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ASIA PACIFIC

Alert issued after testing detects PFAS in NSW village water supply

2024-11-12

PFAS has been detected in a NSW Riverina community's water supply but residents have been assured there is no cause for concern.

Riverina Water said there had been a low-level detection of PFAS substances in the Tarcutta's water supply but the water was safe to drink and within all health guidelines.

PFAS, per- and polyfluoroalkyl substances, are a group of over 4000 chemicals, with some of them effective at resisting heat, stains, grease and water.

Riverina Water chief executive Andrew Crakanthorp said as part of its ongoing management of PFAS contamination, the utility company participated in a round of expanded testing funded by NSW Health.

Riverina Water confirmed 15 nanograms per litre (ng/l) of the substance PFOS (perfluorooctane sulfonate) to be in the Tarcutta treated water supply.

"The result is within the current Australian Drinking Water Guidelines limits, but above proposed new guidelines," Mr Crakanthorp said.

The Australian Drinking Water Guidelines are health-based levels for numerous water quality measures, including PFAS substances.

The health guidelines for PFAS substances are based on long-term exposure over a lifetime

Read More

The North West Star, 12-11-24

<https://www.northweststar.com.au/story/8818027/pfas-detected-in-tarcutta-but-water-deemed-safe-to-drink/?src=rss>

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Pakistan limits outdoor activities, market hours to curb air pollution-related illness

2024-11-11

Pakistan's Punjab province banned most outdoor activities and ordered shops, markets and malls in some areas to close early from Monday to curb illnesses caused by intense air pollution.

The province has closed educational institutions and public spaces like parks and zoos until Nov. 17 in places including Lahore, the world's most polluted city in terms of air quality, according to Swiss group IQAir's live ratings.

The districts of Lahore, Multan, Faisalabad and Gujranwala have seen an unprecedented rise in patients with respiratory diseases, eye and throat irritation, and pink eye disease, the Punjab government said in an order issued late on Sunday.

The new restrictions will also remain in force until Nov. 17.

"The spread of conjunctivitis/ pink eye disease due to bacterial or viral infection, smoke, dust or chemical exposure is posing a serious and imminent threat to public health," the Punjab government said.

Read More

Reuters, 11-11-24

<https://www.reuters.com/world/asia-pacific/pakistan-limits-outdoor-activities-market-hours-curb-air-pollution-related-2024-11-11/>

Amendments to the APVMA MRL Standard

2024-11-12

The Australian Pesticides and Veterinary Medicines Authority (APVMA) approves maximum residue limits (MRLs) of agricultural and veterinary chemicals in agricultural produce, particularly produce entering the food chain. The MRLs approved by the APVMA are associated with a regulatory decision to register a product, grant a permit approval, or as an outcome from a review decision and are set out in the Agricultural and Veterinary Chemicals (MRL Standard for Residues of Chemical Products) Instrument 2023. The MRL Standard lists MRLs of substances that may arise from the approved use of agricultural and veterinary chemical products containing those substances on commodities used for human consumption as well as livestock feeds. The MRL Standard also provides the relevant residue

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definitions to which these MRLs apply. There may be situations where the residue definition for monitoring and enforcement is different to the definition used for dietary risk assessment purposes.

MRLs are set at levels which are not likely to be exceeded if the agricultural or veterinary chemicals are used in accordance with approved label instructions. In considering MRLs and variation to MRLs, the APVMA takes into account studies on chemistry, metabolism, analytical methodology, residues, toxicology, good agricultural practice and dietary exposure. In approving MRLs, the APVMA is satisfied, from dietary exposure assessment, that the levels set are not an undue hazard to human health.

The APVMA has amended the MRL Standard and the changes will have affect the day after the instrument is registered.

Read More

APVMA, 12-11-24

<https://www.apvma.gov.au/news-and-publications/publications/gazette/gazette-23-12-november-24>

Agricultural chemical products and approved labels

2024-11-12

Pursuant to the Agricultural and Veterinary Chemicals Code scheduled to the *Agricultural and Veterinary Chemicals Code Act 1994*, the APVMA hereby gives notice that it has registered or varied the relevant particulars or conditions of the registration in respect of the following products and has approved the label or varied the relevant particulars or conditions of the approval in respect of the containers for the chemical product, with effect from the dates shown.

Table 1: Agricultural products based on new active constituents

Application no.	132224
Product name	Trefinti Turf Nematicide
Active constituent	450 g/L cyclobutrifluram
Applicant name	Syngenta Australia Pty Ltd
Applicant ACN	002 933 717
Date of registration	22 October 2024
Product registration no.	91438
Label approval no.	91438/132224

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Application no.	132224
Description of the application and its purpose, including the intended use of the chemical product	Registration of a 450 g/L cyclobutrifluram suspension concentrate for control of pathogenic nematodes in turf

Table 2: Agricultural products based on existing active constituents

Application no.	144775
Product name	Agro-Essence Carfentrazone 240 EC Herbicide
Active constituent	240 g/L carfentrazone - ethyl
Applicant name	Agro-Alliance (Australia) Pty Ltd
Applicant ACN	130 864 603
Date of registration	21 October 2024
Product registration no.	95135
Label approval no.	95135/144775
Description of the application and its purpose, including the intended use of the chemical product	Registration of a carfentrazone-ethyl 240 g/L emulsifiable concentrate product for the improvement in the control of marshmallow and certain other broadleaf weeds

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APVMA, 12-11-24

<https://www.apvma.gov.au/news-and-publications/publications/gazette/gazette-23-12-november-24>

AMERICA

Kentucky utilities moving to replace lead drinking water lines, notices coming soon

2024-11-12

Kentuckians will soon get notices from their water utilities as part of a national plan to eliminate water lines made of the neurotoxin lead — along with a chance to replace suspect pipes at no cost to themselves.

The notices will tell property owners if they have lead or galvanized water lines on their property and if there are utility-owned lead lines going to

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the property that need to be replaced. Property owners will also get a notice if the material in a water line is not known.

Utilities are mailing the notices as part of new regulations finalized last month by the U.S. Environmental Protection Agency that seek to remove lead water lines across the country over the next 10 years. But environmental protection officials and water utilities first need to know where lead water lines are.

Lead is a harmful neurotoxin, especially to children, that can leach into drinking water through aging lead water lines that were primarily installed from the late 1800s to the 1940s. No amount of lead is considered safe in a child's blood. Congress banned the installation of lead water lines in 1986.

The federal Bipartisan Infrastructure law is providing \$15 billion to pay for new lines. Local utilities, including in Louisville, have developed programs to cover the costs of replacing lead and galvanized pipes for property owners.

An EPA report from September 2023 projected fewer than 1% of service lines, or roughly 40,000, in Kentucky contain lead. Service lines connect a utility's water main to a building. The estimate is based on the number of lead lines found in other states that have conducted full inventories. It's unknown what 265,000 service lines in Kentucky are made of, according to the September 2023 report. The status of more than 500,000 lines had not yet been reported by water utilities.

Joe Burns, the director of operations and management for the utility group Kentucky Rural Water Association, told the Lantern decades-old records, especially for Kentucky's older cities, make it hard to determine the composition of some water lines.

Read More

WKMS, 12-11-24

<https://www.wkms.org/health/2024-11-12/kentucky-utilities-moving-to-replace-lead-drinking-water-lines-notices-coming-soon>

Brazil "REACH" Now Law

2024-11-15

Law 15.022, published today (15/Nov/2024), is Brazil's REACH-inspired framework chemical management law.

What does it all mean

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Under the new law, Brazil will require manufacturers and importers of non-exempt chemicals produced or imported in quantities over 1 ton per year to register them in a brand-new registration system so that the country can then prioritize chemicals of concern, conduct risk assessments, and ultimately impose risk management measures.

The new law still needs some regulatory infrastructure to be fully operational:

New Committees

The government will create the Technical Committee for the Evaluation of Chemical Substances and the Deliberative Committee for Chemical Substances, new entities that carry out different roles under the new system.

Implementing Regulation

Government has 180 days from now to issue an important implementing regulation that fleshes out details left open in the law. Officials recently announced that a Working Group will be formed at the next meeting of Brazil's exemplary interdisciplinary, multistakeholder chemical group, CONASQ, to develop that draft. It's worth noting that CONASQ was the group that developed the original text of the new law.

Read More

Ambiente Legal, 15-11-24

<https://www.linkedin.com/pulse/brazil-reach-now-law-melissa-owen-419jc/>

From tires to nail polish, we're studying a new round of consumer products with toxic chemicals

2024-11-01

Draft report open for formal public comment

In May 2024, our Safer Products for Washington team identified a new set of toxic chemicals in everyday consumer products. That's important because it gives us an opportunity to reduce exposure to toxic chemicals and prevent their release into the environment. We want your feedback on the products we've identified as significant sources of these toxic chemicals.

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We prioritized products where we saw potential opportunities to reduce or prevent the use of toxic chemicals and to reduce disproportionate exposures. The new priority products and priority chemicals we identify in our report include:

- Artificial turf with PFAS and 6PPD.
- Cleaning and household care products with formaldehyde releasers and ortho-phthalates.
- Cosmetics with cVMS (cyclic volatile methylsiloxanes).
- Insulation with organohalogen flame retardants (OFRs).
- Jewelry with lead and cadmium.
- Motor vehicle tires with 6PPD.
- Nail products with BTEX (benzene, ethyl benzene, toluene, and xylene substances).
- Plastic packaging with organobromine or organochlorine substances.
- Paints with PFAS.
- Sealants, caulks, and adhesives with ortho-phthalates.
- Toilet and bathroom deodorizers with organobromine or organochlorine substances.

We're continuing the work we started in 2022 on PFAS in:

- Firefighting personal protective equipment
- Cookware
- Hard surface sealers
- Floor waxes and polishes

Read More

Department of Ecology State of Washington, 01-11-24

<https://ecology.wa.gov/blog/november-2024/from-tires-to-nail-polish-we-re-studying-a-new-round-of-consumer-products-with-toxic-chemicals>

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EUROPE

EU adopts rules to better measure the environment's contribution to the economy

2024-11-05

Today, the Council formally adopted the amended regulation on European environmental economic accounts, the EU's common statistical system which brings together economic and environmental information.

The new rules extend the scope of the European environmental economic accounts, introducing forest accounts, ecosystem accounts, and environmental subsidies accounts.

The amended regulation aims to provide better information for the European Green Deal, in order to support monitoring and evaluation of the EU's progress in meeting its environmental objectives.

New account modules

The current regulation on European environmental economic accounts sets out a common framework for collecting, compiling, transmitting and evaluating European environmental economic accounts. The regulation contains six modules, including air emissions accounts and environmentally related taxes.

Relevant and detailed data from member states is key to keeping the EU on track to meet the European Green Deal objectives. Therefore, the new regulation introduces three new environmental account modules for more comprehensive monitoring:

- ecosystem accounts, which provide data on the extent and condition of ecosystems and on the services delivered to society and the economy by ecosystem assets
- forest accounts, which specifically measure forest areas and the share available for timber extraction, and trace changes over time
- environmental subsidies, which identify and quantify resources that support the Green Deal through economic activities and products, protecting the environment and safeguarding natural resources

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[Read More](#)

European Council, 05-11-24

<https://www.consilium.europa.eu/en/press/press-releases/2024/11/05/eu-adopts-rules-to-better-measure-the-environment-s-contribution-to-the-economy/>

Hydrogen: Council calls for swift implementation of EU law and coordinated action for networks, industry and investors

2024-11-05

The Council has today adopted conclusions on the special report of the Court of Auditors on the EU's industrial policy on renewable hydrogen. The conclusions welcome the report, call for swift implementation of the EU's regulatory framework, encourage development of an interconnected transportation network and call on the Commission to take measures that support both the competitiveness of EU industry and security of investment.

Milestones towards clean hydrogen

The Council conclusions adopted today follow an in-depth analysis of the Special Report on the EU's industrial policy on renewable hydrogen. The report evaluates the Commission's effectiveness in creating the right conditions for the emerging renewable and low-carbon hydrogen markets. The report assesses EU's policy communications and legislative proposals (i.e. the Hydrogen Strategy of the EU, the REPowerEU Plan, the Renewable Energy Directive (RED III), the ReFuelEU Aviation Regulation, the FuelEU Maritime Regulation, the Net-Zero Industry Act and the Gas Package), as well as funding programmes aimed at developing the hydrogen value chain.

The conclusions note that the Council and the Parliament have already adopted important legislative proposals (i.e. the Gas and Hydrogen Package and the Net-Zero Industry Act), which will help the EU reach its energy and climate objectives and strengthen the competitiveness of the EU's strategic net-zero industry. However, for these legislative acts to contribute to the emergence of the European hydrogen ecosystem, it is important that the existing legal framework is implemented swiftly.

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The conclusions attach particular importance to Member States' national energy and climate plans when considering EU-level targets for the production and import of hydrogen.

According to the conclusions adopted today, the interconnection of European networks will be of great importance for facilitating cross-border hydrogen transportation and storage, and for linking producers and buyers.

[Read More](#)

European Council, 05-11-24

<https://www.consilium.europa.eu/en/press/press-releases/2024/11/05/hydrogen-council-calls-for-swift-implementation-of-eu-law-and-coordinated-action-for-networks-industry-and-investors/>

EEA Trends and Projections: EU greenhouse gas emissions see significant drop in 2023

2024-1-31

In 2023, EU total net greenhouse gas emissions decreased to 37% below 1990 levels according to preliminary figures in the EEA Trends and Projections report. After two years of slower progress against the backdrop of recovery from the COVID crisis and impact of the energy crisis, the EU is resuming its strong downward trajectory in emissions, moving towards climate neutrality. At the same time, sustained progress will be needed towards 2030 and beyond, the report says.

The EU Climate Law sets ambitious targets for greenhouse gas emission reductions - a net 55% reduction below 1990 levels by 2030 and climate neutrality by 2050, to deliver European commitments under the international Paris Agreement. This target includes net removals from the so-called land use, land use change and forestry (LULUCF) sector as well as emissions from international aviation and maritime transport activities regulated under EU law. The European Commission has also recommended a 90% net reduction target for 2040.

Based on reported existing climate measures alone, Member State projections forecast a reduction in net emissions by 2030 to a level 43% below 1990 levels. However, 22 Member States have submitted additional projections that include planned but not yet launched measures. Together, these would reduce net emissions in the EU by 49% below 1990 levels in 2030, in the target scope of the EU Climate Law. Updates to national

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energy and climate plans — where several Member States have yet to submit their revised plans — offer an opportunity to implement additional measures to bridge the gap towards the target. An initial European Commission estimate of the plans submitted so far confirm an increased collective ambition level and a reduction of the gap.

[Read More](#)

European Environment Agency, 31-10-24

<https://www.eea.europa.eu/en/newsroom/news/eea-trends-and-projections>

Workers at laboratories are being put at risk of infection because of missing information on specimen request forms

2024-11-12

If specimen request forms do not provide sufficient clinical information, then laboratory staff cannot identify the appropriate safety measures they need to apply to control exposure and possible infection.

For example, specimens considered likely to contain Hazard Group 3 pathogens requiring propagation or culture must be processed within a containment level 3 laboratory.

HSE investigations have confirmed several occasions when workers have been exposed to pathogens capable of causing severe disease.

Action required

Duty holders should ensure that:

- specimen request forms contain all relevant clinical information
- laboratory staff act on clinical information provided
- record-keeping and IT systems are fit for purpose

[Read More](#)

UK HSE, 12-11-24

<https://www.hse.gov.uk/safetybulletins/risk-exposure-lab-staff-biological-agents.htm>

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REACH Update

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ECHA to investigate new test method potentially replacing toxicity testing with fish

2024-11-13

The Agency has contracted the Fraunhofer Institute to explore one potential alternative method to current aquatic toxicity testing of chemicals involving the use of fish.

Helsinki, 13 November 2024 – The project examines whether the Fish Embryo Toxicity (FET) test, one of the most popular alternatives to acute toxicity testing, could be considered as a valid alternative to chronic fish toxicity testing when enhanced with transcriptomics measurements.

In ecotoxicological assessment, fish are used to evaluate short and long-term toxicity of chemicals in the aquatic environment. In addition, fish are important models for evaluating modes of toxicological action such as endocrine-disrupting effects in the environment.

To learn more about the framework contract, listen to our interview with Sylvia Escher from the Fraunhofer Institute and Tomasz Sobanski from ECHA's Alternative Methods Team. They discuss priorities and upcoming research to advance non-animal testing methods that ensure chemical safety and meet regulatory requirements through our work to enhance science, knowledge and collaboration.

[Read More](#)

ECHA, 13-11-24

<https://echa.europa.eu/-/echa-to-investigate-new-test-method-potentially-replacing-toxicity-testing-with-fish>

Consultations launched for applications for authorisation

2024-11-15

We have launched consultations on 10 applications for authorisation covering 9 uses of Chromium trioxide (EC 215-607-8, CAS 1333-82-0) and 1 use of Chromic acid (EC 231-801-5, CAS 7738-94-5). These are used for functional and decorative chrome plating of various components, electroplating, etching and surface treatment.

You can find more information about the uses that are applied for, including the description of the function of the substance, exposure

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scenarios, possible alternatives identified by the applicants, together with socio-economic information, on our website.

Have your say using a web form until **8 January 2025**.

Read More

ECHA, 15-11-24

<https://echa.europa.eu/applications-for-authorisation-consultation>

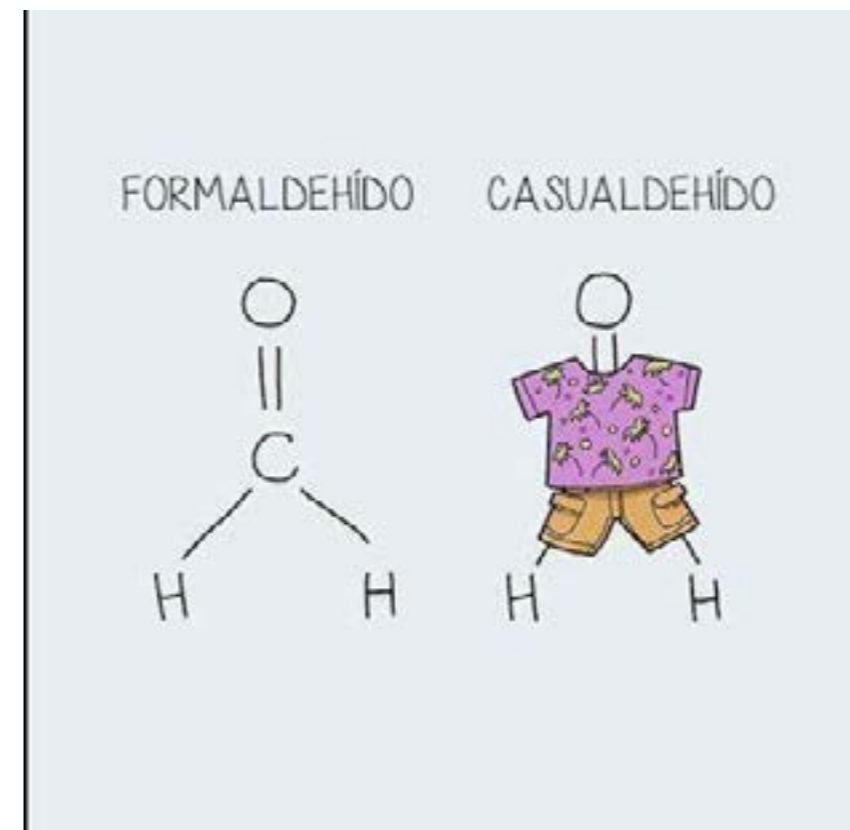
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Janet's Corner

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Formaldehyde

2024-11-22



<https://i.pinimg.com/564x/b7/55/2b/b7552bc7e8ebde16a3e4b71d3aa9d131.jpg>

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Hazard Alert

NOV. 22, 2024

Propylene Glycol

2024-11-22

USES [2,3]

Forty-five percent of propylene glycol produced is used as chemical feedstock for the production of unsaturated polyester resins. In this regard, propylene glycol reacts with a mixture of unsaturated maleic anhydride and isophthalic acid to give a copolymer. This partially unsaturated polymer undergoes further cross-linking to yield thermoset plastics. Related to this application, propylene glycol reacts with propylene oxide to give oligomers and polymers that are used to produce polyurethanes. Propylene glycol is used as a humectant (E1520), solvent, and preservative in food and for tobacco products, as well as being the major ingredient in the liquid used in electronic cigarettes (along with vegetable glycerine and, more rarely, PEG 400). It is also used in pharmaceutical and personal care products. Propylene glycol is a solvent in many pharmaceuticals, including oral, injectable and topical formulations, such as for diazepam and lorazepam that are insoluble in water, use propylene glycol as a solvent in their clinical, injectable forms. Like ethylene glycol, propylene glycol is able to lower the melting point of water, and so it is used as aircraft de-icing fluid. It is similarly used as automotive antifreeze. Furthermore, propylene glycol is a minor ingredient in the oil dispersant Corexit, used in great quantities during the Deepwater Horizon oil spill.

EXPOSURE SOURCES & ROUTES OF EXPOSURE [3]

Exposure Sources

Exposure to propylene glycol can occur by:

- eating food products;
- using cosmetics;
- taking medicine that contains it;
- If you work in an industry that uses propylene glycol or products containing propylene glycol, you could be exposed by breathing or touching these substances.

Routes of Exposure

The major routes of exposure to propylene glycol are:

- inhalation,

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- ingestion,
- skin and/or eye contact

HEALTH EFFECTS [4]

Acute Health Effects

The following health effects may be experienced when exposed to propylene glycol:

- May cause slight transient injury of the eye.
- May be absorbed through damaged or abraded skin in harmful amounts. Allergic reactions have been reported.
- A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts. Prolonged contact is essentially non-irritating to skin. Repeated exposures may cause problems.
- Negative results have consistently been obtained in guinea pigs studies for sensitisation. Propylene glycol is not considered an occupational skin sensitiser.
- When ingested it may cause gastrointestinal irritation with nausea, vomiting and diarrhoea.
- It may cause hemoglobinuric nephrosis
- It may cause changes in surface EEG.
- Inhalation of a mist of propylene glycol may cause respiratory tract irritation.
- Material has a low vapour pressure at room temperature, so exposure to vapour is not likely.
- Chronic exposure to large doses may cause central nervous system depression.
- Chronic ingestion may cause lactic acidosis and possible seizures.
- As exposure to propylene glycol has no adverse effects on the mother, it should have no effect on the foetus.
- Birth defects are unlikely.
- In animal studies, propylene glycol has been shown not to interfere with reproduction.
- The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the EPA have not classified propylene glycol for carcinogenicity.
- Animal studies have not shown this chemical to be a carcinogen.

Propylene glycol, also called 1,2-propanediol or propane-1,2-diol, is an organic compound (a diol or double alcohol) with formula C₃H₈O₂ or HO-CH₂-CHOH-CH₃. The compound is sometimes called α-propylene glycol to distinguish it from the isomer propane-1,3-diol HO-(CH₂)₃-OH, also called β-propylene glycol. [1] Propylene glycol is a clear, colourless, slightly syrupy liquid at room temperature. It may exist in air in the vapour form, although propylene glycol must be heated or briskly shaken to produce a vapour. Propylene glycol is practically odourless and tasteless. [1,2]

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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. Get medical attention.
- **Skin Contact:** In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.
- **Serious Skin Contact:** Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.
- **Inhalation:** If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
- **Ingestion:** Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Workplace Controls & Practices [4]

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the workstation location.

Personal Protective Equipment [5]

The following personal protective equipment is recommended when handling propylene glycol:

- Splash goggles;
- Lab coat;
- Vapour respirator (be sure to use an approved/certified respirator or equivalent);
- Gloves

Personal Protection in Case of a Large Spill:

- Splash goggles;

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

REGULATION

United States

FDA: The U.S Food & Drug Administration has classified propylene glycol as "generally recognised as safe," which means that it is acceptable for use in flavourings, drugs, and cosmetics, and as a direct food additive.

NIOSH: The National Institute for Occupational Safety & Health has established a time weighted average concentration for propylene glycol of 100 ppm (360 mg/m³).

OSHA: The U.S Occupational Safety & Health Administration has not established a permissible exposure limit for propylene glycol.

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6. <http://www.safeworkaustralia.gov.au/sites/swa/search/results?k=propylene+glycol>

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Gossip

NOV. 22, 2024

The Chocolate Cure: Cocoa Flavanols Protect Against Stress and High-Fat Diets

2024-11-18

Consuming a cocoa drink rich in flavanols can mitigate the negative effects of high-fat foods on the vascular system during stress.

Flavanol-Rich Cocoa and Cardiovascular Protection

New research reveals that a flavanol-rich cocoa drink can help protect the body's vascular system from the effects of stress, even after consuming high-fat foods.

The food choices we make during stressful times can significantly impact cardiovascular health. A study from the University of Birmingham previously showed that high-fat foods can impair vascular function and reduce oxygen delivery to the brain. However, flavanols—natural compounds abundant in cocoa and green tea—can support vascular health during periods of everyday stress.

Combating Stress With Cocoa

Building on these findings, the same research team has now demonstrated that drinking high-flavanol cocoa alongside a fatty meal can mitigate some of the harmful effects of fatty foods and stress on the vascular system.

The research was published today (November 18th) in the journal Food and Function.

Dr. Catarina Rendeiro, Assistant Professor in Nutritional Sciences at the University of Birmingham, and leading author said: "We know that when people are stressed, they tend to gravitate towards high-fat foods. We have previously shown that fatty food can impair the body's vascular recovery from stress. In this study, we wanted to see if adding a high-flavanol food to the fatty meal would alleviate the negative impact of stress in the body."

Understanding Flavanols and Their Health Benefits

Rosalind Baynham, first author on the paper, explained: "Flavanols are a type of compound that occur in different fruits, vegetables, tea, and nuts including berries and unprocessed cocoa. Flavanols are known to have health benefits, particularly for regulating blood pressure and protecting cardiovascular health.

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"We took a group of young healthy adults and gave them two butter croissants with 10 g salted butter, 1.5 slices of cheddar cheese, and 250 ml whole milk as breakfast, and either a high-flavanol cocoa or a low-flavanol cocoa drink. Following a rest period, we asked the participants to complete a mental maths test which increased in speed for eight minutes, alerting them when they got an answer wrong. During the 8-minute rest period and 8-minute mental maths test, we measured forearm blood flow, cardiovascular activity, and prefrontal cortex (PFC) tissue oxygenation. We also measured vascular function using Brachial Flow-mediated dilatation (FMD), which is a prognostic measure for future risk of cardiovascular disease. This stress task-induced significant increases in heart rate and blood pressure, similar to the stress you may encounter in daily life."

The cocoa beverages were prepared by dissolving 12 g cocoa powder into 250 ml of whole milk. The low-flavanol powder was an alkalized cocoa powder that was processed to reduce total flavanols to 5.6 mg per serving; and the high-flavanol cocoa powder was a non-alkalized powder, delivering 695.0 mg total flavanols per serving. Alkalization is a process typically used in chocolate making to enhance flavor, but unfortunately it reduces the amount of flavanols.

Key Findings: Flavanols and Vascular Protection

The team confirmed that consuming fatty foods with the low-flavanol drink when mentally stressed reduced vascular function (by 1.29% FMD) and lasted up to 90 minutes after the stressful event was over.

The findings also showed that the cocoa drink high in flavanols was effective at preventing the decline in vascular function following stress and fat consumption. Brachial flow-mediated dilatation was significantly higher following high-flavanol cocoa compared to low-flavanol cocoa 30 and 90 minutes after the stressful period.

The team had also found in their previous work, that eating high-fat foods attenuated cerebral oxygenation in the pre-frontal cortex, during stress. However, cocoa flavanols did not improve cerebral oxygenation or impact mood.

Practical Applications and Flavanol Intake Recommendations

Dr. Catarina Rendeiro, Assistant Professor in Nutritional Sciences at the University of Birmingham, added: "This research shows that drinking or eating a food high in flavanols can be used as a strategy to mitigate some of the impact of poorer food choices on the vascular system. This can help

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us make more informed decisions about what we eat and drink during stressful periods.”

In the supermarket look for a minimally processed cocoa powder, and if cocoa isn't quite your beverage of choice, there are other ways you can get a higher dose of flavanols, such as green tea, black tea, and berries. Recent published guidelines for flavanol intake recommend between 400 to 600 mg/day, which can be achieved for example, by consuming two cups of black or green tea, or a combination of berries, apples, and high-quality cocoa.

Stress, Modern Life, and Small Lifestyle Changes

Jet Veldhuijzen van Zanten, Professor of Biological Psychology at the University of Birmingham, and author of this paper added: “Modern life is stressful and the impact of stress on our health and the economy has been well documented, so any changes we can make to protect ourselves from some of the symptoms of stress is positive. For those who tend to reach for a treat when stressed or depend on convenient food because they work high-pressure jobs or are time-poor, incorporating some of these small changes could make a real difference.”

Sci Tech Daily, 18 November 2024

<https://scitechdaily.com>

Durable supramolecular plastic is fully ocean-degradable and doesn't generate microplastics

2024-11-21

Researchers led by Takuzo Aida at the RIKEN Center for Emergent Matter Science (CEMS) have developed a new durable plastic that won't pollute our oceans. The new material is as strong as conventional plastics and biodegradable, but what makes it special is that it breaks down in seawater. The new plastic is therefore expected to help reduce harmful microplastic pollution that accumulates in oceans and soil and eventually enters the food chain.

The experimental findings are published Nov 22 in Science.

Scientists have been trying to develop safe and sustainable materials that can replace traditional plastics, which are non-sustainable and harm the environment. While some recyclable and biodegradable plastics exist, one big problem remains. Current biodegradable plastics like PLA often find their way into the ocean where they cannot be degraded because they

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are water insoluble. As a result, microplastics—plastic bits smaller than 5 mm—are harming aquatic life and finding their way into the food chain, including our own bodies.

In their new study, Aida and his team focused on solving this problem with supramolecular plastics—polymers with structures held together by reversible interactions. The new plastics were made by combining two ionic monomers that form cross-linked salt bridges, which provide strength and flexibility.

In the initial tests, one of the monomers was a common food additive called sodium hexametaphosphate and the other was any of several guanidinium ion-based monomers. Both monomers can be metabolized by bacteria, ensuring biodegradability once the plastic is dissolved into its components.

“While the reversible nature of the bonds in supramolecular plastics has been thought to make them weak and unstable,” says Aida, “our new materials are just the opposite.”

In the new material, the salt bridge structure is irreversible unless exposed to electrolytes like those found in seawater. The key discovery was how to create these selectively irreversible cross-links.

As with oil with water, after mixing the two monomers together in water, the researchers observed two separate liquids. One was thick and viscous and contained the important structural cross-linked salt bridges, while the other was watery and contained salt ions. For example, when sodium hexametaphosphate and alkyl diguanidinium sulfate were used, sodium sulfate salt was expelled into the watery layer. The final plastic, alkyl SP2, was made by drying what remained in the thick viscous liquid layer.

The “desalting” turned out to be the critical step; without it, the resulting dried material was a brittle crystal, unfit for use. Resalting the plastic by placing it in salt water caused the interactions to reverse and the plastic's structure to be destabilized in a matter of hours. Thus, having created a strong and durable plastic that can still be dissolved under certain conditions, the researchers next tested the plastic's quality.

The new plastics are non-toxic and non-flammable—meaning no CO₂ emissions—and can be reshaped at temperatures above 120°C like other thermoplastics. By testing different types of guanidinium sulfates, the team was able to generate plastics that had varying hardnesses and tensile strengths, all comparable or better than conventional plastics. This means

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that the new type of plastic can be customized for need; hard scratch-resistant plastics, rubber silicone-like plastics, strong weight-bearing plastics, or low tensile flexible plastics are all possible.

The researchers also created ocean-degradable plastics using polysaccharides that form cross-linked salt bridges with guanidinium monomers. Plastics like these can be used in 3D printing as well as medical or health-related applications.

Lastly, the researchers investigated the new plastic's recyclability and biodegradability. After dissolving the initial new plastic in salt water, they were able to recover 91% of the hexametaphosphate and 82% of the guanidinium as powders, indicating that recycling is easy and efficient. In soil, sheets of the new plastic degraded completely over the course of 10 days, supplying the soil with phosphorous and nitrogen similar to a fertilizer.

"With this new material, we have created a new family of plastics that are strong, stable, recyclable, can serve multiple functions, and importantly, do not generate microplastics," says Aida.

Phys Org, 21 November 2024

<https://phys.org>

Chemists create world's thinnest 'spaghetti'

2024-11-21

The world's thinnest spaghetti, about 200 times thinner than a human hair, has been created by a UCL-led research team.

The spaghetti is not intended to be a new food but was created because of the wide-ranging uses that extremely thin strands of material, called nanofibers, have in medicine and industry.

Nanofibers made of starch -- produced by most green plants to store excess glucose -- are especially promising and could be used in bandages to aid wound healing (as the nanofiber mats are highly porous, allowing water and moisture in but keeping bacteria out), as scaffolding for bone regeneration and for drug delivery. However, they rely on starch being extracted from plant cells and purified, a process requiring much energy and water.

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A more environmentally friendly method, the researchers say, is to create nanofibers directly from a starch-rich ingredient like flour, which is the basis for pasta.

In a new paper in *Nanoscale Advances*, the team describe making spaghetti just 372 nanometres (billionths of a metre) across using a technique called electrospinning, in which threads of flour and liquid are pulled through the tip of a needle by an electric charge. The work was performed by Beatrice Britton, who carried out the study as part of her master's degree in chemistry at UCL.

Co-author Dr Adam Clancy (UCL Chemistry) said: "To make spaghetti, you push a mixture of water and flour through metal holes. In our study, we did the same except we pulled our flour mixture through with an electrical charge. It's literally spaghetti but much smaller."

In their paper, the researchers describe the next thinnest known pasta, called *su filindeu* ("threads of God"), made by hand by a pasta maker in the town of Nuoro, Sardinia. This *pasta lunga* ("long pasta") is estimated at about 400 microns wide -- 1,000 times thicker than the new electrospun creation, which, at 372 nanometres, is narrower than some wavelengths of light.

The novel "nanopasta" formed a mat of nanofibers about 2 cm across, and so is visible, but each individual strand is too narrow to be clearly captured by any form of visible light camera or microscope, so their widths were measured with a scanning electron microscope.

Co-author Professor Gareth Williams (UCL School of Pharmacy) said: "Nanofibers, such as those made of starch, show potential for use in wound dressings as they are very porous. In addition, nanofibers are being explored for use as a scaffold to regrow tissue, as they mimic the extra-cellular matrix -- a network of proteins and other molecules that cells build to support themselves."

Dr Clancy said: "Starch is a promising material to use as it is abundant and renewable -- it is the second largest source of biomass on Earth, behind cellulose -- and it is biodegradable, meaning it can be broken down in the body.

"But purifying starch requires lots of processing. We've shown that a simpler way to make nanofibers using flour is possible. The next step would be to investigate the properties of this product. We would want to

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know, for instance, how quickly it disintegrates, how it interacts with cells, and if you could produce it at scale.”

Professor Williams added: “I don’t think it’s useful as pasta, sadly, as it would overcook in less than a second, before you could take it out of the pan.”

In electrospinning, the needle in which the mixture is contained and the metal plate upon which the mixture is deposited form two ends of a battery. Applying an electrical charge makes the mixture complete the circuit by streaming out of the needle on to the metal plate.

Electrospinning using a starch-rich ingredient such as white flour is more challenging than using pure starch, as the impurities -- the protein and cellulose -- make the mixture more viscous and unable to form fibres.

The researchers used flour and formic acid rather than water, as the formic acid breaks up the giant stacks of spirals (or helices) that make up starch. This is because the layers of helices stuck together are too big to be the building blocks of nanofibers. (Cooking has the same effect on the starch as the formic acid -- it breaks up the layers of helices, making the pasta digestible.)

The formic acid then evaporates as the noodle flies through the air to the metal plate.

The researchers also had to carefully warm up the mixture for several hours before slowly cooling it back down to make sure it was the right consistency.

Science Daily, 21 November 2024

<https://sciencedaily.com>

Inexpensive catalyst recycles methane emissions at room temperature

2024-11-21

Natural gas is a fossil fuel that is widely used in the U.S. for heating, cooking, and electricity generation, and it is also used as a chemical feedstock for the manufacture of plastics and other products. But because it consists primarily of the greenhouse gas methane, natural gas is one of the leading sources of methane emissions.

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To recycle methane in the atmosphere, researchers worldwide are studying catalysts that can convert methane into useable fuels and other products. Recently, a research collaboration led by scientists at the U.S. Department of Energy’s (DOE) Brookhaven National Laboratory developed an inexpensive catalyst that performs well and—critically—works at, or near, room temperature, which is key to developing real-life, widespread methane recycling applications.

The work is featured on the cover of the Oct. 15, 2024, edition of the journal ACS Nano.

“Researchers have been continually searching for a catalyst that can achieve methane conversion at moderate temperatures,” said Brookhaven chemist Arephin Islam, the paper’s lead author. “Our catalyst does not require temperatures well above 500 K (about 440°F), as many others do. It is also efficient and uses common, low-cost materials, making it potentially scalable to commercial applications.”

The catalyst consists of magnesium oxide nanoparticles—each just about half a billionth of a meter in diameter—embedded within a very thin layer of copper oxide, which, in turn, sits upon a layer of copper. Although bulk magnesium oxide is not a good methane conversion catalyst on its own, researchers have learned that it is activated by the addition of certain metals or metal oxides.

This was one factor that led to this investigation, but the group was also guided by a theoretical study conducted by Brookhaven chemists Ping Liu and Erwei Huang, which was published in May of this year in The Journal of Physical Chemistry C. That work determined that integrating nanostructured magnesium oxide with copper oxide could be a successful catalytic approach for methane conversion at mild temperatures.

“It was worth investigating how magnesium oxide in nanoparticle form could be more reactive toward methane, particularly when combined with copper, which is known to have the ability to catalyze methane conversion,” said Brookhaven chemist Jose Rodriguez, principal investigator of the research.

Studying the system with light and electrons

The group studied the performance of catalyst samples that were synthesized with different concentrations of magnesium oxide applied to the copper oxide surface. They used several techniques, including an X-ray method known as ambient-pressure X-ray photoelectron spectroscopy

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(AP-XPS), which yielded information on chemical composition and the chemical interactions taking place on the catalyst surface.

This work was performed at the National Synchrotron Light Source II (NSLS-II), a DOE Office of Science user facility located at Brookhaven that produces intense beams of X-ray light for studying a wide variety of materials and biological samples.

At NSLS-II, the group used state-of-the-art instrumentation at the In Situ and Operando X-ray Spectroscopy (IOS) beamline, which allows scientists to study samples “at work” in real time and under realistic operating conditions. and under realistic operating conditions.

At the beamline’s AP-XPS endstation, the team prepared catalyst samples via a process called physical vapor deposition, which allows ultra-thin layers of a material to be deposited onto a substrate. Next, they exposed each sample to reactant gases at realistic pressures and directed X-rays at its surface. The X-ray light caused electrons to be ejected from the surface via the photoelectric effect, and these ejected electrons were then analyzed to determine their kinetic energies.

These energies, in turn, revealed the binding energies of electrons from specific atoms in the sample and allowed the researchers to identify specific chemical elements as well as their oxidation states and chemical environments—information that is key to understanding a catalyst’s behavior.

AP-XPS is an excellent technique to use in this type of study because it allows real-time surface analysis of materials during reactions, bridging the gap between controlled lab studies and practical industrial applications.

To see how the reactions had changed the magnesium oxide/copper oxide catalyst surface of each sample, the researchers employed a powerful imaging technique called scanning tunneling microscopy (STM), which creates a visual map of a sample’s surface by sweeping across it with an extremely sharp conducting tip. A voltage between the surface and tip causes electrons to “tunnel” across the tiny gap between the tip and the surface, and the currents created by those electrons are measured and translated into an image.

The AP-XPS and STM measurements collectively showed that the catalyst system activates methane at room temperature, breaking its carbon-hydrogen bonds and converting it to ethane, which is used for a variety of commercial purposes, including refrigerants and the production of fuels.

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Overall, the new catalyst’s performance rivals that of expensive catalysts based on platinum and other metals in that group, such as palladium.

Beyond methane

In another recent Brookhaven-led study published in April in *The Journal of Physical Chemistry C*, members of the group determined that this catalyst system is also successful at converting carbon dioxide, another greenhouse gas, at room temperature.

Using the same two methods, synchrotron-based AP-XPS at the IOS beamline and STM, they showed that nanoclusters of magnesium oxide on a copper oxide/copper surface can dissociate carbon dioxide into carbon monoxide and other carbon species. This ability opens reaction channels that could lead to the formation of oxygenates and light alkanes, two chemical groups that are involved in the production of fuels.

“Together, these findings are a significant step toward sustainable conversion of two potent greenhouse gases and carbon mitigation strategies,” said Islam.

Phys Org, 21 November 2024

<https://phys.org>

“Phantom chemical” identified in drinking water is new to science

2024-11-21

Plumbed drinking water in developed countries is pretty clean, but invisible contaminants can still lurk. One mysterious “phantom chemical” has haunted drinking water for decades, and now researchers have identified it – and found it’s completely new to science.

Water is often chlorinated to disinfect it, which has proven effective at eliminating most waterborne pathogens but it can create by-products that are harmful to human health. A related compound, chloramine, was found to not only produce fewer of these by-products but also lasted longer. As such, it’s commonly used in the US and some other regions.

Chloramine, however, is not without its own by-products. Chemical analysis has long been found to reveal that about five to 10% of the expected nitrogen disappears, locked up in some other molecule that evaded direct identification for decades.

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Now, scientists have finally pinpointed this strange “phantom chemical.” It’s called a chloronitramide anion, which is a negatively charged molecule made up of one chlorine atom, two nitrogen atoms and two oxygen atoms.

The researchers synthesized and isolated the chemical, then analyzed it with high-resolution mass spectrometry and nuclear magnetic resonance spectroscopy, to reveal its properties.

Next, they measured the concentrations of these anions in different water systems in the US that are treated with chloramines. They detected it at levels of up to 100 micrograms per liter, which is higher than the regulation limits of 60 to 80 micrograms per liter that’s usually allowed for disinfection by-products.

Direct toxicology studies have yet to be conducted on the compound, but the team says the analyses do suggest that chloronitramide anion is not entirely benign.

“I agree that a toxicological investigation of this anion would be useful now that we know its identity, but I am not overly worried about my tap water,” says Oliver Jones, Professor of Chemistry at RMIT. “The compound in question is not newly discovered, just newly defined. Its presence in some (not all) drinking waters has been known for over 30 years.”

“The question is whether the substance is toxic at the amount we are exposed to,” Jones continues. “I think here the answer is probably not. Only 40 samples were tested in this study, which is not enough to be representative of all tap water in the USA and the concentration of chloronitramide was well below the regulatory limits for most disinfection by-products in the majority of samples.”

Whether or not it’s unsafe, identifying the mysterious chemical after all this time is an important step. The research was published in the journal *Science*.

Source: University of Arkansas via Scimex

New Atlas, 21 November 2024

<https://newatlas.com>

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Omega-3 and Omega-6 Fatty Acids Linked to Lower Cancer Risk

2024-11-04

In addition to lowering your cholesterol, keeping your brain healthy and improving mental health, new research from the University of Georgia suggests omega-3 and omega-6 fatty acids may help ward off a variety of cancers.

The study relied on data from more than 250,000 people and found that higher levels of omega-3 and omega-6 fatty acids were associated with a lower risk of developing cancer.

“Higher omega-3 and omega-6 levels were associated with lower rates of cancer,” said Yuchen Zhang, lead author of the study and a doctoral student in UGA’s College of Public Health. “These findings suggest that the average person should focus on getting more of these fatty acids in their diets.”

Participants with higher levels of omega-3s had lower rates of colon, stomach and lung cancer, in addition to lower rates of other digestive tract cancers.

High omega-6 levels led to lower rates of 14 different cancers, including brain, malignant melanoma, bladder and more.

Healthy fats reduce risk of developing 19 types of cancer

The study relied on data from a United Kingdom-based study of over 250,000 people who were followed for more than a decade. Of those participants, almost 30,000 developed some form of cancer during the study period.

Some earlier research drew connections between levels of fatty acids and risk of developing cancer. However, no studies could conclusively determine whether omega-3 and omega-6 fatty acids reduced cancer rates or increased the likelihood of surviving a cancer diagnosis.

Importantly, the benefits of high levels of fatty acids were not dependent on other risk factors like BMI, alcohol use or physical activity.

Fish oil supplements come with a variety of health benefits

Known as “healthy fats,” omega-3 and omega-6 fatty acids are essential for human health. They’re present in fatty fish, nuts and even some plant oils such as canola oil.

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But most Americans probably aren't eating enough of these foods to reach the recommended amounts.

That's why many individuals turn to fish oil supplements. They're one of the most popular dietary pills on the market and for good reason.

Previous studies suggest omega-3 supplements can reduce the risk of developing high cholesterol and lower the risk of heart disease.

Benefits of fish oil may not be one-size-fits-all

But the decision to take the popular fish oil pills isn't one-size-fits-all.

In the present study, for example, the researchers found that high omega-3 levels could be associated with a slightly higher risk of prostate cancer.

"For women, it's an easy decision: Eat more omega-3," said Kaixiong Ye, corresponding author of the study and an associate professor in UGA's Franklin College of Arts and Sciences.

The researchers also saw a stronger beneficial effect of omega-6 in younger participants, particularly women.

Technology Networks, 4 November 2024

<https://technologynetworks.com>

Spinel oxides study reveals pathways for improved electrocatalyst performance

2024-11-21

Catalysts are the keys to speeding up sluggish reactions that require large amounts of energy. Therefore, analyzing which types of catalysts speed up reactions the most and what their underlying mechanisms are can help us improve efficiency.

A research team at Tohoku University's Advanced Institute for Materials Research (AIMR) has proposed a strategy to use spinel oxides to improve a reaction called the oxygen evolution reaction (OER). This catalyst overcomes issues typically encountered with previous spinel oxides by involving a rare-earth cerium (Ce) substitution. The research is published in *Angewandte Chemie International Edition*.

Spinel oxides refer to minerals such as magnesium, nickel, or zinc packed tightly into cubic crystals. Spinel oxides have been explored for their potential as

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active electrochemical oxygen evolution reaction catalysts. However, the catalytic process for spinel oxides often follows the adsorbate evolution mechanism pathway, which largely inhibits their ability to release O₂. This is not helpful for the desired oxygen evolution reaction.

Comparatively, the lattice oxygen mechanism pathway (where the release of O₂ is assisted by lattice oxygen from oxides) is much more efficient. In order to best utilize this method, it is important to understand factors such as how to trigger lattice oxygen activation during the oxygen evolution process.

"Even the slightest change can alter how efficient the reaction is," explains Associate Professor Hao Li of AIMR, "Essentially, we want to reliably be able to control which pathway the spinel oxide tends towards, so we can reach the desired outcome every time."

The research team used NiCo₂O₄ as a model with Ce. The catalyst exhibited remarkable OER activity with a low overpotential, satisfactory electrochemical stability, and good practicability in anion-exchange membrane water electrolyzer.

Theoretical analyses reveal that OER on the Ce-NiCo₂O₄ surface follows the more favorable lattice oxygen mechanism (LOM) pathway compared to NiCo₂O₄, as further verified by pH-dependent behavior and in situ Raman analysis.

In order to better characterize the ins-and-outs of the reaction, electrochemical mass spectrometry was used to confirm that the oxygen was specifically originating from the lattice oxygen of Ce-NiCo₂O₄.

The addition of Ce was successful in promoting the lattice oxygen pathway, which opens new doors for using this and similar catalysts in electrochemical reactions. This work provides a new perspective for designing highly active spinel oxides for OER and offers significant insights into the rare-earth-enhanced LOM mechanism.

In particular, the OER water-splitting process is useful for producing green hydrogen fuels, hence the intense interest in this reaction. In order for things to change so that these environmentally-friendly fuels can start being used more widely, it all starts with a catalyst.

Phys Org, 21 November 2024

<https://phys.org>

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New method for designing artificial proteins

2024-11-21

Protein design aims to create customized antibodies for therapies, biosensors for diagnostics, or enzymes for chemical reactions. An international research team has now developed a method for designing large new proteins better than before and producing them with the desired properties in the laboratory. Their approach involves a new way of using the capabilities of the AI-based software AlphaFold2, for which the Nobel Prize in Chemistry was awarded in 2024.

Whether as building blocks, transport systems, enzymes, or antibodies, proteins play a vital role in our bodies. Researchers are, therefore, trying to recreate them or to design so-called de novo proteins that do not occur in nature. Such artificial proteins are designed to bind to certain viruses or transport drugs, for example. Scientists are increasingly using machine learning to design them. Recently, advances in this field were honored with the Nobel Prize in Chemistry: This year's Nobel Prize went to David Baker, a pioneer of de novo protein design, and to the developers of the software AlphaFold2 Demis Hassabis and John Jumper. This software makes it possible to predict protein structures on the computer with high accuracy.

An international team led by Hendrik Dietz, Professor of Biomolecular Nanotechnology at the Technical University of Munich (TUM), and Sergey Ovchinnikov, Professor of Biology at MIT, has now developed a method that uses AlphaFold2's accurate structure prediction together with a so-called gradient descent approach for efficient protein design. It was published in the journal Science.

Gradient descent is a common method for model optimization. In a step-by-step process, it can be used to identify deviations from the desired target function and adjust the parameters until the optimal result is achieved. In protein design, gradient descent can be used to compare the structure of new proteins predicted by AlphaFold2 with the desired protein structure. This allows scientists to further optimize their newly designed amino acid chain and the resulting structure. The latter largely determines the stability and function of the protein and depends on subtle energetic interactions.

Virtual superposition of the building blocks

The new method makes it possible to design large new proteins better than before and to tailor them to the desired properties, for example, to

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bind precisely to other proteins. Their design process differs from previous approaches in several ways.

"We have designed the process for new proteins so that we initially ignore the limits of what is physically possible. Usually, only one of the 20 possible building blocks is assumed at each point of the amino acid chain. Instead, we use a variant in which all possibilities are virtually superimposed," says Christopher Frank, doctoral candidate at the Chair of Biomolecular Nanotechnology and first author of the study.

This virtual superposition cannot be directly translated into an actually producible protein. But it allows the protein to be iteratively optimized. "We improve the arrangement of the amino acids in several iterations until the new protein is very close to the desired structure," says Christopher Frank. This optimized structure is then used to determine the amino acid sequence that can actually be assembled to a protein in the laboratory.

The crucial test: how do the predictions hold up in real life?

The ultimate test for all newly designed proteins: does the actual structure correspond to the predicted construct and the desired function? Using the new method, the team designed more than 100 proteins virtually, produced them in the laboratory and tested them experimentally. "We were able to show that the structures that we designed are very close to the structures that are actually produced," says Christopher Frank.

Using their new method, they were able to produce proteins consisting of up to 1000 amino acids. "This brings us closer to the size of antibodies, and - just as with antibodies - we can then integrate several desired functions into such a protein," explains Hendrik Dietz. "These could, for example, be motifs for recognizing and suppressing pathogens."

Science Daily, 21 November 2024

<https://sciencedaily.com>

'Absolute miracle' breakthrough provides recipe for zero-carbon cement

2024-04-23

Concrete and steel production are major sources of CO₂ emissions, but a new solution from Cambridge could recycle both at the same time. Throwing old concrete into steel-processing furnaces not only purifies iron but produces "reactivated cement" as a byproduct. If done using

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renewable energy, the process could make for completely carbon-zero cement.

Concrete is the world's most used building material, and making it is a particularly dirty business – concrete production alone is responsible for about 8% of total global CO₂ emissions. Unfortunately it's not easy to recycle back into a form that can be used to make new concrete structures.

Scientists have of course been investigating ways to make concrete greener. That can include changing the recipe to switch out the most polluting ingredients – specifically limestone – or designing concrete so that it absorbs more CO₂ from the air after it's laid. For the new study, Cambridge researchers investigated how waste concrete could be converted back into clinker, the dry component of cement, ready to be used again.

"I had a vague idea from previous work that if it were possible to crush old concrete, taking out the sand and stones, heating the cement would remove the water, and then it would form clinker again," said Dr. Cyrille Dunant, first author of the study. "A bath of liquid metal would help this chemical reaction along, and an electric arc furnace, used to recycle steel, felt like a strong possibility. We had to try."

An electric arc furnace needs a "flux" material, usually lime, to purify the steel. This molten rocky substance captures the impurities, then bubbles to the surface and forms a protective layer that prevents the new pure steel from becoming exposed to air. At the end of the process, the used flux is discarded as a waste material.

So for the Cambridge method, the lime flux was swapped out for the recycled cement paste. And sure enough, not only was it able to purify the steel just fine, but if the leftover slag is cooled quickly in air, it becomes new Portland cement. The resulting concrete has similar performance to the original stuff.

Importantly, the team says this technique doesn't add major costs to either concrete or steel production, and significantly reduces CO₂ emissions compared to the usual methods of making both. If the electric arc furnace was powered by renewable sources, it could essentially make for zero-emission cement.

The technique has already been trialed in furnaces that produce a few dozen kilograms of cement, and the researchers say the first industrial-scale trials are underway this month, where it would be producing about

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66 tons of cement in two hours. The researchers say that the process could scale up to produce one billion tonnes of "electric cement" by 2050.

"Producing zero emissions cement is an absolute miracle, but we've also got to reduce the amount of cement and concrete we use," said Professor Julian Allwood, who led the research. "Concrete is cheap, strong and can be made almost anywhere, but we just use far too much of it. We could dramatically reduce the amount of concrete we use without any reduction in safety, but there needs to be political will to make that happen.

"As well as being a breakthrough for the construction industry, we hope that Cambridge Electric Cement will also be a flag to help the government recognize that the opportunities for innovation on our journey to zero emissions extend far beyond the energy sector." A patent has been filed for the process, as the first step towards commercialization.

The research was published in the journal Nature. The team describes the work in the video below.

New Atlas, 23 May 2024

<https://newatlas.com>

Weight Loss Drugs May Reduce Alcohol Consumption in Alcohol Use Disorder

2024-11-15

A new joint study by the University of Eastern Finland and Karolinska Institutet in Sweden found that the GLP-1 agonists semaglutide and liraglutide, which are used for treating diabetes and obesity, were associated with fewer hospitalisations among individuals with alcohol use disorder, AUD. Fewer hospitalisations were observed for alcohol related causes, substance use related causes, and for physical illnesses. However, no association was observed for hospitalisations due to attempted suicide.

Effective treatments for alcohol dependence exist; however, they remain underused and are not effective, or suitable, for all patients with alcohol or substance use disorder. Previous preliminary studies in animals and humans have shown that GLP-1 agonists may significantly reduce the consumption of alcohol and other substances.

The present study examined Swedish registry data on more than 200,000 individuals who had been diagnosed with alcohol use disorder in 2006–2021. Their drug treatments and hospitalisations were followed up until the end of 2023 using the PRE2DUP method developed by the

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research team and a within-individual design. During the follow-up, 4,321 of the study participants were using semaglutide, and 2,509 were using liraglutide.

The use of GLP-1-agonists was associated with a significantly reduced risk of hospitalisation due to alcohol use disorder. Semaglutide was associated with a 36% lower risk, and liraglutide with a 28% lower risk of hospitalisation. Both drugs were also associated with a significantly reduced risk of hospitalisation due to any substance use disorder: semaglutide with a 32% lower risk, and liraglutide with a 22% lower risk.

The risk of hospitalisation when using GLP-1-agonists was lower than when using naltrexone, which was the most effective drug among drugs already approved for alcohol use disorder. Naltrexone was associated with a 14% lower risk of hospitalisation due to alcohol and substance use related causes.

The use of semaglutide, liraglutide and AUD drugs were all associated with fewer hospitalisations due to physical illness: semaglutide with 22% fewer, liraglutide with 21% fewer, and AUD drugs with 15% fewer hospitalisations. No statistically significant association was observed between the use of GLP-1-agonists and hospitalisations due to attempted suicide.

“The research idea stems from patient observations reporting less alcohol consumption since initiating a semaglutide drug. Similar observations have also been highlighted by scientists in international conferences, so we decided to examine this in more detail,” says Docent of Forensic Psychiatry Markku Lähteenenvuo of the University of Eastern Finland and the Niuvanniemi Hospital.

“Our study suggests that besides obesity and diabetes, GLP-1-agonists may also help in the treatment of alcohol and substance use disorders; however, these findings need to be further validated in randomised controlled trials,” Lähteenenvuo notes.

Technology Networks, 15 November 2024

<https://technologynetworks.com>

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Omega-3 and Omega-6 Fatty Acids Linked to Lower Cancer Risk

2024-11-04

In addition to lowering your cholesterol, keeping your brain healthy and improving mental health, new research from the University of Georgia suggests omega-3 and omega-6 fatty acids may help ward off a variety of cancers.

The study relied on data from more than 250,000 people and found that higher levels of omega-3 and omega-6 fatty acids were associated with a lower risk of developing cancer.

“Higher omega-3 and omega-6 levels were associated with lower rates of cancer,” said Yuchen Zhang, lead author of the study and a doctoral student in UGA’s College of Public Health. “These findings suggest that the average person should focus on getting more of these fatty acids in their diets.”

Participants with higher levels of omega-3s had lower rates of colon, stomach and lung cancer, in addition to lower rates of other digestive tract cancers.

High omega-6 levels led to lower rates of 14 different cancers, including brain, malignant melanoma, bladder and more.

Healthy fats reduce risk of developing 19 types of cancer

The study relied on data from a United Kingdom-based study of over 250,000 people who were followed for more than a decade. Of those participants, almost 30,000 developed some form of cancer during the study period.

Some earlier research drew connections between levels of fatty acids and risk of developing cancer. However, no studies could conclusively determine whether omega-3 and omega-6 fatty acids reduced cancer rates or increased the likelihood of surviving a cancer diagnosis.

Importantly, the benefits of high levels of fatty acids were not dependent on other risk factors like BMI, alcohol use or physical activity.

Fish oil supplements come with a variety of health benefits

Known as “healthy fats,” omega-3 and omega-6 fatty acids are essential for human health. They’re present in fatty fish, nuts and even some plant oils such as canola oil.

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But most Americans probably aren't eating enough of these foods to reach the recommended amounts.

That's why many individuals turn to fish oil supplements. They're one of the most popular dietary pills on the market and for good reason.

Previous studies suggest omega-3 supplements can reduce the risk of developing high cholesterol and lower the risk of heart disease.

Benefits of fish oil may not be one-size-fits-all

But the decision to take the popular fish oil pills isn't one-size-fits-all.

In the present study, for example, the researchers found that high omega-3 levels could be associated with a slightly higher risk of prostate cancer.

"For women, it's an easy decision: Eat more omega-3," said Kaixiong Ye, corresponding author of the study and an associate professor in UGA's Franklin College of Arts and Sciences.

The researchers also saw a stronger beneficial effect of omega-6 in younger participants, particularly women.

Technology Networks, 4 November 2024

<https://technologynetworks.com>

Novel crystals can harvest water from air without any energy input

2024-11-19

A team of researchers from Jilin University, NYU Abu Dhabi's Smart Materials Lab, and the Center for Smart Engineering Materials, led by Professor of Chemistry Pance Naumov, has developed a new crystalline material that can harvest water from fog without any energy input.

The design of the novel type of smart crystals, which the researchers named Janus crystals, is inspired by desert plants and animals, which can survive in arid conditions. Desert beetles and lizards, for example, have evolved to develop surface structures that have both hydrophilic and hydrophobic areas and effectively capture moisture from the air. Water is attracted to the hydrophilic areas and droplets are accumulated and transported through the hydrophobic areas.

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The findings are presented in the paper titled "Efficient Aerial Water Harvesting with Self-Sensing Dynamic Janus Crystals," recently published in the Journal of the American Chemical Society.

The researchers chose three chemically versatile organic compounds from which they grew elastic organic crystals. They then tested how each of these materials interacted with the airborne water, which led to the creation of the new water-collecting materials, Janus crystals, that contain both hydrophilic and hydrophobic regions on the surface level, one to capture water and one to transfer it to a receptacle for collection.

The Janus crystals capture humidity from humid air with the highest-to-date water collection efficiency. The crystals' narrow and light-translucent structures enable researchers to monitor the collection and condensation of fog droplets in real time by using light.

Desalination is a widely used method to produce potable water, however an energy-intensive process is required to separate the dissolved salt in saltwater. In contrast, the process of condensation of aerial humidity or fog utilized by the Janus crystals is spontaneous under ambient conditions and can be performed without the input of energy, potentially providing an endless source of clean water.

Unlike previously reported porous organic crystals, the Janus crystals combine water-collection and water-delivery functions at their surface, creating a highly efficient water harvesting process that maximizes the amount of collected water at ambient conditions.

"The Earth's atmosphere contains an abundance of untapped fresh water, but we desperately need materials that can efficiently capture and collect this humidity and condense it into potable water," said Naumov.

"The crystals developed by our team not only capitalize on the mechanical compliance and optical transparency of organic crystals, but also pave the way for the design of active, self-sensing, and efficient surface-active harvesters which, when used at a larger scale, can help us combat water scarcity at a societal level."

Phys Org, 19 November 2024

<https://phys.org>

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Building roots in glass, a bio-inspired approach to creating 3D microvascular networks using plants and fungi

2024-22-19

Now, researchers from Kyushu University have developed a new and convenient technique for building such complex 3D microfluidic networks. Their tool? Plants and fungi. The team developed a 'soil' medium using nanoparticles of glass (silica) and a cellulose based binding agent, then allowed plants and fungi to grow roots into it. After the plants were removed, the glass was left with a complex 3D microfluidic network of micrometer-sized hollow holes where the roots once were.

The new method can also be utilized for observing and preserving 3D biological structures that are typically difficult to study in soil, opening new opportunities for research in plant and fungal biology. Their findings were published in the journal *Scientific Reports*.

"The primary motivation for this research was to overcome the limitations of conventional microfabrication techniques in creating complex 3D microfluidic structures. The focus of our lab is biomimetics, where we try to solve engineering problems by looking to nature and artificially replicating such structures," explains Professor Fujio Tsumori of Kyushu University's Faculty of Engineering, who led the study. "And what better example of microfluidics in nature than plant roots and fungal hyphae? So, we set out to develop a method that could harness the natural growth patterns of these organisms and create optimized microfluidic networks."

The researchers began by developing a 'soil' like mix for plants to grow in, but instead of dirt, they combined growth medium with glass nanoparticles smaller than 1 μm in diameter with hydroxypropyl methyl cellulose as a binding agent. They then seeded this 'soil' mixture and waited for the plants to take root. After confirming successful plant growth, the 'soil' was baked leaving only the glass with root cavities.

"The process is called sintering, which aggregates fine particles together into a more solid state. It is similar to powder metallurgy in the manufacturing of ceramics," continues Tsumori. "In this case it is the plant that does the molding."

Their method was able to replicate the intricate biological structures of a plant's main roots which can be up to 150 μm in diameter, and all the way down to its root hairs which can be about 8 μm in diameter. Tests with

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other organisms showed that the method can even replicate the root structure of fungi, called hyphae.

"Hyphae are even thinner and can be as small as 1-2 μm in diameter. That's thinner than a single strand of spider silk," says Tsumori.

The team hopes that their new bio-inspired microfluidic fabrication technique could be used in various fields of science and engineering, potentially leading to more efficient microreactors, advanced heat exchangers, and innovative tissue engineering scaffolds.

"In the biological sciences, this technique provides a unique tool for studying the intricate 3D structures of plant roots and fungal networks, which can advance our understanding of soil ecosystems," concludes Tsumori. "By bridging biological systems and engineering, our research has the potential to pave the way for new technologies and scientific discoveries."

Science Daily, 19 November 2024

<https://sciencedaily.com>

Ytterbium thin-disk lasers pave the way for sensitive detection of atmospheric pollutants

2024-11-18

Short-lived pollutants play a critical role in global warming.

For example, methane is of particular relevance to the global greenhouse effect because its warming potential is 25 times higher than that of carbon dioxide.

However, detecting and monitoring these pollutants is challenging for two reasons.

Firstly, water vapor interferes and overlaps with the absorption spectra of many gases in the standard infrared ranges normally used for detection.

Secondly, these pollutants are difficult to detect due to their volatile presence in the atmosphere.

By targeting the SWIR range, where pollutants such as methane absorb strongly while water absorption remains minimal, the new laser system offers unprecedented detection sensitivity and accuracy.

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Central to this innovation is the ytterbium thin-disk laser, which produces high-power, femtosecond pulses at megahertz repetition rates.

This allows the system to pump an OPO, converting laser pulses to the SWIR range with remarkable power and intensity.

Operating at twice the repetition rate of the pump laser, the OPO delivers stable, tunable SWIR pulses optimized for high-sensitivity spectroscopic applications.

The team's pioneering approach also integrates broadband, high-frequency modulation of the OPO output, which allows the enhancement of the signal-to-noise ratio, providing even greater detection precision.

"The output of our laser system can be scaled to higher average and peak power, due to the power scalability of ytterbium thin-disk lasers. Employing the system for the accurate detection of pollutants in real time allows deeper insights into greenhouse gas dynamics. This could help address some of the challenges we face in understanding climate change," said Anni Li, PhD student at the MPL.

The laser's capacity to generate high-power, stable pulses in the SWIR range is a game-changer for field-resolved spectroscopy and femtosecond fieldoscopy, methods which enable re-searchers to detect and analyze a wide range of atmospheric compounds with minimal interference.

"This new technology is not only applicable to atmospheric monitoring and gas sensing, but also holds potential for other scientific fields such as earth-orbit communication, where high bandwidth modulated lasers are required," said Dr. Hanieh Fattahi, the lead researcher on the project. The researchers plan to develop the system further with the goal of creating a versatile platform for real-time pollutant monitoring and earth-space optical communications.

Science Daily, 18 November 2024

<https://sciencedaily.com>

Snail study points to bright future for AI in biological research

2024-11-19

A new James Cook University study using artificial intelligence to analyze the structure of cone snail venom has had mixed results—but points to a bright future for AI in the field of biological research.

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Professor Norelle Daly from JCU's Australian Institute of Tropical Health and Medicine, Dr. David Wilson from JCU's Advanced Analytical Center, and Ph.D. student and lead author Tiziano Raffaelli conducted the study, now published in the Journal of Biological Chemistry.

The scientists tested how accurately the AI tool AlphaFold could predict the structure of a specific venom peptide of a cone snail—highly venomous sea snails which can paralyze prey almost instantly and can be a danger to humans.

"The AI successfully predicted the overall structure of the peptide but made errors leading to incorrect predictions about how its stabilizing bonds are formed. While AI software like AlphaFold has made significant strides in predicting larger protein structures, smaller peptides still present challenges," said Professor Daly.

Despite current limitations, Professor Daly believes AI has enormous potential in structural biology, highlighted by the 2024 Nobel Prize in Chemistry awarded to Demis Hassabis and John Jumper for developing AlphaFold.

"AI for structure prediction is incredibly exciting and very promising. I believe it will continue to improve and play a significant role in the field. Although we're not yet at a stage where experimental structural biology can be fully replaced by predictions, studies like this one are crucial for shaping the future of AI predictions."

She said at present, getting structures of peptides is extremely time consuming, costly, and requires specialized equipment and techniques such as crystallography and NMR spectroscopy.

"If we can use AI to accurately predict these structures, it would accelerate the identification and development of novel therapeutics," said Professor Daly.

Phys Org, 19 November 2024

<https://phys.org>

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Gadolinium, lutetium and zirconium all have new atomic weights

2024-11-15

The International Union of Pure and Applied Chemistry (IUPAC) has updated the standard atomic weights of gadolinium, lutetium and zirconium following a detailed review of their isotopic abundances.

Gadolinium's standard atomic weight was revised from 157.250 to 157.249. Similarly, lutetium's weight changed from 174.9668 to 174.96669, while zirconium's was updated from 91.224 to 91.222. The revisions follow a review by IUPAC's commission on isotopic abundances and atomic weights, who noted that gadolinium's standard atomic weight had remained unchanged since 1969, based on isotopic data from the 1940s. Recent evaluations of their natural isotopic abundances prompted this update. For lutetium and zirconium, more accurate measurements of their isotopic compositions have been obtained since their weights were last updated in 2007 and 1983, respectively.

Chemistry World, 15 November 2024

<https://chemistryworld.com>

How Cannabis Use is Changing Across the U.S.

2024-11-04

Voters in four states will weigh in this week on ballot initiatives that would legalize the recreational or medical use of marijuana.

If Nebraska, North Dakota, South Dakota and Florida pass the measures, they will join over two dozen other states to have legalized the drug in some way, becoming part of a shifting landscape of cannabis use in the United States.

Researchers tracking cannabis say that the picture of who uses the drug — and how — is evolving, and point to a few key trends.

Use appears to be rising among everyone — except teens.

When states first legalized recreational cannabis, starting with Colorado and Washington in 2012, some panicked. "The 'sky's going to fall' scenario was that all of the kids were just going to have access to all of the cannabis and it was going to be a terrible, terrible thing," said Ryan Vandrey, a professor of psychiatry and behavioral sciences at Johns Hopkins Medicine who studies cannabis.

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The largest jumps in use in recent years, though, appear to be among adults.

About 42 percent of adults ages 19 to 30 and 29 percent of those ages 35 to 50 have used cannabis in the past year — a historically high level of use, according to data from a nationwide survey. That shift may be in part because of changing public perceptions about the drug and whether it's all that harmful, Dr. Vandrey said. (This is despite evidence that many cannabis products are stronger than they used to be; doctors have also raised concerns that some users can become dependent on the drug.)

Seniors are also increasingly using cannabis. In 2007, less than 1 percent of adults 65 and older had used the drug in the past year. By 2022, that number grew to more than 8 percent. Experts aren't exactly sure what's behind that trend, but noted that some cannabis brands have ramped up marketing to older adults.

Use among teens, however, seems to be falling. The percentage of adolescents who say they currently use marijuana dropped from 23 percent in 2011 to just under 16 percent in 2021.

"It just goes to show that teenagers will do exactly the opposite of what you think they're going to do at all times," Dr. Vandrey said.

Part of why teenagers have not reported higher rates of marijuana use may be because of stringent age restrictions at dispensaries in states that were early to legalize cannabis, said Traci Toomey, director of the University of Minnesota School of Public Health Cannabis Research Center. "With the legalization, with those controls in place, there wasn't necessarily easier access for young people," she said, adding that without such strict policies, teen use might rise.

And some studies show that teenagers have shifted away from substance use in general, reporting lower rates of drinking and other drugs. That could be a lingering effect of pandemic lockdowns, when they spent less time socializing in-person and more at home with parents.

Still, researchers are continuing to closely watch cannabis use rates among teens as they study the potential hazards of the drug while the brain is still developing.

The gender gap is narrowing.

Men have historically used cannabis at far higher rates than women, said Ziva Cooper, director of the U.C.L.A. Center for Cannabis and Cannabinoids.

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That gap is closing. In 2023, women between the ages of 19 and 30 reported using cannabis more within the past year than men in that age range. Teenage girls have also reported using marijuana at higher rates than teenage boys.

Researchers have a few hypotheses about this shift. More women tend to use marijuana for medical reasons, Dr. Cooper said. That may be because women have higher rates of conditions the drug is often used for, like chronic pain.

It's also possible that women have always consumed weed in comparable numbers to men — but only now, with less stigma around the drug, do they feel comfortable reporting their use in surveys, Dr. Vandrey said.

More people use it daily.

More Americans are now using marijuana every day than are drinking alcohol, a study published in May found. Nearly 18 million people reported using the drug every day or nearly every day, compared with just under 15 million who drank with the same frequency.

The data shows just how entrenched marijuana has become in American life, surprising even scientists like Dr. Cooper, who has closely tracked the growing popularity of cannabis.

It also raises questions about the potential health implications, Dr. Vandrey said. Statistics on the frequency of cannabis use don't tell scientists why people are using the drug, or at what dose. They don't capture the nuance of whether someone is taking a small amount each night to relieve chronic pain or larger doses throughout the day to get high. Scientists are still working to understand the long-term health effects of routine cannabis use, especially in the strengths and formulations of the drug available today.

Edibles and vapes are on the rise.

Vapes and edibles are becoming more popular, researchers say, a potential signal that consumers are favoring more discreet options. Part of the appeal of these products is that consumers can purchase them at standardized doses, Dr. Vandrey said.

Some consumers may believe that edibles are a healthier mode of consuming cannabis, since they don't carry the same risk of lung damage as smoking. But there isn't conclusive evidence to say that one mode of consumption has fewer risks.

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There are also simply more options on the market, like cannabis-infused drinks, which can draw in new consumers.

"I know people who would never have used before but they say, 'Gosh, those T.H.C. seltzers are very tasty,'" Dr. Toomey said.

NY Times, 4 November 2024

<https://nytimes.com>

A clean break: Scientists convert plastics into soaps and detergents

2024-11-18

As an undergraduate student at Zhejiang University in eastern China, Greg Liu went with some of his classmates on a university-sponsored trip to tour a host of chemical industries within the area.

The tour gave students pursuing degrees in chemical engineering an opportunity to learn more about the manufacturing and production processes of chemicals within China at the time. Liu realized that day exactly what he wanted to do for a career—find ways to alleviate or stop the industry from polluting the environment.

"I realized that this was not going to be the sustainable way of our future. Pollution was everywhere; water, soil, road, you name it. Workers were in unbearable working conditions. I didn't want to be in an environment like that, nor our future generations," Liu said. "That basically drove me to think, 'OK, I must pursue an advanced degree to change the way we work in the chemical industry.'"

Liu later came to the United States and earned his doctoral degree from the University of Wisconsin-Madison. Now, his zeal to use his knowledge of chemical engineering to create a more sustainable world has led to him developing a revolutionary way to deal with arguably one of the world's most pressing issues—plastic pollution.

A long research project encompassing five or six years finally led to a breakthrough, with Liu, a professor within Virginia Tech's Department of Chemistry housed in the College of Science, and his team of undergraduate and graduate students finding a way to convert certain plastics into soaps, detergents, lubricants, and other products.

Liu has written an article about the process and the feasibility and commercialization of it that was published in Nature Sustainability.

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In simple terms, Liu's system was two steps. It first involved using thermolysis, or breaking down a substance—in this case, plastic—by using heat. Plastic placed in a reactor built by Liu's team and heated to between 650 and 750 degrees Fahrenheit broke down into chemical compounds, leaving a mixture of oil, gas, and residual solids.

The key to this first step was breaking down the polypropylene and polyethylene molecules that make up plastic within a certain carbon range, and Liu and his team were able to accomplish this.

The residual solids left behind were minimal, and the gas could be captured and used as fuel. The oil, though, was the product of the most interest here.

During his research, Liu was able to functionalize, or change the chemistry, of the oil into molecules to be converted into soaps, detergents, lubricants, and other products.

"These materials are stable," Liu said, holding up a vial of soap. "This vial of soap has been in my office for, I would say, a year already. ... You could use it to wash your hands and dishes. We have used it to wash our lab glassware in the laboratory."

The process, which took less than a day, led to almost zero air pollution output, thus offering clues to a desperately needed solution to a global problem. According to the United Nation's website, the world produces 430 million tons of plastic each year, with the equivalent of 2,000 garbage trucks full of plastic dumped into oceans, rivers, and lakes each day.

Phys Org, 18 November 2024

<https://phys.org>

Common Cardiovascular Drugs May Reduce Dementia Risk

2024-11-20

Common cardiovascular drugs are linked to a lower risk of dementia in older age, according to a new study from Karolinska Institutet published in *Alzheimer's & Dementia: The Journal of the Alzheimer's Association*.

Cardiovascular disease and dementia are major public health challenges that cause a significant burden on both healthcare and society. A new study from Karolinska Institutet in Sweden shows that long-term use of

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common cardiovascular drugs is associated with lower risk of dementia later in life.

"We can see a clear link between long-term use – five years or more – of these drugs and reduced risk of dementia in older age," says Mozhu Ding, assistant professor at the Institute of Environmental Medicine, Karolinska Institutet, and one of the lead authors of the paper.

Up to 25 per cent lower risk

The researchers used Swedish national registers. Around 88,000 people over the age of 70 who were diagnosed with dementia between 2011 and 2016 were included in the study, as well as 880,000 controls. Information on cardiovascular medicines was obtained from the Swedish Prescribed Drug Register.

The results show that long-term use of antihypertensive drugs, cholesterol-lowering drugs, diuretics and blood-thinning drugs is associated with between 4 and 25 per cent lower risk of dementia. Combinations of the drugs had stronger protective effects than if they were used alone.

"Previous studies have focused on individual drugs and specific patient groups but in this study, we take a broader approach," says Alexandra Wennberg, affiliated researcher at the Institute of Environmental Medicine and the other lead author of the paper.

Some drugs linked to higher risk

The researchers also found that, on the contrary, the use of antiplatelet drugs may be linked to a higher risk of dementia. Antiplatelet drugs are medicines used to prevent strokes and stop platelets from clumping together. One possible explanation is that these drugs increase the risk of microbleeds in the brain, which are associated with cognitive decline.

The study is an important piece of the puzzle for finding new treatments for dementia, according to the researchers.

"We currently have no cure for dementia, so it's important to find preventive measures," says Alexandra Wennberg.

The researchers stress the importance of further studies, especially randomised controlled clinical trials, to better understand the mechanisms behind the findings. Among other things, they will continue to study how

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diet and lifestyle, in addition to drug treatment for cardiovascular disease, affect the risk of developing dementia. \

Technology Networks, 20 November 2024

<https://technologynetworks.com>

Can We Stop Mercury Poisoning? Scientists Identify the Missing Link

2024-11-20

Scientists discovered that SAM plays a critical role in the production of methylmercury, a highly toxic compound that contaminates seafood. Their findings could aid efforts to reduce methylmercury's environmental impact.

Mercury is highly toxic, but it becomes particularly dangerous when converted into methylmercury—a form so harmful that even a few billionths of a gram can cause severe and lasting neurological damage to a developing fetus. Unfortunately, methylmercury frequently enters our bodies through seafood, and once it contaminates our food and environment, there is no easy way to eliminate it.

Now, leveraging high-energy X-rays at the Stanford Synchrotron Radiation Lightsource (SSRL) at the U.S. Department of Energy's SLAC National Accelerator Laboratory, researchers have identified an unexpected major player in methylmercury poisoning – a molecule called S-adenosyl-L-methionine (SAM).

The results, published in the Proceedings of the National Academy of Sciences, could help researchers figure out new ways to address methylmercury poisoning.

"Nobody knew how mercury is methylated biologically," said Riti Sarangi, a senior scientist in SSRL's Structural Molecular Biology program and co-author on the paper. "We need to understand that fundamental process before we can develop an effective methylmercury remediation strategy. This study is a step toward that."

Challenges in Studying the Elusive HgcAB Protein

At issue in the new paper is a narrow but essential mystery concerning how methylmercury is produced. Scientists knew that most of the mercury we consume starts out as industrial emissions that make their way into

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bodies of water, where microbes convert it into methylmercury. That form concentrates in fish – and ultimately us – as it moves up the food web.

Still, researchers weren't sure how microorganisms make methylmercury. A key confounding factor, Sarangi said, is that the protein system that converts mercury to methylmercury, called HgcAB, is present only in very small amounts in microbes, making it extremely difficult to gather and purify enough to study. It's also extremely finicky: The slightest exposure to oxygen and light deactivates HgcAB.

In an effort spanning 10 years and collaborations across national laboratories and universities, University of Michigan professor Steve Ragsdale, his graduate student Katherine Rush, now an assistant professor at Auburn University, and postdoctoral associate Kaiyuan Zheng developed a new protocol to yield enough stable HgcAB to finally investigate how it transforms mercury into methylmercury.

"We've worked with a lot of very difficult proteins, but this one had everything you would not want to have in a protein if you wanted to purify it. It was very complicated," Ragsdale said.

Once the team purified enough HgcAB, they transported the samples – cooled by liquid nitrogen and shielded from light – to SSRL for X-ray absorption spectroscopy measurements. There, SSRL associate scientist Macon Abernathy used a method called extended X-ray absorption fine structure spectroscopy to study HgcAB.

"SSRL's X-ray spectroscopy facilities are especially equipped to study biological samples and have powerful detector systems that can resolve the extremely weak signals of ultra dilute protein samples like these," Sarangi said.

A Surprising Role for SAM in Methylmercury Formation

While previous studies hypothesized that the methyl group in question came from methyltetrahydrofolate, a common methyl donor in cellular reactions, the new study finds that it was donated by SAM instead. The researchers said that the results, which narrow in on the main actors in the production of methylmercury, could aid in the development of environmental remediation strategies.

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"No one has tried it yet, but perhaps analogs of SAM could be developed that could address methylmercury in the environment," Ragsdale said.

Sci Tech Daily, 20 November 2024

<https://scitechdaily.com>

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Technical Notes

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CHEMICAL EFFECTS

An intelligent spectral identification approach for the simultaneous detection of endocrine-disrupting chemicals in aquatic environments

Poly- γ -glutamic acid chelates chromium (III) and copper (II), alleviating their toxicity in cucumber and affecting rhizosphere bacterial community assembly

A novel integrated testing strategy (ITS) for evaluating acute fish toxicity with new approach methodologies (NAMs)

ENVIRONMENTAL RESEARCH

Assessment of heavy metals contamination/pollution of phosphogypsum waste of the Mdhilla region (Gafsa, southern Tunisia)

Assessment of long-term exposure to traffic-related air pollution: An exposure framework

Breathing life into equity: How air pollution influences corporate pay gap

PHARMACEUTICAL/TOXICOLOGY

Prenatal exposure to per- and polyfluoroalkyl substances (PFAS) and their influence on inflammatory biomarkers in pregnancy: Findings from the LIFECODES cohort

The impact of high exposure to perfluoroalkyl substances and risk for hormone receptor-positive breast cancer - A Swedish cohort study

OCCUPATIONAL

Integrating the lifelong exposure dimension of a chemical mixture into the risk assessment process. Application to trace elements

Inhalation Exposure to Cross-linked Polyacrylic Acid Induces Pulmonary Disorders