoo Woo, works on molecules that already have a nitrogen atom nearby in the structure. The new method cleaves open the ring of atoms using ozone, and then uses the first nitrogen molecule to "guide" the second in.

The other approach, described in a paper in Science led by Pearson, works on molecules that don't already have a nitrogen atom. It can simply

CHEMWATCH
Bulletin Board
Gossip
NOV. 03, 2023

remove one carbon atom—the right one—and replace it with a nitrogen atom.

Neither method is perfect yet, the scientists said. But they offer a way forward where none previously existed.

Levin said the techniques are helpful because they more closely align with how people think when developing new drugs. "It's a bit like typing on a computer instead of a typewriter," he said. "It's much easier on a computer because it lets you write the way you think, which is not always linear."

The scientists pointed out that both solutions involved a bit of serendipity and invention.

"To me, this is a great example of the creativity that you need in order to make breakthroughs in chemistry," said Levin. "In both we had precipitating events that gave us a glimpse of something unusual, and that gave us a foothold we could work from."

Phys Org, 01 November 2023

https://phys.org

Water can evaporate with just light, no heat, says surprising study

2023-10-31

Evaporation occurs when water molecules near the surface of the liquid absorb enough energy to escape into the air above as a gas – water vapor. Generally, heat is the energy source, and in the case of Earth's water cycle, that heat comes primarily from sunlight.

But in the last few years, different teams of scientists have noticed discrepancies in their experiments concerning water held in hydrogels. Water appeared to be evaporating at much higher rates than should be possible based on the amount of heat it was exposed to, sometimes tripling the theoretical maximum rate.

So for the new study, scientists at MIT set out to investigate what might be happening. After a few basic experiments, they suspected that light itself was causing the excess evaporation. The idea is surprising because water doesn't really absorb light – hence why you can see through it to a decent depth if it's clean.

Contrary to what we all learned in elementary school science class, it turns out that heat may not be necessary to make water evaporate. Scientists at MIT have made the surprising discovery that light alone can evaporate water, and is even more efficient at it than heat. The finding could improve our understanding of natural phenomena or boost desalination systems.

To really check their hypothesis, the scientists placed a hydrogel sample in a container on a scale, exposed it to different wavelengths of light in sequence, and measured the amount of mass it lost over time to evaporation. The equipment was carefully controlled and the lights shielded to prevent any heat being introduced to the system and messing with the results.

And sure enough, the water was evaporating at rates much higher than the thermal limit should allow. The degree of evaporation seemed to vary based on the wavelengths of light, peaking at a wavelength of green light. This dependence on color adds evidence that it's not related to heat.

Next, the researchers repeated the experiment in the dark, using electricity to apply the same amount of heat to the hydrogel as in the light experiment. The rate of water evaporation remained well within the thermal limit, and far below that achieved with light exposure.

The team named the new phenomenon the "photomolecular effect," and hypothesized that photons of light could potentially "cleave off" clusters of water molecules near the liquid's surface. While it's only been observed under carefully controlled lab conditions so far, the researchers say that it could be happening in nature too, such as in clouds or on the surface of the sea, although in those conditions heat is still probably doing most of the work.

The team also suggests that the photomolecular effect could potentially be used to improve the efficiencies of systems like desalination or evaporative cooling. The researchers have already been awarded a grant to study its use in solar-powered desalination, which they estimate could boost efficiency by three or four times. They also have funding to explore whether the effect could be messing up climate models.

The research was published in the journal PNAS.

New Atlas, 31 October 2023

https:// newatlas.com

Carbon's anti-aromatic allotrope is ringing the changes

2023-10-27

In 2019, researchers at Oxford University and IBM Research Europe – Zurich reported the on-surface synthesis of a new allotrope of carbon, C18 – a circular polyyne of 18 carbon atoms linked by alternating single

Chemists in the UK and Switzerland have synthesised the cyclo-carbon molecule C16 and obtained the first proof of its anti-aromatic character. The rings are a new form of the element, and more novel cyclocarbons are on the way.

CHEMWATCH
Bulletin Board
Gossip
NOV. 03, 2023

and triple bonds. The molecule is also doubly aromatic, thanks to its two perpendicular π systems – one in the ring plane and one out of the plane.

Now the groups of Harry Anderson at Oxford and Leo Gross at Zurich have taken the carbon-ring concept a step further by adding a more challenging candidate: a ring of 16 carbon atoms.1 Unlike C18, which follows the Hückel rule for aromaticity with 4n+2 atoms, the C16 molecule is predicted to be doubly anti-aromatic, and thus destabilised by ring effects. Before the successful synthesis, it was not known whether it was possible to make such a molecule and keep it stable for long enough to study its structure and electronic properties.

'The challenge with making C16 was mainly the instability of the potential precursors, which are also anti-aromatic,' Anderson explains. The macrocyclic precursors contain several 'masking' groups that stabilise the molecule. These groups can then be converted to alkyne connections by eliminating the masking substituent. An initial attempt to use only carbon monoxide masking groups analogous to the precursor used for C18 turned out to be too unstable to survive the logistics of the Oxford–Zurich collaboration. The successful protocol involves a macrocycle with four carbon monoxide and two bromine substituents, which is then deposited on a sodium chloride substrate. With a tunnelling microscope, the Zurich group targeted currents of a few picoampere to specific reaction sites, driving up the voltage to eject the bromines at around 1.3 V and then the carbon monoxide groups at around 3 V.

Atomic force microscopy confirmed the ring's polyyne structure of alternating single- and triple-bonds. The researchers were also able to analyse the distribution of electrons in the molecular orbitals both for the neutral C16 molecule and for its negatively charged ion using Kelvin probe force microscopy and scanning tunnelling microscopy. These analyses and calculations confirm that the electronic ground state of the molecule is indeed doubly anti-aromatic.

The molecule therefore opens new opportunities for experimental exploration of these theories. 'Organic chemists love to discuss and debate the concept of aromaticity, and the remarkable synthesis of the doubly anti-aromatic C16 is bound to raise these debates to new heights,' remarks Rik Tykwinski from the University of Alberta, Canada.

The cyclocarbon family may soon grow even larger. Wei Xu's group at Tongji University, China, has three papers currently under review describing the syntheses of cyclocarbons C6, C10, C12, C14 and C20.2,3,4

These cover the entire size range over which these rings are now believed to be sufficiently stable for studies.

With a whole array of new molecules to experiment with, making them react with each other could be the next step. 'The next breakthrough in this field could be the discovery of ways to control the reaction of cyclocarbon molecules with each other to generate extended carbon allotropes,' Anderson says.

Chemistry World, 27 October 2023

https://chemistryworld.com

Why Does Sourdough Have Such a Unique Flavor?

2023-10-28

A staple of lockdown kitchens and bakeries across the world, sourdough is famed for its unique, tangy flavor. New research, presented at the American Chemical Society (ACS) Fall 2023 conference, has identified what makes sourdough taste so good.

The importance of the starter

The wild yeast and microbes found in the starter of a sourdough cause the bread to rise by consuming the carbohydrates in the flour and producing carbon dioxide, which gives the bread its characteristic airy texture. Early sourdough research revealed that over 50 types of lactic acid bacteria and over 20 species of yeast can thrive in sourdough starters.

As the starter uses wild yeast and microbes, starters across the world can vary. San Francisco is particularly famed for its sourdough, with some bakeries using the same starters in their recipes for around 170 years. It has been rumored that the foggy environment of the city plays a role in the taste of the sourdough, with the loaves once thought to contain a unique bacterium dubbed Lactobacillus sanfranciscensis, which was later found across the world.

The essence of sourdough

The taste of sourdough can be influenced by factors including fermentation time, temperature and flour type, as well as the microbes present in the starter.

A research team has identified the compounds responsible for sourdough's unique taste, finding 11 odorants and 10 tastants using a technique called sensomics.

"With sensomics, you can take just a few key compounds and completely recreate the characteristic taste of a food," said Laura Eckrich, who presented the team's research at ACS Fall 2023.

CHEMWATCH
Bulletin Board
Gossip
NOV. 03, 2023

Sensomics uses data from chromatography, mass spectrometry and other techniques to isolate and quantify key molecules from food – in this case, the crumb of the sourdough – enabling researchers to piece together the food's "essence".

The sourdough essence was then confirmed to match the smell and taste of sourdough bread by a human sensory panel.

The key tastants in sourdough include salt, acetic acid and lactic acid. Salt is added to the loaves by the baker, but acetic and lactic acids are the byproducts of fermentation. The researchers then compared the concentrations of these compounds in sourdough with yeast-based breads, made with either rye or wheat flour.

Although yeast-based breads did contain lactic and acetic acids, they were present in much lower concentrations than in sourdough, confirming the importance of the fermentation process for developing flavor in a sourdough loaf.

Of benefit to bakers

This new research could help bakers control the quality and consistency of their loaves and prevent waste from loaves that are too sour. It can also help optimize the amount of salt bakers add to their sourdough.

"This was the first time the key taste and aroma compounds of bread crumb were elucidated using the sensomics approach, and we hope what we learned will help bakers create the best sourdough breads they can," said Eckrich.

Technology Networks, 28 October 2023

https://technologynetworks.com

Common Polymer Found in Cosmetics Could Reduce Drug Effectiveness

2023-10-23

PEG exposure

Polyethylene glycol (PEG) is a synthetic polymer that is used in a wide variety of commercial and industrial products, including food and beverages, textiles, electronic devices, skincare and medical pharmaceuticals. The extensive use of PEG and its derivatives reflects the versatility offered by its unique properties, including the fact it is hydrophilic and biocompatible.

PEG is also used widely across the biopharmaceutical industry in drug coatings and conjugated drugs. The polymer's characteristics can help facilitate the delivery of these complex therapeutics – which are often unstable – and reduce the clearance time from the body.

For many years, PEG was considered an entirely safe molecule with little potential for immunogenicity. This viewpoint is evolving as a growing number of animal and human studies demonstrate that people can develop anti-PEG antibodies, which are capable of recognizing PEG as a "foreign substance" and mounting an immune response. This phenomenon has been reported in individuals that are healthy and have not received PEGylated biotherapeutics.

The impact of anti-PEG antibodies on nano-carrier therapeutics and their side effects are still unclear. At the Max Planck Institute (MPI) for Polymer Research, Professor Katharina Landfester's research group has published a new study analyzing the prevalence of these antibodies in healthy individuals and studying their impact on the cellular uptake of PEGylated nanocapsules.

"For us, PEG is interesting for coating nano-sized drug carriers," says Svenja Morsbach, a group leader in Landfester's department and a corresponding author on the paper published in Nanoscale Horizons.

Anti-PEG antibodies detected in 83% of tested population

In 2019, Morsbach and colleagues screened 500 blood samples from healthy German donors aged between 18 and 70 for anti-PEG antibodies using a technique called the enzyme-linked immunosorbent assay (ELISA). PEG antibodies were already detectable in 83% of the samples examined. The team highlighted that the older the person was, the less anti-PEG antibodies there were in their sample. "We currently assume that this is

Anti-PEG antibodies could hinder the effectiveness of biopharmaceuticals and may require further monitoring.

CHEMWATCH
Bulletin Board
Curiosities
NOV. 03, 2023

due to the increasing use of PEG in various areas of life only recently and the variation of the immune system in age," says Morsbach.

Samples of various anti-PEG antibody concentrations were then incubated with nanocapsules containing PEG, so that the research team could analyze the concentration of anti-PEG antibodies in the protein corona using liquid chromatography-mass spectrometry (LC-MS).

When the nanocapsules were tested in human and murine immune cell lines, Morsbach and colleagues found that the anti-PEG antibodies attach to the nanocapsules, effectively achieving the opposite effect of coating nanocapsules with PEG in the first place: "The nanocarrier becomes visible to the immune system and is removed before it can exert its effect," says Landfester. Ultimately, anti-PEG antibodies could reduce the effectiveness of PEG-containing drugs.

Anti-PEG antibody "supercarriers"

The researchers believe their results warrant further monitoring of anti-PEG antibody prevalence in the bloodstream. Kozma et al made a similar suggestion earlier this year in a paper exploring hypersensitivity reactions in a small number of people receiving PEG-containing mRNA COVID-19 vaccines: "Screening for anti-PEG Ab 'supercarriers' may help predicting reactors and thus preventing these adverse phenomena," they suggest.

Beyond screening, Moscbrach et al say that sourcing alternatives to PEG could be a promising approach: "On the other hand, one strategy could be to find solutions that do not require PEGylation or functionalization with other polymers and create stealth behavior in other ways (e.g., protein precoating)," they write.

Technology Networks, 23 October 2023

https://technologynetworks.com

Scientists ID 'tap out' molecule that tells a loser when to leave a fight

2023-10-31

The scientists from the Japanese research institute Riken had previously found that the habenula, a deep brain structure, houses two neural circuits that play a crucial role in the zebrafish determining if it's won or lost a fight.

Scientists have identified the molecular mechanism that causes a losing zebrafish to withdraw from a battle. While fighting fish in general may not spark a lot of interest, the fact that zebrafish and humans have very similar neurobiology means this discovery could be significant for treating mood disorders.

Now, the puzzle of how this circuit was activated has been solved, with the team finding that, when a fish is in the grips of defeat, the neurotransmitter acetylcholine (ACh) flicks the neural switch that creates a loser-specific potentiation – or the strengthening of a signal along a pre-existing pathway – in the habenula-interpeduncular nucleus.

The process then also involves another neurotransmitter, glutamate, moving from the inside to the surface of the postsynaptic membrane of the neurons in the interpeduncular nucleus – something that did not occur in winners.

Essentially, this molecular activation that induces a very specific neural chain reaction signals to the fish that it's time to cut and run, or swim.

Because zebrafish possess similar neurotransmitter receptors, transporters, and enzymes of synthesis and metabolism as humans and rodents, it's likely this mechanism exists across species with similarly conserved brain makeup. The fish also share about 70 per cent of genes with humans, and 84 per cent of genes that we so far know are implicated in human diseases.

"This circuit from the habenula to the interpeduncular nucleus exists in all vertebrates," said Hitoshi Okamoto, who led the research team on the previous discovery. "So I'm quite confident that it plays a similar role in other animals."

The researchers made their discovery after putting two male zebrafish in a tank to fight. After there was a clear dominant fish, both were euthanized and their sliced brains were intensely studied.

So while, philosophically, perhaps neither fish was a winner at the end of the day, in the neuroscience world the difference was significant.

The researchers believe understanding this 'loser switch' could be hugely relevant in new treatments for mood disorders such as social anxiety and withdrawal.

"There's a lot of research implicating the habenula in severe depression, but the part of the habenula connected to the interpeduncular nucleus hasn't been studied very much," said Okamoto. "I'm sure that this circuit is probably involved in conditions such as social withdrawal."

While preliminary, the findings have interesting future considerations, such as could something that suppressed ACh activity have a positive effect on human drive, persistence and mental resilience?

CHEMWATCH
Bulletin Board
Curiosities
NOV. 03, 2023

In the meantime, the researchers intend to continue working out the roles that these winning and losing circuits play in survival.

"Our ultimate goal is to identify the real roles of these two circuits," said Okamoto. "Our current hypothesis is that the winner circuit makes fish focus on their internal state, whereas the loser circuit causes fish to look to the external world. We're currently performing experiments to test this hypothesis."

The study was published in the journal Current Biology.

New Atlas, 31 October 2023

https://newatlas.com

Testing extends range of US chocolate foods containing lead and cadmium

2023-10-31

Testing by a US consumer group has found widely variable amounts of cadmium and lead in a variety of chocolate products, including chocolate bars, brownie mixes and chocolate chips.

Consumer Reports calls on brands to do more to lower levels of metals in their products

A single serving of around a third of products tested by Consumer Reports scientists contained sufficient either lead or cadmium to exceed the state of California's daily maximum allowable dose level (MADL). The US does not set federal limits for cadmium and lead content in foods, and California's exposure limits are the most stringent set by any state. The EU introduced cadmium limits in chocolate and other foods in 2019. Exposure to heavy metals can damage the central nervous system, causing developmental delay and learning problems posing significant risk to pregnant women and children.

Lead and cadmium tend to accumulate more in cocoa solids than cocoa butter. Hence, products with higher proportions of cocoa solids such darker chocolate tended to contain more of the metals than products with lots of other ingredients.

Consumer Reports investigations have previously suggested that the metals get into cacao in different ways. Cadmium is taken up from the soil, and accumulates in the cacao bean as the plant grows. Meanwhile lead is mostly introduced as the beans dry, gathering contaminated dust and dirt.

The report suggests companies can do more to minimise lead in their products by promoting cleaner practices where drying beans are covered

and soil contact minimised. Cadmium is more challenging to address but options include treating soils or replacing older cacao trees with younger ones, as well as blending beans from different areas to maintain lower average cadmium levels.

Consumer Reports has called on big brands to do more to reduce metal levels in their products. Hershey responded that it is continuing to look for ways to remove more of the metals in its products, while Nestle said it was working with suppliers to monitor and minimise these substances in its foods.

Chemistry World, 31 October 2023

https://chemistryworld.com

"Eat Your Broccoli Sprouts", They Contain Seven Times More Polysulfides Than Mature Vegetables

2023-10-24

Scientists investigated how germination impacts the polysulfide content and composition of broccoli sprouts.

The study revealed that the total polysulfide content of broccoli sprouts was significantly higher than that of mature broccoli.

Remember when your parents used to say, "Eat your greens, they are good for you"? Well, they were really onto something. Several studies have shown that higher intakes of cruciferous vegetables like broccoli, one of the most widely consumed vegetables in the United States, are associated with reduced risks of diseases such as diabetes and cancer, thanks to their organosulfur compounds, such as glucosinolates and isothiocyanates that exhibit a broad spectrum of bioactivities including antioxidant activity. However, few studies have focused on the endogenous content of polysulfide in broccoli sprouts.

A research team led by Assistant Professor Shingo Kasamatsu and Professor Hideshi Ihara of the Graduate School of Science at Osaka Metropolitan University, investigated the amount of polysulfides in broccoli sprouts during the process of their germination and growth. Building upon their previous work, where the research team demonstrated the abundance of polysulfide molecules in cruciferous vegetables.

The team found that total polysulfide content in broccoli sprouts significantly increased during germination and growth, with an approximately 20-fold increase in polysulfides on the fifth day of

Broccoli and cruciferous vegetables are rich in polysulfide molecules, but the sprouts are even more so.

CHEMWATCH
Bulletin Board
Curiosities
NOV. 03, 2023

germination. Furthermore, they discovered a number of unknown polysulfides with indeterminate molecular structures. These findings suggest that the abundance of polysulfides in broccoli sprouts may contribute to their well-known health-promoting properties.

Dr. Kasamatsu stated, "The discovery of the significant increase in polysulfide content during the sprouting process from broccoli seeds was completely by chance and very surprising. This finding suggests that polysulfides may play an important role in the process of plant germination and growth. Further investigation of the pharmacological function of these unknown polysulfides could lead to the development of new preventive and therapeutic approaches and medicines for neurodegenerative diseases, stroke, cancer, inflammation, and other oxidative stress-related diseases."

Technology Networks, 24 October 2023

https://technologynetworks.com

Plastic-eating bacteria turn waste into useful starting materials for other products

2023-11-01

Previously, a team of researchers including Stephen Wallace engineered a strain of E. coli to transform the main component in old PET bottles, terephthalic acid, into something tastier and more valuable: the vanilla flavor compound vanillin. At the same time, other researchers engineered microbes to metabolize terephthalic acid into a variety of small molecules, including short acids.

So, Wallace and a new team from the University of Edinburgh wanted to expand E. coli's biosynthetic pathways to include the metabolism of terephthalic acid into adipic acid, a feedstock for many everyday products that's typically generated from fossil fuels using energy-intensive processes.

The team developed a new E. coli strain that produced enzymes that could transform terephthalic acid into compounds such as muconic acid and adipic acid. Then, to transform the muconic acid into adipic acid, they used a second type of E. coli, which produced hydrogen gas, and a palladium catalyst.

Mountains of used plastic bottles get thrown away every day, but microbes could potentially tackle this problem. Now, researchers report in ACS Central Science that they've developed a plastic-eating E. coli that can efficiently turn polyethylene terephthalate (PET) waste into adipic acid, which is used to make nylon materials, drugs and fragrances.

In experiments, the team found that attaching the engineered microbial cells to alginate hydrogel beads improved their efficiency, and up to 79% of the terephthalic acid was converted into adipic acid.

Using real-world samples of terephthalic acid from a discarded bottle and a coating taken from waste packaging labels, the engineered E. coli system efficiently produced adipic acid. In the future, the researchers say they will look for pathways to biosynthesize additional higher-value products.

New Atlas, 01 November 2023

https://newatlas.com

60-year-old drug can resensitize treatment-resistant brain cancer cells

2023-10-29

Cerebrospinal fluid (CSF) has several important functions. It acts like a cushion to protect the brain and spinal cord and provides nourishment and waste removal services. But, when it comes to brain cancer, a new study has found that this important fluid may be making brain cancers resistant to treatment, reducing their effectiveness.

Researchers from Flinders University in South Australia examined the effect of CSF on the growth of tumor cells in patients with glioblastoma, a common, fast-growing and lethal central nervous system cancer, and, importantly, discovered a potential treatment.

"Glioblastoma kills so many people who are otherwise fit, healthy and young, within months," said Cedric Bardy, one of the study's co-authors. "This is a horrible disease, and the treatments available are just not effective enough despite serious side effects."

The mainstay treatments for glioblastoma are surgical resection, followed by a combination of radiation therapy and the oral chemotherapeutic drug temozolomide. Despite this aggressive treatment, the cancer often returns and proves fatal, indicating that the cancer cells have developed a resistance to treatment.

Taking CSF from 25 patients with glioblastoma receiving both radiation and chemotherapy, the researchers found that cancer cells exposed to CSF were more resistant to ferroptosis, a form of therapy-induced cell death. They identified that nuclear protein 1 (NUPR1) in the CSF was responsible for increasing treatment resistance by hampering ferroptosis.

Researchers have discovered that cerebrospinal fluid, the brain's shock absorber, contributes to treatment resistance in people with brain cancer. But their study also identified a more-than-sixty-year-old antipsychotic medication that can be repurposed to resensitize cancer cells to treatment.

CHEMWATCH
Bulletin Board
Curiosities
NOV. 03, 2023

Importantly, they found that trifluoperazine, a drug that's been marketed as an antipsychotic and anti-anxiety medication since 1959 under the brand name Stelazine, inhibited NUPR1 and resensitized the cancer cells to both therapies. The researchers concluded that adding trifluoperazine to current treatments may improve GBM survival rates.

"This study helps us understand the limitations of the current chemotherapies and provides new hope for repurposing a class of drugs that could be added to the standard of care," Bardy said. "We are working hard now to try this on patients in a clinical trial."

The study was published in the journal Science Advances.

New Atlas, 29 October 2023

https://newatlas.com

Biodegradable Plastics Are Still Damaging to Fish

2023-10-19

Biodegradable plastics may not be the solution to plastic pollution many hoped for, with a University of Otago study showing they are still harmful to fish.

Petroleum-derived microplastics are known to impact marine life, but little is known about the impact of biodegradable alternatives.

The study, published in Science of the Total Environment and funded by a University of Otago Research Grant, is the first to assess the impact petroleum-derived plastic and biodegradable plastic have on wild fish.

Lead author Ashleigh Hawke, who completed a Master of Science in Otago's Department of Marine Science, says petroleum-derived plastic exposure negatively affected the fishes escape performance, routine swimming, and aerobic metabolism.

In contrast, those exposed to bioplastics only had their maximum escape speed negatively affected.

She says the research is significant as it demonstrates that both petroleum-derived plastics and biodegradable plastics can be damaging to marine fish, should they be exposed to them.

"Biodegradable plastics may not be the silver bullet to plastic pollution as we believe them to be.

Biodegradable plastics may not be the solution to plastic pollution many hoped for.

"Although they are not as bad, they can still cause negative effects to those animals that may be exposed to them – in the case of this study, populations would decline as their escape behaviours are impaired."

Co-author Dr Bridie Allan, also of the Department of Marine Science, says more needs to be done at a policy level to protect marine environments.

"The development of traditional plastics has been well established for decades and so there is little variation in the production of them. However, because biodegradable plastics are a relatively new area, there is variation in the way they are manufactured and the materials that are being used.

"This research shows that the raw materials used in these products matters and that the use of them should be more regulated and controlled."

Technology Networks, 19 October 2023

https://technologynetworks.com

Activating a chemical reaction by 'flipping a switch'

2023-10-28

The researchers from Switzerland and the UK collaborated after observing that the reactor used by Thomas Wirth at the University of Cardiff, which had industrial success in radical chemistry, could be applied to Matile's work on anion-π electrocatalysis at the University of Geneva. 'It's much more interesting what we can see before the electron jumps from the electrode into the reaction – we just use the [electric] field directing the electrons that are already there,' says Matile, adding that they are interested in supramolecular interactions not redox chemistry.

The reactor consists of two 5cm metal electrodes, coated in carbon nanotubes. The polarisability and conductivity of the carbon nanotubes are important – they produce a strong dipole that stabilises the ionic transition state of the reaction and amplifies the applied electric field. The plates are only separated by a 250µm thin fluorinated ethylene propylene foil that is printed with a flow channel. 'The solution is always exposed to the field; the field is voltage divided by distance. The distance is small, so it is important to have a soft voltage,' explains Matile. The short distance is also critical in avoiding unwanted electron transfer and the need for electrolytes. The substrate is injected into one side where it flows through the reactor, at which point a voltage is applied – flipping a switch – and a characterisable product is obtained on the other side.

'You can consider every chemical reaction as a movement of charge from one place to another… it's always electrons moving,' says Stefan Matile, whose work with UK chemists has provided backing for a two-decades-old theory that an oriented external electric field can accelerate and direct electrons during a molecular transformation.

CHEMWATCH
Bulletin Board
Curiosities
NOV. 03, 2023

The researchers tested the reactor with an epoxide-opening ether cyclisation. Only once the electric field is applied, does the epoxide open and the negatively charged oxygen leave – activated by the carbon nanotubes. They induce powerful anion–π interactions, stabilising the electron rich transition state and, ultimately, accelerate the reaction rate catalysis.

Sason Shaik, a researcher at the Hebrew University of Jerusalem, Israel, says that the researchers improved on previous work by 'adding new features, which makes the reaction proceed in a continuous flow system and generates quantitative amounts of the products'. Matile's team measured the product conversion as a function of the applied field and found a quasi-linear relationship – the greater the electric field, the more product produced.

Shaik comments that the new research might lead to new materials and mechanistic discoveries. 'The use of carbon nanotubes, which are delocalised and highly polarisable, gives rise to an ingenious method of catalysis based on electric fields,' he adds.

Matile says that now that the proof of principle has been demonstrated, they are already working on expanding the pool of substrates adding that 'it will be very easy to transfer [the system] to industry so it's very promising'.

Chemistry World, 28 October 2023

https://chemistryworld.com

New frequency comb can identify molecules in 20-nanosecond snapshots

2023-10-30

From monitoring concentrations of greenhouse gases to detecting COVID in the breath, laser systems known as frequency combs can identify specific molecules as simple as carbon dioxide and as complex as monoclonal antibodies with unprecedented accuracy and sensitivity. Amazing as they are, however, frequency combs have been limited in how fast they can capture a high-speed process such as hypersonic propulsion or the folding of proteins into their final three-dimensional shapes.

Now, researchers at the National Institute of Standards and Technology (NIST), Toptica Photonics AG and the University of Colorado Boulder have developed a frequency comb system that can detect the presence of

Researchers at the National Institute of Standards and Technology (NIST), Toptica Photonics AG and the University of Colorado Boulder have developed a device that can detect the presence of specific molecules in a sample every 20 nanoseconds, or billionths of a second.

specific molecules in a sample every 20 nanoseconds, or billionths of a second. With this new capability, researchers can potentially use frequency combs to better understand the split-second intermediate steps in fast-moving processes ranging from the workings of hypersonic jet engines to the chemical reactions between enzymes that regulate cell growth. The research team announced its results in a paper published in Nature Photonics.

In their experiment, the researchers used the now-common dual-frequency comb setup, which contains two laser beams that work together to detect the spectrum of colors that a molecule absorbs. Most dual-frequency comb setups involve two femtosecond lasers, which send out a pair of ultrafast pulses in lockstep.

In this new experiment, the researchers used a simpler and cheaper setup known as "electro-optic combs," in which a single continuous beam of light first gets split into two beams. Then, an electronic modulator produces electric fields that alter each light beam, shaping them into the individual "teeth" of a frequency comb. Each tooth is a specific color or frequency of light that can then be absorbed by a molecule of interest.

Whereas conventional frequency combs can have thousands or even millions of teeth, the researchers' electro-optic comb only had 14 in a typical experimental run. However, as a result, each tooth had much higher optical power, and was far apart from others in frequency, resulting in a clear, strong signal that enabled the researchers to detect changes in the absorption of light at the 20-nanosecond time scale.

In their demonstration, the researchers used the instrument to measure supersonic pulses of CO2 emerging from a small nozzle in an air-filled chamber. They measured the CO2 mixing ratio, the proportion of carbon dioxide in the air. The changing concentration of CO2 told researchers about the motion of the pulse. The researchers saw how the CO2 interacted with the air and created oscillations of air pressure in its wake. Such details are often hard to accurately obtain even with the most sophisticated computer simulations.

"In a more complicated system like an aircraft engine we could use this approach to look at a particular species of interest, such as water or fuel or CO2, to observe the chemistry. We can also use this approach to measure things such as pressure, temperature or velocity by looking at changes in the signal," said NIST research chemist David Long. The information from these experiments could provide insights that could lead to design

CHEMWATCH
Bulletin Board
Curiosities
NOV. 03, 2023

improvements in combustion engines, or a better understanding of how greenhouse gases interact with the atmosphere.

A special component in the setup, known as an optical parametric oscillator, was used to shift the comb teeth from the near-infrared to the mid-infrared colors absorbed by CO2. But the optical parametric oscillator can also be tuned to other regions of the mid-infrared so that the combs can detect other molecules that absorb light in those regions.

The paper includes information that other researchers can use to build a similar system in the lab, making this new technique widely available across many research fields and industries.

"What is truly special about this work is that it substantially lowers the barrier to entry for researchers who would like to use frequency combs to study fast processes," said co-author Greg Rieker, a professor at the University of Colorado Boulder and former NIST research associate.

"With this setup, you can generate any comb you want. The tunability, flexibility and speed of this method open the door to lots of different types of measurements," Long said.

This work was supported in part by the Air Force Office of Scientific Research.

Science Daily, 30 October 2023

https://sciencedaily.com

Could Artificial Sweeteners Have a Future in Autoimmunity Treatment?

2023-10-22

Earlier this year, researchers at the Francis Crick Institute conducted a murine study indicating that sucralose, an artificial sweetener commonly found in drinks and food, may have the potential to suppress immune responses, particularly those involving T cells.

While the study was carried out on mice, it raises the possibility that similar effects might be observed in humans, leading to potential therapeutic applications for managing diseases where excessive T-cell activation is problematic, such as autoimmune conditions.

Sucralose, an artificial sweetener commonly found in drinks and food, may have the potential to suppress immune responses.

The impact of sucralose on the immune system in mice

The impact of sucralose on the human body is not fully understood. Recent research has suggested that sucralose can affect human health by influencing the microbiome. In this study, published in Nature, the researchers administered high doses of sucralose to mice at levels corresponding to the acceptable daily intake recommended by European and American food safety authorities.

The study found that mice fed high doses of sucralose showed reduced T-cell activation in response to cancer or infection. This dampening effect was specific to T cells, with no noticeable impact on other types of immune cells. Upon closer examination, the researchers discovered that high-dose sucralose affected intracellular calcium release in response to stimulation, thus impairing T-cell function.

In mice with T cell mediated autoimmune disease, a high-dose sucralose diet helped to mitigate the harmful effects of their overactive T cells. Professor Neil Mabbott, personal chair in immunopathology at the Roslin Institute, University of Edinburgh, said: "the study also showed that the effects of high doses of sucralose on T cells delayed the development [of] the autoimmune disease type-1 diabetes. Further research on how sucralose affects T cell function may identify new methods to treat certain T cell-related autoimmune diseases such as Type 1 diabetes."

This research should not be a cause for concern among individuals seeking to maintain a healthy immune system, as typical or moderately elevated levels of sucralose in the diet are unlikely to expose humans to the high levels used in the study. Dr. Fabio Zani, co-first author and postdoctoral fellow at the Francis Crick Institute, said: "We do not want people to take away the message that sucralose is harmful if consumed in the course of a normal balanced diet, as the doses we used in mice would be very hard to achieve without medical intervention."

The future of sucralose as a possible therapeutic

A research highlight published in response to the Nature study set out to investigate the potential of sucralose to modulate autoimmune diseases. "Despite the experimental nature of data with limited transferability to humans due to differences in immune system function, genetic variability between the species, and high heterogeneity in genetic background and lifestyle in humans… the potential benefit of high-dose sucralose on T-cell proliferation and effector function merits further studies for conditions of uncontrolled T-cell activation in humans," the authors write.

CHEMWATCH
Bulletin Board
Curiosities
NOV. 03, 2023

Dr. Karen Vousden, senior author and principal group leader at the Francis Crick Institute, said: "More research and studies are needed to see whether these effects of sucralose in mice can be reproduced in humans. If these initial findings hold up in people, they could one day offer a way to limit some of the harmful effects of autoimmune conditions."

Technology Networks, 22 October 2023

https://technologynetworks.com

CHEMWATCH

Bulletin Board

Technical Notes

NOV. 03, 2023

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

CHEMICAL EFFECTS

Short-term nitrogen deposition changes chemical composition of litter and soil organic matter in a Moso bamboo forest

First report on chemometric modeling of tilapia fish aquatic toxicity to organic chemicals: Toxicity data gap filling

ENVIRONMENTAL RESEARCH

Trophic transfer and biomagnification potential of environmental contaminants (heavy metals) in aquatic ecosystems

Application of yellow phosphorus slag in resource recovery and environmental remediation: A review

Differences in nonpoint source pollution load losses based on hydrological zone characteristics: a case study of the Shaying River Basin, China

PHARMACEUTICAL/TOXICOLOGY

Copper oxide nanoparticles: An effective suppression tool against bacterial leaf blight of rice and its impacts on plants

OCCUPATIONAL

Exposure estimates of parabens from personal care products compared with biomonitoring data in human hair from Northeast China

Occupational Exposure during Pregnancy and Effects on Newborns: A Nested Case-Control Study

Statistical Post-Processing Method for Evaluating Bioaccumulation in Fish Due to Dietary Exposure in Japan