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ASIA PACIFIC

Chemicals added to the Inventory 5 years after issue of assessment certificate – 10 November 2023

2023-11-10

The following industrial chemicals have been added to the Australian Inventory of Industrial Chemicals in accordance with section 82 of the Industrial Chemicals Act 2019 because 5 years have passed since the assessment certificates for the industrial chemicals were issued.

A list of chemicals added to the Inventory 5 years after issue of assessment certificate:

CAS Number	2989897-59-6
Chemical Name	Poly(oxy-1,2-ethanediyl), .alpha.,.alpha. -[[[4-[2-(3-sulfophenyl) diazenyl]phenyl]imino]di-2,1-ethanediyl]bis[.omega.-hydroxy-, sodium salt (1:1)
Molecular Formula	(C2H4O)n(C2H4O)nC16H19N3O5S.Na
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	26 October 2023
CAS Number	1902936-62-2
Chemical Name	1,3,5-Triazine-2,4,6-triamine, N2,N2 - 1,6-hexanediylbis[N4,N6-dibutyl-N2,N4,N6-tris(2,2,6,6-tetramethyl-4-piperidinyl)-, N-allyl derivs., oxidized, hydrogenated
Molecular Formula	Unspecified
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	03 November 2023
CAS Number	1395069-30-3

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CAS Number	2989897-59-6
Chemical Name	Butanal, reaction products with N2,N2 -1,6-hexanediylbis[N4,N6-dibutyl-N2,N4,N6-tris(2,2,6,6-tetramethyl-4-piperidinyl)-1,3,5-triazine-2,4,6-triamine and hydrogen peroxide
Molecular Formula	Unspecified
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	03 November 2023
CAS Number	1812871-32-1
Chemical Name	Isocyanic acid, polymethylenepolyphenylene ester, polymer with oxybis[propanol], propylene glycol monomethacrylate-blocked
Molecular Formula	Unspecified
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	06 November 2023

CAS Number	800399-69-3
Chemical Name	Poly[oxy(methyl-1,2-ethanediyl)], .alpha.-[[[3-(trimethoxysilyl)propyl]amino]carbonyl]-.omega.-butoxy-
Molecular Formula	(C3H6O)nC11H25NO5Si
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	06 November 2023
CAS Number	187348-14-7

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CAS Number	800399-69-3
Chemical Name	2-Propenoic acid, 2-hydroxyethyl ester, reaction products with 5-isocyanato-1-(isocyanatomethyl)-1,3,3-trimethylcyclohexane and polyethylene-polypropylene glycol ether with trimethylolpropane (3:1) acrylate
Molecular Formula	Unspecified
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	08 November 2023

CAS Number	1374645-21-2
Chemical Name	Niobium sulfur tin zinc oxide
Molecular Formula	Nb.O.S.Sn.Zn
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	08 November 2023

Published date

10 November 2023

Read More

AICIS, 10-11-23

<https://www.industrialchemicals.gov.au/news-and-notice/chemicals-added-inventory-5-years-after-issue-assessment-certificate-10-november-2023>

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China promulgates rules on voluntary greenhouse gas emission reduction trading

2023-11-10

On October 19, 2023, the Ministry of Ecology and Environment of China promulgated the "Measures for the management of voluntary emission reduction trading of greenhouse gases (Trial)". The Measures came into effect immediately on the same day. The Measures, which is a revised version of the "Temporary measures for the management of voluntary emission reduction trading of greenhouse gas" promulgated in 2012, stipulates the entities of applications and trading, the conditions for voluntary greenhouse gas emission reduction projects applying for registration, and the conditions for emission reductions applying for registration. The targets of the "National carbon emissions trading market" is "key emitters", but companies other than "key emitters" can also participate the "voluntary emission reduction trading" stipulated in the Measures voluntarily.

Entities of application and trading

Corporations and other organizations registered in China can carry out voluntary emission reduction activities and register voluntary greenhouse gas emission reduction projects and emission reductions in accordance with the Measures. Legal entities, other organizations, and natural persons that meet the relevant national regulations also can participate in voluntary greenhouse gas emission reduction trading based on the Measures.

Conditions for projects applying for registration

Greenhouse gas voluntary emission reduction projects applying for registration must meet the following conditions:

- Conform to the principle of conservatism
- Comply with the project methodology issued by the Ministry of Ecology and Environment
- Construction begins on or after November 8, 2012
- Meet other conditions stipulated by the Ministry of Ecology and Environment

Read More

Envilience, 10-11-23

https://envilience.com/regions/east-asia/cn/report_11117

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Korea to Update Hazard Assessment Results of Chemicals Registered under K-REACH

2023-11-07

South Korea's National Institute of Environment Research (NIER) is currently consulting on the draft amendments to the hazard assessment results of new and existing chemical substances previously registered under K-REACH. Comments are welcome before November 21, 2023.

Proposed updates to Annex 1 – New Chemical Substances Hazard Assessments Results

- To add hazard assessment results of 124 previously registered new chemical substances (Given No.2023-38 ~ 2023-161), 18 of which are found toxic.
- To update chemical names of 10 new chemical substances previously registered under K-REACH.
- To delete Given No.2022-166 (Substituted-methyl-heteromonocycle) from Annex 1 due to duplication.
- To update hazard properties and classification details of 67 previously registered new chemical substances.

Proposed updates to Annex 2 – Existing Chemical Substances Hazard Assessments Results

- To add hazard assessment results of 85 previously registered existing chemical substances (Given No. 2023-358 ~ 2023-442), 68 of which are found toxic.
- To update hazard properties and classification details of one existing chemical substance (Given No.2022-242; Calcium nitrite, CAS No.13780-06-8).

Read More

Chemlinked, 07-11-23

<https://chemical.chemlinked.com/news/chemical-news/korea-to-update-hazard-assessment-results-of-chemicals-registered-under-k-reach>

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AMERICA**EPA Publishes New Webpage to Answer Frequently Asked Questions on the EPA/FDA Whitepaper on Modernizing Oversight of Products for Animals Regulated as Pesticides or New Animal Drugs**

2023-11-08

The U.S. Environmental Protection Agency (EPA) and the U.S. Food and Drug Administration (FDA) are publishing new web content to provide an overview of the topics raised during the public comment period and to answer frequently asked questions about EPA and FDA's whitepaper, "A Modern Approach to EPA and FDA Product Oversight."

In February 2023, EPA and FDA released a whitepaper describing approaches for updating the agencies' oversight of various animal products regulated as either pesticides or new animal drugs. It describes challenges with the way EPA and FDA currently regulate these products and highlights the potential benefits of a modernized approach for oversight, particularly the transfer of product oversight for topically administered flea and tick products from EPA to FDA. Any change to regulatory jurisdiction, however, has not been formally proposed or finalized by the agencies. Rather, through the whitepaper, the agencies sought public input on whether to potentially transfer oversight of these products and, if so, how best to do so.

EPA and FDA opened a 60-day public comment period on Feb. 23, 2023. The agencies received over 18,000 comments from environmental organizations, veterinarians, industry, pet and livestock owners, and other members of the public. In addition to the comment period, the agencies also collected stakeholder feedback during a public meeting on March 22, 2023. All comments received during the comment period and the public meeting, are posted in docket EPA-HQ-OPP-2023-0103.

- In reviewing the comments, EPA and FDA identified common questions from stakeholders, such as:
- How do EPA and FDA currently regulate products and review animal safety and incident data?
- How could EPA and FDA coordinate more closely on animal health, environmental, and efficacy considerations for these products?
- If products are transferred to FDA, how would products—particularly those used to protect livestock and honeybees—move from EPA

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to FDA? What would it cost for product manufacturers, how could it impact consumer access to products, and what would the FDA approval process look like?

[Read More](#)

US EPA, 08-11-23

<https://www.epa.gov/pesticides/questions-and-answers-regarding-epafda-whitepaper-modern-approach-epa-and-fda-product>

US chemical industry likely spent \$110m trying to thwart PFAS legislation, study finds

2023-11-08

The US chemical industry likely spent over \$110m during the last two election cycles deploying lobbyists to kill dozens of pieces of PFAS legislation and slow administrative regulation around “forever chemicals”, a new analysis of federal lobbying documents has found.

The industry’s onslaught was effective: only eight pieces of legislation that targeted PFAS made it through Congress, the paper prepared by the Food and Water Watch (FWW) nonprofit found.

“There’s an extreme amount of money that’s going into fighting [PFAS legislation],” said Amanda Starbuck, FWW’s research director and the lead author on the report. “It’s hard to win these fights when there’s so much funding being put in from the opposing side.”

PFAS are a class of about 14,000 compounds used to make products resist water, stains and heat. They are known as “forever chemicals” because they do not naturally break down, and they have been linked to cancer, high cholesterol, liver disease, kidney disease, fetal complications and other serious health problems.

As the dangers from PFAS have come into sharper focus over the last decade, lawmakers, the Environmental Protection Agency and other administrative agencies have come under an ever-increasing amount of pressure to rein in the chemicals use and clean up pollution. Chemical manufacturers’ spending has jumped in response, the report noted

“The chemical and associated industries are powerful and have used their army of lobbyists and campaign finance war chests to thwart meaningful action,” the paper states.

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It looked at lobbying records for eight major producers, such as 3M, Chemours, and Honeywell. During the 2019-2020 and 2021-2022 election cycles, over 130 PFAS bills were introduced in Congress, the report noted. Of the eight that passed, only two were stand alone bills, while PFAS provisions were included in several larger pieces of legislation, like the National Defense Authorization Act.

[Read More](#)

The Guardian, 08-11-23

<https://www.theguardian.com/us-news/2023/nov/07/us-chemical-industry-110-million-thwart-pfas-legislation>

Another Change to PFAS Regulation: EPA Lowers the Toxic Release Inventory Reporting Thresholds

2023-11-23

At a Glance

- This rule adds more than 2,000 facilities reporting to EPA, and applies to the reporting year starting January 1, 2024 (reports due July 1, 2025).
- A facility must report to EPA if it manufactures, processes or uses more than 100 pounds of any of the listed Per- and Polyfluoroalkyl Substances (PFAS) in a year.
- This rule does not change which PFAS must be reported, just the thresholds that trigger reporting.
- The Toxic Release Inventory (TRI) program currently covers 189 PFAS, and changes under this rule would apply to any future PFAS added to the TRI program.
- This rule defines PFAS as a “Chemical of Special Concern,” which includes chemicals such as mercury and lead.
- This rule requires companies to report even trace (de minimis) amounts of PFAS, including amounts left over as impurities.
- Companies will also be required to notify downstream customers, even if a mixture only includes a small concentration of a “chemical of special concern.” Therefore, downstream customers are more likely to trigger the TRI reporting thresholds.

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Regulatory Update

NOV. 17, 2023

Read More

JDSupra, 07-11-23

<https://www.jdsupra.com/legalnews/another-change-to-pfas-regulation-epa-3691476/>

EPA Has Found More Than a Dozen Contaminants in Drinking Water but Hasn't Set Safety Limits on Them

2023-11-07

As far as state and federal officials are concerned, the drinking water in Smithwick, Texas, is perfectly safe.

Over the past two decades, the utility that provides water to much of the community has had little trouble complying with the Safe Drinking Water Act, which is intended to assure Americans that their tap water is clean.

Yet, at least once a year since 2019, the Smithwick Mills water system, which serves about 200 residents in the area, has reported high levels of the synthetic chemical 1,2,3-trichloropropane, according to data provided by the Environmental Working Group, an advocacy organization that collects water testing results from states.

The chemical, a cleaning and degreasing solvent that is also a byproduct from manufacturing pesticides, is commonly referred to as TCP. It has been labeled as a likely carcinogen by the Environmental Protection Agency for more than a decade. There have been few active sources of TCP since the 1990s, but its legacy lives on because it breaks down slowly in the environment.

Read More

Go Local Prov, 07-11-23

<https://www.golocalprov.com/news/EPA-Has-Found-More-Than-a-Dozen-Contaminants-in-Drinking-Water-but-Hasnt-S>

PFAS Final Data Reporting Regulations

2023-11-06

After several deadline extensions, the EPA released its final per- and polyfluoroalkyl substances (PFAS) data reporting rule in late September 2023. The rule is expected to provide the "EPA, its partners, and the public with the largest-ever dataset of per- and polyfluoroalkyl substances (PFAS) manufactured and used in the United States," according to an Agency

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news release. "This rule builds on over two years of progress on the Biden-Harris Administration's action plan to combat PFAS pollution, safeguarding public health and advancing environmental justice, and is a key action in EPA's PFAS Strategic Roadmap."

PFAS are a group of manufactured chemicals that include chemicals known as perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), and GenX. PFAS are also referred to as "forever chemicals" because of their resistance to breaking down in the environment over time. There are nearly 5,000 different types of PFAS, some of which have been more widely used and studied than others, according to the U.S. Food and Drug Administration (FDA).

EPA authority for this rule falls under the Toxic Substances Control Act (TSCA). The rule is a statutory requirement under the FY2020 National Defense Authorization Act (NDAA) that requires all manufacturers (including importers) of PFAS and PFAS-containing articles in any year since 2011 to report information related to chemical identity, uses, volumes made and processed, byproducts, environmental and health effects, worker exposure, and disposal to the EPA.

Read More

EHS Daily Advisor, 06-11-23

<https://ehsdailyadvisor.blr.com/2023/11/pfas-final-data-reporting-regulations/>

Department of Pesticide Regulation Proposes Regulation to Provide Public Access to Pesticide Information Prior to Applications

2023-11-02

Today, the Department of Pesticide Regulation (DPR) noticed a proposed regulation for a statewide system that will provide the public with information prior to intended applications of restricted material pesticides in California.

DPR's proposed regulation builds on the process in the state of California to regulate restricted material pesticides. Applicators must be licensed, obtain a permit and provide notice to the county agricultural commissioner prior to applications of restricted material pesticides. The proposed regulation would require information about restricted material applications for the production of an agricultural commodity

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to be submitted electronically to DPR for public posting through a new statewide information system 24 hours prior to intended restricted material pesticide applications except for soil fumigant restricted materials, which would be posted 48 hours before an intended application.

The proposed regulation complements California's existing regulatory system that includes the evaluation and registration of pesticides before use, restrictions on pesticide use to reduce risk to people and the environment, and the enforcement of pesticide laws and regulations by DPR and the state's 55 county agricultural commissioners.

DPR is holding three public hearings on the regulation: Dec. 13 in Clovis, Dec. 14 in Ventura and Dec. 19 in a virtual setting. The department is additionally accepting written comments on the proposed regulation between Nov. 3, 2023, and Jan. 12, 2024.

"This proposed regulation and statewide pesticide application information system are an important advance in increasing transparency and equitable access to information for all Californians," said DPR Director Julie Henderson. "The proposed regulation builds on and complements the strict regulatory programs carried out by the Department of Pesticide Regulation and county agricultural commissioners that keep people and the environment safe."

The proposed regulation follows a two-year period of outreach conducted by DPR to inform development of the statewide information system, including four focus groups and eight public meetings held between 2021-2022 and a series of pilot projects hosted by four counties to test elements of system design in 2022. The department is currently conducting beta testing to inform the ongoing development of the technology needed to support the statewide system. The department began system development in 2021 after the state's 2021-2022 budget allocated an initial \$10 million over four years for that purpose.

The draft regulation can be viewed on DPR's website.

Public Comment Period Open Nov. 3, 2023, through Jan. 12, 2024

Public comments may be submitted via email sent to dpr23003@cdpr.ca.gov or by mail sent to DPR 1001 I Street, P.O. Box 4015 Sacramento, CA 95812-4015.

Public Hearings Held on Dec. 13, 14 and 19, 2023

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DPR is hosting three public hearings to collect oral and written comments on the proposed regulation.

- **Wednesday, Dec. 13, 2023, at 4:30 p.m.**

Clovis Veterans Memorial District

Memorial Auditorium

808 4th Street

Clovis, California 93612

- **Thursday, Dec. 14, 2023, at 4:30 p.m.**

Ventura County Fairgrounds

Santa Rosa Hall

10 West Harbor Boulevard

Ventura, California 93001

- **VIRTUAL Tuesday, Dec. 19, 2023, at 4:30 p.m.**

Held on Zoom

Webinar ID: 873 2837 5612

Read More

California DPR, 02-11-23

<https://www.cdpr.ca.gov/docs/pressrls/2023/110223.htm>

EUROPE

Pollinators: MEPs call for increased action and funding to reverse decline

2023-11-23

The Environment Committee adopted a resolution on the revised EU Pollinators Initiative calling for increased action to reverse pollinator decline and achieve EU Green Deal.

In the resolution, adopted with 65 votes to 1 and 3 abstentions, MEPs endorse the main goal of the revised EU Pollinators Initiative to reverse pollinator decline, which poses a threat to human well-being, agricultural productivity, food security and nature in general.

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MEPs remind of their resolution of 23 October 2019 on the impact of plant protection products on honeybees and refer to the revised EFSA Bee guidance document. They also call on the Commission and EFSA to enable a transition towards a more holistic and contextualised environmental risk assessment of pesticides for insects, including pollinators.

While they recognise the contribution made by the first EU Pollinators Initiative, they call on the Commission to incorporate the results of this Initiative in the next Biodiversity Strategy and underline that measures to address biodiversity loss should also take place outside protected areas.

MEPs also call on the Commission to assess the compliance of CAP Strategic Plans with the objectives of the EU Pollinators Initiative and to create a specific chapter within these Plans to describe concrete measures aiming at wild and managed pollinators' protection. They also seek improved pollinator monitoring and a specific pollinator indicator for the Common Agricultural Policy by 2026

MEPs also want to stop import of agricultural products produced using pesticides that are banned in the EU by 2027, as they can cause unacceptable harm to pollinators globally.

As regards funding, MEPs call on the Commission to assess new avenues for financing the measures needed to meet the objectives of the EU Pollinators Initiative, including by setting up a Nature Fund within the next Multiannual Financial Framework. They also want the Commission to propose a dedicated budget line to support systematic biodiversity monitoring, indicators and reporting on state, trends and pressures across all EU countries. The need for research, knowledge and capacity building is also highlighted.

Finally, MEPs also acknowledges the European Citizens Initiative Save Bees and Farmers saying that the demands of citizens need to be translated into future policies quickly and efficiently.

Next steps

The entire House is scheduled to adopt the text during the 20-23 November 2023 plenary session where they will also seek answers from the Commission and the Council to their oral questions on the EU Pollinator Initiative.

Background

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The revision of the EU Pollinators Initiative complements the Nature Restoration Law and is a key part of the Biodiversity Strategy 2030, the Farm to Fork Strategy and the European Green Deal.

Another related file is the sustainable use of plant protection products, where the Environment Committee adopted its position on 24 October 2023. It includes targets to reduce the use and risk of all chemical pesticides by at least 50 % by 2030 and the use of more hazardous plant protection products by 65 %.

Read More

European Parliament, 08-11-23

<https://www.europarl.europa.eu/news/en/press-room/20231031IPR08709/pollinators-meps-call-for-increased-action-and-funding-to-reverse-decline>

Forever chemicals: New report claims PFAS are sprayed onto fields and food in pesticides

2023-11-09

A new report exposes the 'urgent' threat of forever chemicals in pesticides, as it calls for tighter EU regulation.

Dozens of substances used in pesticides in Europe are 'forever chemicals', a new investigation reveals.

The stable door is slowly closing on PFAS - man-made per- or poly-fluorinated alkyl substances which persist in the environment for an incredibly long time.

The EU is set to restrict their use and phase them out with a review of its REACH regulation that governs chemicals. It is part of a promised 'great detox' on dangerous substances.

But this won't apply to pesticides - and that's a big problem, according to the NGOs Générations Futures and Pesticide Action Network (PAN) Europe.

"It is shocking to find that PFAS, with their long-lasting environmental impacts, are intentionally sprayed on fields and food," says Angeliki Lysimachou, head of science and policy at PAN Europe. "Given all the identified risks, their use should stop immediately."

A new joint report from the two NGOs has found that 37 active substances currently approved for use in pesticides are PFAS. That equates to 12 per cent of all approved synthetic substances.

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Why are PFAS in pesticides a problem?

PFAS are a growing cause for public concern. Recent research has revealed shocking findings - such as the news that rainwater almost everywhere on Earth has unsafe levels of forever chemicals.

This pollution has many potential sources, from chemical manufacturing plants to firefighting foams.

Read More

Euronews.green, 09-11-23

<https://www.euronews.com/green/2023/11/09/forever-chemicals-new-report-claims-pfas-are-sprayed-onto-fields-and-food-in-pesticides>

INTERNATIONAL

Ksh100,000 Fine For Kenyans Making Herbal Medicine Without Following Regulations

2023-11-06

The Kenya Drugs Authority Bill, 2022, introduced by the Ministry of Health, has put forth strict measures for individuals involved in the sale of herbal medicine.

Kenyan citizens must adhere to the requirements stated in this particular bill proposed to the Parliamentary Health Committee. Failure to do so will be considered a violation of the law. This can lead to a maximum fine of Sh100,000, one-year imprisonment, or both. The proposed bill defines herbal medicine as substances sourced from plants that can elicit therapeutic or health benefits for humans or animals.

Furthermore, the legislation specifies that herbal medicine can consist of raw or processed ingredients sourced from one or more plants, as well as materials of inorganic or animal origin. Herbalists will only be held accountable for the aforementioned offences if the medicine was used per the instructions on the label or in a manner that is customary for its intended purposes. In addition, the Ministry of Health has proposed that the sale of herbal medicine containing any filth or harmful foreign substances, in whole or in part, will be considered an offence.

Upon passing the bill, the sale of unhygienically handled herbs for medicinal purposes will be deemed unlawful. Furthermore, peddling

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herbal products with misleading therapeutic cosmetic labels will be regarded as an infringement. If the bill is enacted, the Kenyan government will set up the Kenya Drugs Authority to regulate the control and administration of drugs and chemical substances.

Read More

Mwakilishi, 06-11-23

<https://www.mwakilishi.com/article/kenya-news/2023-11-06/ksh100000-fine-for-kenyans-making-herbal-medicine>

The chemical industry may have killed a landmark EU chemical policy. Here's what that means for the US.

2023-11-09

Improvements to a pivotal European chemical policy may have permanently stalled after political pressure and industry interference in what many European environmental advocates say is a step backward for public health.

REACH, which stands for Registration, Evaluation, Authorisation and Restriction of Chemicals, was enacted in the European Union 2007. Unlike chemical regulation in the U.S., REACH requires chemical companies to research the safety of their chemicals — such as those used in pesticides, cleaners, personal care products and plastics — before those chemicals can be sold. REACH, which applies to all chemical substances in products sold in the EU, is meant to protect the public from adverse health effects caused by hazardous chemicals.

Higher standards in the EU tend to drive up standards globally, Tatiana Santos, the head of chemicals policy at the European Environmental Bureau, a network of environmental advocacy organizations in the EU, told Environmental Health News (EHN). "Many parts of the world benefit actually from REACH, not only Europeans."

As part of the 2020 European Green Deal, the European Commission (the EU's executive branch) promised to propose a revised version of REACH that would improve its effectiveness, particularly by requiring stricter data collection in research done by chemical companies.

The European Parliament would then vote on the revised version, deciding to either pass or reject the law. The European Commission originally promised to release a proposed revision by the end of 2022, then delayed their goal to December 2023. But now, a leaked copy of the commission's

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2024 agenda and sources with inside knowledge of the political process indicate it's unlikely the proposed revision will be released this year or released at all, dashing environmental advocates' hopes that REACH will be revised before the 2024 European Parliament elections. Without a REACH revision, chemical companies that sell products in both the U.S. and EU will have one less reason to commit to safer chemistry, and U.S. consumers could pay the price.

Read More

EHN, 09-11-23

<https://www.ehn.org/eu-reach-chemical-policy-2666066709.html>

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NOV. 17, 2023

Poison centre notifications: ensuring compliance for industrial use mixtures

2023-11-14

Summary

Join us for an informative webinar that will equip notifiers of industrial use only mixtures with essential knowledge ahead of the compliance date on 1 January 2024.

This webinar gives an overview of the changes to the CLP Regulation and their potential impact on poison centre notifiers. Gain valuable insights into the submission format, tools, and support that will facilitate your compliance process.

Read More

ECHA, 10-11-23

<https://echa.europa.eu/-/poison-centre-notifications-ensuring-compliance-for-industrial-use-mixtures>

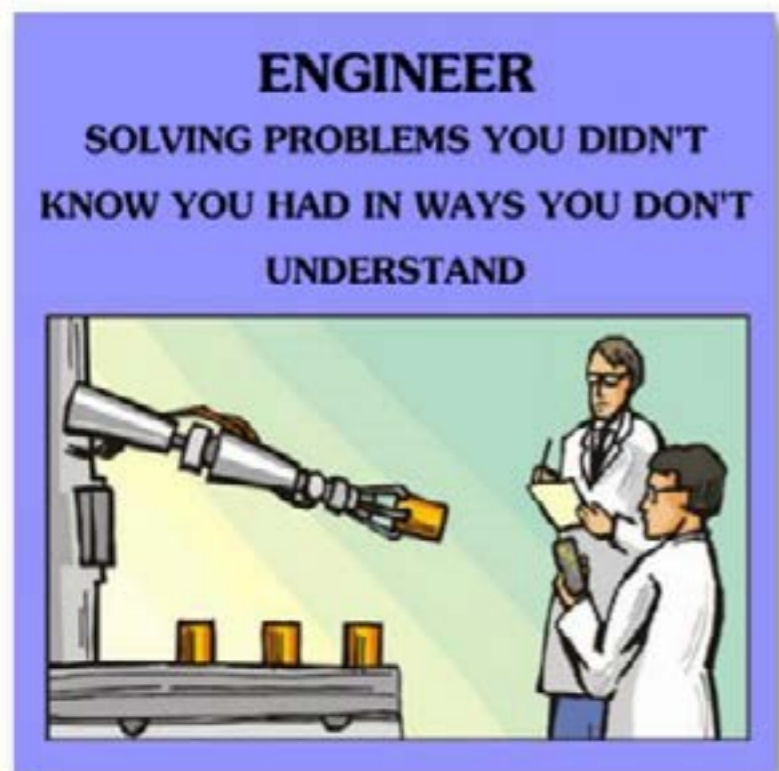
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Janet's Corner

NOV. 17, 2023

Engineer

2023-11-17



<http://chemicalengineeringnews.org/>

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Hazard Alert

NOV. 17, 2023

Propylene Glycol

2023-11-17

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,

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.

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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.

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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]

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 Protective Equipment [5]

- Splash goggles;
- Full suit;
- Vapour respirator;
- Boots;
- Gloves;
- A self-contained breathing apparatus should be used to avoid inhalation of the product;

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

REGULATION

United States

The following exposure limits are for Coal Tar Pitch Volatiles:

- 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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Gossip

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Researchers improve water splitting reaction for green hydrogen gas production

2023-11-15

It is a simple reaction, ensures high-quality products, and has zero carbon emissions. Despite its advantages, however, electrochemical water splitting has yet to gain prominence on a commercial scale. This is because of the low electrical conductivity of active (oxy)hydroxide catalysts generated in situ during the electrochemical processes. This, in turn, leads to restricted catalytic activity, hampering hydrogen as well as oxygen evolution reactions in the cell.

The problem of (oxy)hydroxide’s poor electrical properties has been a long-standing challenge to the achievement of efficient water splitting. Now, a team of researchers led by Associate Professor Junhyeok Seo from the Department of Chemistry at Gwangju Institute of Science and Technology, has found a solution to this issue in the form of Schottky junctions.

In a recent study published in Applied Catalysis B: Environmental, they demonstrated an electrode with a Schottky junction formed at the interface of metallic nickel-tungsten nitride (Ni-W₅N₄) and semiconducting n-type nickel-iron (oxy)hydroxide (NiFeOOH) catalyst. This electrode was able to overcome the conductance limit of (oxy)hydroxide and improved the water-splitting ability of the setup.

Notably, two materials, a metal, and a semiconductor, with largely different electronic behaviors, were put in contact to make an energy difference at the interface, forming a junction. “Our research utilized this potential energy barrier present in the Schottky junction to accelerate electron flow in the electrode, leading to a significant increase in oxygen evolution reaction activity, expediting overall water splitting,” explains Dr. Seo, highlighting the core mechanism behind their newly designed electrode.

Upon carrying out electrocatalytic water splitting, the team observed that Ni-W₅N₄ alloy catalyzed the hydrogen evolution reaction, resulting in 10 mA/cm² current density at a small overpotential of 11 mV. Furthermore, the rectifying Schottky junction formed at the interface of Ni-W₅N₄|NiFeOOH nullified the non-conductive lamination produced by (oxy)hydroxide species.

In forward bias, it exhibited a current density of 11 mA/cm² at 181 mV overpotential. The electrochemical analysis of the electrode revealed that

Green hydrogen (or H₂) produced from renewable energy resources is the fuel of a decarbonized future. Electrolysis, or splitting of water into oxygen and hydrogen with the help of an electrochemical cell, is one of the most popular ways of producing green H₂.

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the improved catalytic activity could indeed be attributed to the Schottky junction.

Lastly, the researchers designed an electrolyzer using their Schottky junction electrode for industrial seawater electrolysis. They found that the new device could operate continuously for 10 days, while also exhibiting outstanding catalytic activity and durability during electrolysis. It showed a remarkable current density of 100 mA/cm² at an overpotential of just 230 mV.

Overall, the researchers believe that these findings can contribute toward a sustainable strategy for hydrogen production to eventually replace conventional methods that still rely on fossil fuels. As Dr. Seo concludes, "Freshwater and seawater are abundant and renewable sources of protons. Efficient water splitting systems ensure that we can establish sustainable production of zero carbon hydrogen fuel, thus helping manage our current climate problems."

Phys Org, 15 November 2023

<https://phys.org>

New drug given every few months reduces high blood pressure in trial

2023-11-13

According to the American Heart Association's 2023 report, some 46.7% of American adults have high blood pressure. If untreated, the condition can lead to a variety of complications, including an increased risk of heart disease. It's most commonly treated with oral medication like ACE inhibitors or calcium channel blockers, which need to be taken once or twice a day.

An experimental drug could help reduce that disease management burden by only needing to be administered every few months. Administered via subcutaneous injection, similar to insulin for diabetics, Zilebesiran is an RNA interference agent that targets a liver hormone called AGT that regulates blood pressure.

The current trial investigated Zilebesiran's safety and efficacy in 377 patients with mild-to-moderate high blood pressure, defined as systolic blood pressure of between 135 and 160 mmHg. These patients were randomized into five groups, receiving either 150, 300 or 600 mg of Zilebesiran every six months, 300 mg every three months, or a placebo.

People with high blood pressure may soon be able to swap the daily pills for an injection every few months. A phase 2 clinical trial has shown that a drug called Zilebesiran can drastically reduce blood pressure for long periods of time with no side effects.

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Patients who received any dose of Zilebesiran showed reductions in 24-hour systolic blood pressure of more than 10 mmHg on average, compared to the placebo group. At the three-month check-up, it was reduced by 14.1 mmHg for the 150-mg dose, 16.7 mmHg with the 300-mg dose, and 15.7 mmHg for the 600-mg dose.

After six months, patients receiving the drug were significantly more likely to have reductions of 20 mmHg, which in many cases brought their 24-hour average systolic blood pressure below 130 mmHg – under the threshold for even mild high blood pressure.

Not only would a drug like this reduce the hassle of taking a pill every day, it also resulted in more consistent blood pressure reductions throughout both day and night. After all, patients can't take a pill while they sleep.

Few adverse effects were detected, with the most common being mild reactions at the injection site. Four patients experienced reactions that led to discontinuation of the drug, but none were too serious, the team says.

"Our study demonstrates that either quarterly or biannual doses of Zilebesiran can effectively and safely lower blood pressure in patients with uncontrolled hypertension," said George Bakris, lead author of the study. "It is well known that reductions in systolic blood pressure of greater than or equal to 5 mmHg are linked to a reduction in cardiovascular risk. These results reinforce the potential of Zilebesiran to provide sustained blood pressure control, improve adherence to medication via infrequent dosing, and in turn, improve outcomes for people with high blood pressure."

The next phase of the trial will investigate longer-term safety and whether the drug may prevent cardiovascular events such as heart attacks and stroke that often follow untreated high blood pressure.

The research was presented at the American Heart Association Congress, and is expected to be published in a journal in the next few weeks.

New Atlas, 13 November 2023

<https://newatlas.com>

Tau Proteins Visualized While Neurons Are "Talking"

2023-11-15

The study led by Dr Ramón Martínez-Mármol and PhD student Shanley Longfield from UQ's Queensland Brain Institute used super-resolution

For the first time, University of Queensland (UQ) researchers have shown how the tau protein, known for its role in dementias, behaves where communication in the brain takes place.

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microscopy to visualise individual tau proteins in motion while neurons are “talking” to each other.

Dr Martínez-Mármol explained that the team’s discovery is a big step towards understanding what triggers tau aggregation in disease states like Alzheimer’s disease.

“We discovered that tau in a healthy brain controls an important population of vesicles at the presynapse critical for neuronal communication,” Dr Martínez-Mármol said.

“These vesicles are like the words that neurons use to transmit information to other neurons.

“For the very first time, we’ve shed light on the mechanism by which tau acts in our nerve cells.

“By understanding tau’s role in a healthy context, we begin to fully understand what leads to the abnormal accumulation of tau in disease.”

Ms Longfield said that observing tau’s behaviour in healthy states provides clues to how these toxic aggregates start to form.

“Studying tau in a healthy brain is more challenging than studying it in a diseased brain, where changes in its molecular behaviour are far more prominent and obvious,” Ms Longfield said.

“But by visualising tau at the nanoscale and in this context, we can identify the molecular behaviours that precede the formation of toxic protein aggregates in disease.”

The team also discovered that tau molecules form tiny condensates, dense gel-like bodies within brain cells, which resemble oil droplets suspended in water.

“What we noticed is that these tau condensates are very fluid-like and dynamic and are tightly regulated by synaptic activity,” Ms Longfield said.

“In neurodegenerative disorders, these condensates get bigger and denser and eventually form aggregates, which are destructive to brain function.

“Our next challenge is to track diseased tau in brain cells to see how this new function is altered, leading to tau aggregation.”

Technology Networks, 15 November 2023

<https://technologynetworks.com>

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A formula to calculate carbon

2023-11-14

As we approach COP28, the world’s attention is once again focused on the urgent need to combat climate change. The world is at a critical juncture, and industries across the globe must step up efforts to reduce greenhouse gas (GHG) emissions, including the target of reducing global emissions by 45% by 2030. Among these industries, the chemical sector plays a pivotal role. It is the backbone of the global economy, with countless sectors dependent on its processes and products. But chemical companies also generate a large amount of GHG emissions, and to meet these ambitious climate goals, the sector must undergo a profound transformation.

Calculating emissions from ‘cradle to gate’

Together for Sustainability (TfS), a global initiative led by the chemical sector with 50 members that include some of the world’s largest chemical groups, is dedicated to decarbonising the industry’s supply chain. This is critical yet complex, as measuring emissions accurately and comprehensively is a difficult task due to the intricate and varied nature of chemical processes, whether making plastics to producing paint.

Product carbon footprints (PCFs) offer a solution to this challenge. A PCF is the carbon footprint of a product from ‘cradle to gate’, providing the total sum of GHG emissions of products. PCFs help to quantify and manage carbon emissions, particularly indirect emissions arising from the supply chain, known as scope 3.

In September 2022, TfS launched the PCF guideline, a detailed step-by-step guide for chemical suppliers to calculate the carbon footprint of their products. The first of its kind for the chemical industry, the PCF guideline offers specific guidance on PCF calculation requirements for each chemical material. It harmonises PCF calculation approaches across the industry and helps identify the factors that generate the highest emissions. In the future, this will allow consumers and the wider market to directly compare and assess the climate impact of different products.

Putting the PCF guideline into practice

To demonstrate how the PCF guideline works in practice, we can use the example of citric acid – a widely used chemical in the food, cleaning and cosmetic industries. Calculating the PCF of citric acid involves considering emissions from the cultivation and harvesting of raw materials (eg, citrus

With COP28 just around the corner, Katherine Agapitos, chair of Together for Sustainability scope 3 GHG emissions programme, discusses why decarbonisation in the chemical sector is crucial, the challenges facing chemical companies and using product carbon footprint guidelines as a solution.

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fruits), the energy and resources consumed during production, and whether clean or fossil fuel sources were used to generate electricity.

One of the key strengths of the PCF guideline is its ability to address the unique challenges posed by the chemical industry. Chemical manufacturing is often a complex web of processes with multiple stages and diverse feedstock sources. The guideline provides the necessary methodologies and data sources to accurately account for these complexities, ensuring that emissions calculations are both rigorous and relevant.

The adoption of the PCF guideline offers several benefits for chemical manufacturers and suppliers, including:

1. **Accurate scope 3 emissions measurement.** By using the PCF guideline, companies can measure their scope 3 emissions, which represent an estimated 77% of the sector's carbon footprint. This knowledge empowers companies to set informed targets and take meaningful actions to reduce their emissions and environmental impact.
2. **Improved supply chain transparency.** The PCF guideline promotes transparency within supply chains. Companies can trace the carbon footprint of their products back to specific processes and suppliers, allowing for more informed decisions and the identification of opportunities for emission reductions.
3. **Harmonised processes and efficiency.** TfS is working on an IT solution that will streamline and automate the process of PCF data sharing between TfS members and their suppliers, making the process more efficient and consistent across the industry. This harmonisation enhances the comparability of PCFs, enabling companies to measure progress against an established baseline and facilitate discussions on emissions-reduction opportunities.

Over the past year, members of TfS have begun implementing the guideline. Doerte Lorenz, director of sustainable procurement at LyondellBasell and TfS coordinator, said: 'At LyondellBasell, we use the TfS PCF guideline as a standardised industry approach to calculate product carbon footprints. Reducing our greenhouse gas emissions is a crucial sustainability goal for us, and working with our suppliers to understand carbon emissions at the product level is one of the most important strategies to achieve our scope 3 emissions reduction targets. We see great value in applying the TfS PCF guideline to understand scope 3 emissions

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across our entire supply chain – and to promote emissions reduction and sustainability more widely.'

Dr Sascha Ceylan, head of sustainability for risk, compliance and procurement at Evonik and co-chair of TfS' governance and partnerships workstream, said: 'Evonik is committed to reducing scope 3 emissions, with a major focus on raw materials. To achieve this, comparable and reliable data is essential. The TfS PCF guideline sets a global standard for high-quality product carbon footprint calculations. Evonik encourages suppliers to adopt this guideline and uses it consistently for its own product calculations. By promoting this standard to customers, Evonik is working towards a more sustainable future for the chemical industry.'

A chemical formula for a sustainable future

As we prepare for COP28, the imperative to decarbonise chemical supply chains becomes increasingly evident.

With the right tools in place, the responsibility now lies with chemical companies and adjacent industries to embrace sustainable practices, and to use resources such as the PCF guideline to kickstart their decarbonisation journey. By taking this crucial step, we can ensure that the chemical sector not only remains the backbone of the global economy, but also a driving force behind a sustainable and resilient future.

Chemistry World, 14 November 2023

<https://chemistryworld.com>

Capturing and Recycling CO₂ To Create New Sustainable Plastics

2023-11-14

In this context, a study led by researchers at the University of Liège and carried out in collaboration with the University of Mons and the University of the Basque Country, reports on a new technique for producing easily recyclable polyurethane plastics. The special feature of this approach is the use of carbon dioxide (CO₂) - a major emblematic waste of our society - as a raw material for the production of the building blocks, or monomers, needed to manufacture these new products," explains Thomas Habets, PhD student at ULiège and first author of the article. The structure of the monomers can be easily modified, making it possible to produce plastics with a wide range of properties, from highly malleable elastomers such as silicones to more rigid materials such as polystyrene". These plastics have

Commodity plastics have transformed global industry. Whether in construction, clothing, vehicles or food packaging, these plastics are everywhere in our daily lives, so much so that their global use has been estimated at around 460 million tons in 2019. This number is staggering, but not surprising, because plastics, also known as synthetic polymers, have met a large success thanks to their irreplaceable characteristics: they are light, cheap and incredibly versatile," explains Christophe Detrembleur, a chemist at the University of Liège. However, the fact that they are difficult to recycle, or even impossible to recycle

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a chemical structure that resembles a three-dimensional network rather than long linear chains. This structure, which is generally associated with thermosets that are very difficult to recycle, makes them more resistant than plastics made from long molecular chains. The polyurethanes created here have new 'dynamic' chemical bonds, which means that despite their thermoset structure, they can be reshaped by exchanges of chemical bonds under relatively mild reaction conditions.

The greatest advantage of this new technology lies in its ability to vary the range of properties accessible while offering multiple ways of recycling materials at their end-of-life. "These new plastics can be recycled in multiple ways, either by simply reshaping them by heating them, or by mixing different types of plastic to create hybrid materials with new properties, or by breaking them down into their constituent monomers, which is ideal for eliminating additives such as dyes or recycling composites," continues Thomas Habets.

With a view to the future industrialization of CO₂ valorization, this study demonstrates that waste CO₂ can be directly used as a chemical resource. "This is the first initial study using our new building blocks and plastics," enthuses Christophe Detrembleur, "but it is quite remarkable to see that our materials can already reach properties similar to those of some conventional petro-sourced plastics." This new technology is emerging as a potential solution for the development of sustainable plastics with a wide range of properties that can easily meet the needs of most of our everyday applications.

Technology Networks, 14 November 2023

<https://technologynetworks.com>

Structurally editable proximal cofactor-like module helps to construct artificial dual-center peroxygenase

2023-11-15

The strategy based on dual-functional small molecules (DFSMs) can convert P450 monooxygenase into peroxygenase, which avoids utilizing the expensive coenzyme and complicate chaperone proteins. However, excess DFSMs are required owing to their low binding affinity for P450, limiting its practical application.

To solve this issue, researchers from the Qingdao Institute of Bioenergy and Bioprocess Technology (QIBEBT) of the Chinese Academy of Sciences

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(CAS) have developed a structurally editable proximal cofactor-like module for constructing an artificial dual-center peroxygenase.

The study was published in *Angewandte Chemie International Edition* on Oct. 27.

The researchers constructed an artificial dual-center peroxygenase by anchoring an editable organic cofactor to the proximal position of the heme center of P450BM3 as a co-catalytic center. The co-crystal structure of P450BM3 in complex with the novel artificial cofactor clearly revealed a precatalytic state in which the cofactor participated in H₂O₂ activation, thus facilitating peroxygenase activity.

Compared with previous DFSMs, the novel artificial cofactors could form more hydrogen bonds and hydrophobic interactions with the enzyme, suggesting a much higher binding affinity. Furthermore, the dissociation constants (K_d) of novel cofactors were accurately determined through titrations. The K_d values of some artificial cofactor were increased by three orders of magnitude and comparable to the binding efficiency of natural enzyme cofactors.

Enzyme activity measurements showed that even with the addition of only a small amount of new artificial cofactors (twice the enzyme amount), the system still exhibited high catalytic activity for typical P450 enzyme oxidation reactions such as olefin epoxidation, hydroxylation of sp³-carbons, and thioether oxidation. Moreover, the researchers found that different catalytic groups, such as imidazole, pyridine or amine groups, had divergent catalytic activity and selectivity for substrates. Therefore, different types of new cofactors would be selected based on the properties of substrates to achieve the optimal catalytic effect in future applications.

Phys Org, 15 November 2023

<https://phys.org>

Ozempic, Wegovy active ingredient may reduce heart risk

2023-11-12

These were the findings of a US study funded by the product manufacturer, Novo Nordisk, in a randomised double-blind trial investigating the effect of the Wegovy dosage in preventing major adverse cardiovascular events in overweight people with cardiovascular disease.

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

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

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

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

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

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

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

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

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

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

Cosmos, 12 November 2023

<https://cosmosmagazine.com>

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Virus observed sucking on another virus' 'neck' for the first time

2023-11-09

The viruses in the study are both categorized as bacteriophages. These are a group of viruses that are known to infect bacteria. Bacteriophages also infect single-celled prokaryotic organisms known as archaea and are commonly called "phages."

Some viruses called satellites (shown in purple) depend on both their host organism and another virus known as a helper to complete its life cycle. The satellite virus depends on the helper virus to build the protective shell that covers its genetic material called a capsid or to help it replicate its DNA. For this relationship to continue, the satellite and the helper must be close to one another for at least a little while, but there were no known cases of a satellite virus attaching to the helper until this discovery.

"When I saw it, I was like, 'I can't believe this,'" study co-author and University of Maryland, Baltimore County biologist Tagide deCarvalho said in a statement. "No one has ever seen a bacteriophage—or any other virus—attach to another virus."

The students who isolated the satellite nicknamed it the MiniFlayer and dubbed its helper the MindFlayer. The team saw this viral relationship between the satellite MiniFlayer and helper MindFlayer while looking at some samples of a family of bacteriophage satellites that infect *Streptomyces* bacteria. They initially believed that the samples had been contaminated due to the large sequences of DNA and some smaller sequences of DNA that didn't match anything they were familiar with.

They took detailed electron microscopy images that show 80 percent of helper viruses in this sample had a satellite bound at its "neck," where the helper's outer shell connects to its tail. The ones that did not still had remnant satellite tendrils at the neck that the team said looked like "bite marks."

Next, they analyzed the genomes of the bacteriophages and bacterial hosts. The satellite viruses had genes that coded for their outer protein shell, but did not have the genes needed to multiply within bacterial cells. This evidence supported the idea that both types of bacteriophages were actually interacting with each other.

They also saw that the satellite viruses did not have a gene that is necessary for them to integrate into the genome of bacterial host cells

For the first time, scientists have observed one virus attaching itself to another virus. An electron microscope captured the interaction in stunning detail and shows how these two different viruses may have co-evolved. The findings were published in the Journal of the International Society of Microbial Ecology on October 31.

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after they have entered them. Since most of the satellite viruses can hide in the host's DNA, they can replicate once the right helper comes along. According to the team, the satellite thus attaches to the helper using a unique adaptation at its tail, so that it can survive without this key gene.

"Attaching now made total sense, because otherwise, how are you going to guarantee that you are going to enter into the cell at the same time? This satellite has been tuning in and optimizing its genome to be associated with the helper for, I would say, at least 100 million years," co-author and University of Maryland, Baltimore County computational biologist Ivan Erill said in a statement.

As of now, this kind of relationship has only been observed in a laboratory setting. Understanding these long-term viral relationships could help scientists discover numerous other examples in nature.

"It's possible that a lot of the bacteriophages that people thought were contaminated were actually these satellite-helper systems," said deCarvalho. "So now, with this paper, people might be able to recognize more of these systems."

Popular Science, 09 November 2023

<https://poposci.com>

study finds unexpected demographic to have highest concentration of dangerous chemical in blood

2023-10-01

Often referred to as "forever chemicals," they cannot be broken down in humans or the environment and can lead to serious health complications, such as types of cancer, birth defects, and kidney disease.

They are so prevalent that they can now be found in human blood samples, and a study has found that one particular demographic seems to have higher levels in their bodies than others.

What's happening?

Per- and polyfluorinated alkyl substances, shortened to PFAS, were developed by DuPont through the 1940s, leading to the creation of Teflon, which was used on non-stick cooking utensils, waterproof clothing, and stain-repellent items.

Harmful chemicals known as PFAS can be found in food, water, and items we use on a daily basis.

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They have since been used in manufacturing for decades, but their impact on health became apparent when it was clear they contaminated the water supply in Parkersburg, West Virginia, near a DuPont plant, affecting the lives of workers and residents.

Despite DuPont having to pay millions following a class-action lawsuit from people in Parkersburg who were exposed to the chemicals — and even more in further legal settlements alongside similar companies — PFAS are still present in a number of items we use today. Forever chemicals are, unsurprisingly, becoming more ubiquitous worldwide.

And a peer-reviewed study, summarized by the Guardian, has now found that Asian Americans have 88% higher median levels of PFAS in their blood compared to non-Hispanic white people.

Why are the levels of PFAS in Asian Americans higher?

The research didn't draw a conclusion on why levels in Asian Americans were among the highest between demographics. But study lead Shelley Liu told the Guardian of one potential reason.

Liu observed that fish is a major source of PFAS exposure, so populations that have higher levels of seafood in their diets might be more at risk.

Notably, the study found "no statistical disparity in PFAS levels of non-Hispanic Black and white people, and Mexican Americans had lower levels than white," reports the Guardian.

How can we limit our exposure to forever chemicals?

It's almost impossible to avoid forever chemicals entirely — because of their presence in a number of things essential to life and their inability to break down — but there are certain things we can do to avoid overexposure.

Clean Water Action suggests avoiding non-stick cookware, even if the item claims to be PFA/PFOA-free. Stainless steel or cast-iron pots and pans are a much safer alternative.

Meanwhile, other advice includes using your own metal or glass containers for takeout food and leftovers, steering clear of microwavable

Scattering sunlight-reflecting particles in the atmosphere could slow rapid melting in West Antarctica and reduce the risk of catastrophic sea-level rise, according to a study led by Indiana University researchers.

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popcorn bags, avoiding stain-resistant coatings on furniture, and not buying outdoor clothing made with fabrics like Scotchgard and Gore-Tex.

The Cool Down, 01 October 2023

<https://thecooldown.com>

Climate engineering could slow Antarctic ice loss

2023-11-15

The study, one of the first to look at how climate engineering might impact Antarctica, comes as scientists sound the alarm over the increasing likelihood of accelerated ice loss in West Antarctica this century. The work appears in the *Journal of Geophysical Research: Atmospheres*.

“Even if the world meets the ambitious target of limiting global warming to 1.5 degrees Celsius above pre-industrial levels -- which we are not on track to do -- we are going to see significant sea-level rise,” said Paul Goddard, an assistant research scientist in the IU College of Arts and Sciences’ Department of Earth and Atmospheric Sciences and the lead author of the study. “Exploring ways to reflect sunlight into space before it is absorbed into Earth’s climate system could help buy us more time to address climate change and avoid or delay climate tipping points, such as collapse of the West Antarctic Ice Sheet.”

In addition to Goddard, co-authors on the paper include IU earth and atmospheric sciences assistant professor Ben Kravitz; Douglas MacMartin and Daniele Visoni of Cornell University; Ewa Bednarz with the National Oceanic and Atmospheric Administration; and Walker Lee of the National Center for Atmospheric Research.

The study explored a form of climate engineering called stratospheric aerosol injection, in which large amounts of tiny sulfur droplets are released into the stratosphere by a fleet of airplanes as a proposed method for keeping global temperatures in check.

The approach mimics what happens when a large volcano spews vast amounts of particles into the upper atmosphere and precipitates a cooling effect that can last months to years. It was recently discussed in a White House report outlining a potential research program on stratospheric aerosol injection and marine cloud brightening, another proposed strategy for cooling the planet.

Ten of the hottest years on record have occurred in the last 14 years. That’s including 2023, which is on track to supplant 2016 as the hottest

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year ever recorded. The spike in global temperatures has coincided with unprecedented heat waves, wildfires, flash flooding, and other climate-related impacts around the world.

In their study, IU researchers and collaborators used high-performance computers and global climate models to simulate different stratospheric aerosol injection scenarios, identifying the cooling strategy with the most potential to slow Antarctic ice loss. A portion of the data analysis conducted for the study took place on IU University Information Technology Services’ large-memory computer cluster, Carbonate.

“Where you release the aerosols matters a lot and can affect the climate differently,” Goddard said. “In this case, we found that releasing stratospheric aerosols at multiple latitudes within the tropics and subtropics, with a greater proportion in the Southern Hemisphere, is the best strategy for preserving land ice in Antarctica because it helps keep warm ocean waters away from the ice shelves.”

Science Daily, 15 November 2023

<https://sciencedaily.com>

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One-dose drug reduced genetic bad cholesterol by 94% for almost a year

2023-11-13

A type of cholesterol, lipoprotein(a) or Lp(a), shares some characteristics with low-density lipoprotein (LDL) cholesterol, the so-called 'bad' cholesterol. Like LDL cholesterol, Lp(a) causes plaque to build up in arteries, reducing blood flow to the heart, brain, and other parts of the body, making it a risk factor for cardiovascular disease. However, because high Lp(a) levels are inherited, they're largely unaffected by exercise, diet, or medications. There are no current treatments for high Lp(a).

Researchers have conducted the first human trials of a new therapeutic called lepodisiran and found that a single injection of the drug lowered Lp(a) to undetectable levels for almost a year by interfering with its mechanism of production.

"How do you beat a risk factor that's largely genetic?" said Steven Nissen, lead author of the study. "One highly effective approach is to interfere with the gene, and that's what lepodisiran and other new therapies are designed to do."

Lepodisiran is a small interfering RNA (siRNA) that disables messenger RNA involved in producing apolipoprotein(a), a component essential for the assembly of Lp(a) particles that is synthesized in the liver. The drug is attached to the sugar N-Acetylgalactosamine (GalNAc), which allows it to be carried into liver cells possessing GalNAc receptors.

Of 48 participants with abnormal Lp(a) levels recruited for the study, 12 were randomly assigned to receive a placebo, and 36 were given a single subcutaneous injection of lepodisiran. In the lepodisiran group, six randomly received different doses: 4, 12, 32, 96, 304 or 608 mg. After three days of inpatient monitoring, the participants were discharged to home. Follow-up blood tests were done for 48 weeks after treatment. None of the participants had pre-existing heart disease.

The researchers found that blood levels of the medication rose quickly – peaking at 10.5 hours – and returned to baseline within 48 hours, likely because it was transported quickly out of the bloodstream and into the liver. With the highest dose of lepodisiran, 608 mg, blood levels of Lp(a) declined rapidly and were undetectable by day 29. Levels remained unmeasurable between days 29 and 281 and then rose slightly, with a median reduction of Lp(a) levels at 94% below baseline at 48 weeks.

Researchers have conducted the first human trials of a new drug, lepodisiran, and found that a single injection reduced lipoprotein(a) – a 'bad' cholesterol with a genetic basis – to undetectable levels for almost a year. It has the potential to eliminate a risk factor for cardiovascular disease for which there is currently no treatment.

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They noted that the smaller doses of lepodisiran produced short-lasting effects, although Lp(a) levels remained down 75% at 48 weeks for those who received the 304 mg dose. The drug was well-tolerated.

"In our view, this therapeutic is very promising," Nissen said. "These data indicate lepodisiran is safe, and its effectiveness at lowering Lp(a) was profound, with near-total elimination of Lp(a) that lasted for a long time. We'll know more after the Phase 2 study, which is underway."

The current Phase 2 clinical trial is testing the medication in people with both high Lp(a) levels and a high risk of early heart attack or stroke.

"If further trials show that this medication – lepodisiran – is safe and can reduce heart attacks and strokes, it would be good news for patients because it eliminates a risk factor we've been unable to treat," Nissen said. "This medication could be a once-a-year injection similar to a vaccine for people with high Lp(a) levels."

The study, funded by Eli Lilly and Company, was presented at the American Heart Association Scientific Sessions 2023 and was published in JAMA.

New Atlas, 13 November 2023

<https://newatlas.com>

Engineering the future of antibiotics

2023-11-10

Before antibiotics became widely available in the 1940s, infectious diseases posed a significant threat to public health, with an average life expectancy for humans of just 47 years at birth in even the most industrialised nations. The discovery of antibiotics has made many previously dangerous or deadly diseases easily treatable. It has enabled much of modern medicine, from surgery to chemotherapy to organ transplants.

However, as bacteria have evolved to resist the effects of these drugs, antimicrobial resistance has become a grave global concern. It is estimated that by 2025, drug-resistant infections will claim the lives of 10 million people annually, equivalent to the current death toll from cancer.

"It's a serious issue, and scientists are looking at alternative ways to kill bacteria," says Dr Shu Lam, head of business development at Linear Clinical Research.

In the ongoing battle against antimicrobial resistance, scientists are exploring innovative approaches to develop new antibiotics capable of tackling the ever-evolving threat of drug-resistant bacteria. One such development is the emergence of polymeric antibiotics, a new class of compounds that show some promise in the fight against bacterial infections.

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A new generation of antibiotics

Ongoing chemistry research has enabled scientists to create a new class of compounds that can fight bacteria. They're known as "antimicrobial polymers," and are synthetic substances composed of large molecules, each consisting of multiple repeating units of simpler chemical structures. Researchers drew inspiration from antimicrobial peptides, also called "host defence peptides" (HDPs), a type of small protein and part of the innate immune response that defend the body against harmful invaders.

HDPs are relatively small, typically composed of 10 to 50 amino acids that confer water solubility and charge-carrying properties, allowing them to attach to bacterial membranes. Their antimicrobial action involves disrupting bacterial cell walls or triggering immune responses.

Natural and synthetic HDPs have proven effective against bacterial infections but have limitations, says Lam, who has spent several years studying antimicrobial polypeptide particles to treat multidrug-resistant bacteria. Peptides are susceptible to degradation in the bloodstream, are expensive to synthesise, and have constraints on the number of amino acids that can be joined in a sequence-defined manner.

"Antimicrobial peptides can be highly specific and effective," says Dr Lewis Blackman, the Drug Discovery Chemistry Team team leader within CSIRO Biomedical Manufacturing. "But they can be rapidly cleared from the bloodstream and, in some cases, stick to proteins in the blood, reducing their effectiveness."

In contrast, polymeric antibiotics offer several advantages that make them an exciting area of research. "One of the holy grails for polymer science is the ability to use low-cost monomers and processes to make polymers of different architectures and lengths while also having perfect sequence and length control," says Blackman.

Playing with structure for precision

Researchers can manipulate the size and structure of polymeric antibiotics to enhance their selectivity for certain types of bacteria, offering a targeted approach to treatment. This precision in targeting holds great promise for addressing bacterial infections with greater specificity and efficacy.

Researchers have experimented with various structural modifications, including sequence control, assessing whether block structures or statistical distributions offer superior antimicrobial activity. They can play

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with factors like how big the polymer is, whether it's a linear chain or branched like a star, whether it self-assembles to make 3D structures or attaches active components to tune antimicrobial activity.

One key advantage of polymeric antibiotics lies in the inherent differences between bacterial and mammalian cell membranes. Bacterial membranes exhibit distinct structural and charge differences compared to mammalian cell membranes. Scientists have used these differences to create polymers that are selectively attracted to bacterial membranes via electrostatic interactions, with minimal impact on healthy mammalian cells.

Recent advances in nanotechnology have further expanded the potential of antimicrobial polymers. Nanoparticles have demonstrated broad-spectrum antimicrobial activity against various pathogens, including bacteria, viruses, fungi, and more. They can disrupt microbial cell membranes, induce intracellular antimicrobial effects, interact with bacterial DNA and proteins, inactivate bacterial enzymes, and interfere with biofilm formation.

Nanoparticles are also effective cargo carriers, capable of transporting and releasing antimicrobial molecules within bacteria. They can be highly specific and biocompatible, with a high potential for synergistic therapy where two or more drugs are administered simultaneously.

Opposing the resistance

Unlike conventional antibiotics, which primarily target specific metabolic pathways within bacteria, polymeric antibiotics employ a multi-pronged attack strategy that has yet to be entirely understood. They target bacterial cell membranes primarily, but some research has shown that they can infiltrate bacterial cytoplasm and interact with bacterial DNA and other metabolic pathways. "The broad-spectrum approach makes it difficult for bacteria to develop resistance, even when exposed to low doses of the polymer multiple times and over a long period of time," says Lam.

Recce Pharmaceuticals, an Australian company developing synthetic polymers to treat infections, including sepsis, burn wound infections, and urinary tract infections, has developed a polymer known as "R327," which irreversibly disrupts the production of adenosine triphosphate (ATP), the primary source of energy for bacterial cells. "It's a universal mechanism of action," says Michele Dilizia, Chief Scientific Officer and Executive Director at Recce Pharmaceuticals. "No matter how much bacteria change, we've got the master key."

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Recce is now testing R327's safety in the phase I clinical trial for urinary tract infection and phase I/II for topical application on infected diabetic foot ulcers. "The road ahead is very promising," says Dilizia.

Overcoming hurdles in clinical translation

As researchers continue to explore the potential of polymeric antibiotics, a critical question remains: can these materials transition from the laboratory to the clinic? The journey from bench to bedside involves assessing in vitro and in vivo toxicity, biocompatibility, cell viability, biodistribution, and immunogenicity. These factors are pivotal in determining whether polymeric antibiotics will become a reality in clinical practice.

Many polymers have demonstrated antimicrobial activity in the lab, but the road to the clinic is rugged. These polymers are often tricky to prepare and hard to administer. They can be toxic to human cells and good bacteria and cause damage to the liver or the bladder where they end up. "The main issue with polymers is never antimicrobial activity. We know they are effective," says Lam. "One of the primary challenges is ensuring their safety when introduced into the human body."

"For something to go into a human, it needs to be really clearly defined and well characterised," says Blackman. "With a polymer, it is somewhat more challenging because you're usually working with distributions rather than specific entities."

While the road ahead may be challenging, ongoing research and advancements in understanding these materials and their interactions with bacteria offer hope for the future.

This is just one solution to antibiotic resistance. Manuela Callari explores many more in her feature for Issue 100 of Cosmos Magazine. To read it online or in print, subscribe to the magazine or become a My Cosmos member.

Cosmos Magazine, 10 November 2023

<https://cosmosmagazine.com>

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Existing drug boots out 'sleeping' bone cells to relieve lower back pain

2023-11-14

"Osteoclasts are the principal bone-resorbing cells essential for bone remodeling and skeletal development, but we have shown that osteoclasts in the endplate of the spinal column undergo senescence, leading to nerve growth and spine pain," said senior author Xu Cao, professor of Orthopedic Surgery at Johns Hopkins University School of Medicine. "Our findings suggest that depletion of these senescent osteoclasts, perhaps by use of existing drugs, could represent a new strategy in the treatment of lower back pain."

The drug in question is experimental anticancer drug Navitoclax, a Bcl-2 inhibitor previously known as ABT263, made by US pharmaceutical company AbbVie. In earlier studies, the drug has shown promise beyond cancer treatment, rejuvenating skin cells and combatting Alzheimer's disease.

Cellular senescence is a key focus of research in the emerging area of geroscience, or age-related disease. Senescent cells are ones that stop dividing, but also don't die off when they should, which can lead to inflammation and, as we are learning, a host of age-related chronic conditions.

It's also one of the main targets of the new class of drugs known as senolytics, which aim to counter the cellular dysfunction that comes with age to extend healthspan and lifespan. Navitoclax is also a senolytic.

When it comes to osteoclasts, these types of senescent cells are 'sleeping' instead of doing their job of breaking down bone to be remodeled for new tissue.

"Senescence promotes age-related musculoskeletal diseases such as osteoporosis, and removing senescent cells from degenerated vertebral disks restores the intervertebral disk structure," explains lead author Dayu Pan, from Johns Hopkins. "We previously found that osteoclasts cause the endplates between each vertebra and disk to become porous, allowing infiltration of new nerves that cause lower back pain. In this study, we set out to test whether this is caused by a specific group of senescent osteoclasts and whether eliminating these osteoclasts could reduce the pain."

In some heartening news for the 80% of Americans who will endure lower back pain in their lifetime, researchers have found that an existing drug can be redeployed to target 'sleeping', or senescent, osteoclast cells to significantly reduce spinal hypersensitivity.

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Using a mouse model, the researchers tested whether senescent osteoclasts were to be found in the porous endplates of animals with two types of pain issues – one age-related and the other the result of lumbar spine instability.

Once identified, they used Navitoclax, which targeted the senescent cells and removed them from the 'construction site', effectively reducing pain in both cohorts of mice and increasing activity, compared to a control group.

Analysis of bone tissue showed a reduced degeneration and porousness in the endplates, and reduced separation between them. They also found that without the senescent cells, the lack of porousness meant new nerves were unable to grow into the bones and trigger sensitivity and pain.

It's a promising result for the researchers, who hope it can be further evaluated in a clinical trial.

The study is available as a peer-reviewed preprint ahead of publishing in the journal eLife.

New Atlas, 14 November 2023

<https://newatlas.com>

Tau Proteins Visualized While Neurons Are "Talking"

2023-11-15

For the first time, University of Queensland (UQ) researchers have shown how the tau protein, known for its role in dementias, behaves where communication in the brain takes place.

The study led by Dr Ramón Martínez-Mármol and PhD student Shanley Longfield from UQ's Queensland Brain Institute used super-resolution microscopy to visualise individual tau proteins in motion while neurons are "talking" to each other.

Dr Martínez-Mármol explained that the team's discovery is a big step towards understanding what triggers tau aggregation in disease states like Alzheimer's disease.

"We discovered that tau in a healthy brain controls an important population of vesicles at the presynapse critical for neuronal communication," Dr Martínez-Mármol said.

"These vesicles are like the words that neurons use to transmit information to other neurons.

Researchers visualise individual tau proteins in motion while neurons are "talking" to each other.

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"For the very first time, we've shed light on the mechanism by which tau acts in our nerve cells.

"By understanding tau's role in a healthy context, we begin to fully understand what leads to the abnormal accumulation of tau in disease."

Ms Longfield said that observing tau's behaviour in healthy states provides clues to how these toxic aggregates start to form.

"Studying tau in a healthy brain is more challenging than studying it in a diseased brain, where changes in its molecular behaviour are far more prominent and obvious," Ms Longfield said.

"But by visualising tau at the nanoscale and in this context, we can identify the molecular behaviours that precede the formation of toxic protein aggregates in disease."

The team also discovered that tau molecules form tiny condensates, dense gel-like bodies within brain cells, which resemble oil droplets suspended in water.

"What we noticed is that these tau condensates are very fluid-like and dynamic and are tightly regulated by synaptic activity," Ms Longfield said.

"In neurodegenerative disorders, these condensates get bigger and denser and eventually form aggregates, which are destructive to brain function.

"Our next challenge is to track diseased tau in brain cells to see how this new function is altered, leading to tau aggregation."

Technology Networks, 15 November 2023

<https://technologynetworks.com>

Synthetic Fats Could Reduce Palm Oil Reliance

2023-11-07

This taint of deforestation has led many conscientious consumers to avoid all things palm oil and seek out alternative fatty products.

But these well-intentioned choices could be supporting agriculture that fells even more trees. Because, when it comes to efficiency, palm oil is hard to beat. To produce the same amount of vegetable oil and meet global demand, crops like coconut trees and sunflowers would take up 4–10 times as much land as the oil palm plant currently does.

Palm oil has a bad reputation. Across Southeast Asia, the versatile vegetable fat is farmed on land that was once millions of acres of lush rainforest.

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So, what's the solution? Well, one group of researchers at the University of California, Irvine, (UCI) has a suggestion: forget the farms; go synthetic.

Low fat, low emissions

In a new paper, published in Nature Sustainability, the researchers posit that swapping out palm oil for synthetic fats could save the world millions of tons of carbon emissions per year.

These synthetic fats, they say, could be manufactured from natural gas feedstocks, such as methane (CH₄).

"The process is made up of a series of thermochemical steps, most of which are already performed at large scale independently of one another," Steven Davis, a UCI professor of Earth system science and lead author of the paper, told Technology Networks.

"At the chemical level, the process starts with carbon as CO₂ or CH₄, converts these into syngas, the syngas is then polymerized into long-chain alkanes (also called paraffins), then the paraffins are oxidized into fatty acids and purified. Finally, the purified fatty acids are used to formulate high-performing fats such as beef tallow or milkfat equivalents."

Technology Networks, 7 November 2023

<https://technologynetworks.com>

Consensus definition of sustainable chemistry sets a clear direction for science, governments and investors

2023-11-09

25 years ago, John Warner and Paul Anastas published their 12 principles of green chemistry. These principles were widely adopted as the field's guiding framework and have helped green chemistry evolve into a major chemistry subdiscipline. By contrast, the field of sustainable chemistry has no such framework and is under-developed in comparison, despite having a great deal of overlap.

Moreover, recent legislative efforts by both the European Commission and the US Government require criteria that can be used to determine whether a chemical process is sustainable. The US Sustainable Chemistry Research and Development Act, 2021, for example, mandates the US Office of Science and Technology Policy to define sustainable chemistry.

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Joel Tickner from the University of Massachusetts Lowell in the US, who put the working group behind the definition together, says groups other than chemical researchers will benefit from the definition. A key example is investors, who are increasingly conscious of the impacts of climate change and need some way to determine which companies are working in a sustainable way. Similarly, governments who want to incentivise more sustainable practices through tax benefits need criteria to determine who qualifies. 'It's important to find a measurable way to evaluate progress and to avoid greenwashing,' explains Tickner.

The working group comprised 20 individuals from academia, industry, government, the investment community and the not-for-profit sector. While the majority were from North America or Europe, the working group accounted for bias arising from this by forming a subcommittee with a specific mandate to consider and incorporate other perspectives. This subcommittee was particularly focused on environmental justice, such as people from certain ethnic groups or economic demographics being disproportionately exposed to harmful substances released into the environment by the chemical industry because of where they live.

To arrive at a satisfactory definition, the working group had to make compromises. For example, Tickner says in an early draft 'we had the word "eliminate" a lot, and a lot of the industry people said "eliminating hazards is just not going to happen, you can't fully get rid of hazards.' So, we changed some of the language to soften it, but then made it clear that this is where we'd like to go. We understand that we're probably never going to get there, but unless you have that north star, you're never going to aim for it.'

'The definition has resulted from a considered and detailed process – it strikes me as as reasonable a working definition as any to go with right now,' comments Helen Sneddon, an expert in green chemistry from the University of York in the UK. However, she says it's important that the definition enables action: 'There is value in having [a definition] to align different groups – and save time. Ultimately, we want to be making a difference not revisiting definitions to make sure everyone is on the same page each time different stakeholders meet.'

Tickner echoes this sentiment and accepts that the new definition is only a starting point. The next step will be to develop metrics that can be used

Sustainable chemistry should be defined as 'the development and application of chemicals, chemical processes, and products that benefit current and future generations without harmful impacts to humans or ecosystems.'

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to measure companies and processes by criteria laid out alongside the definition, thereby allowing it to be put to practical use.

Chemistry World, 11 November 2023

<https://chemistryworld.com>

Sun-run device turns dirty water into hydrogen fuel & drinking water

2023-11-13

Photocatalytic water splitting converts sunlight directly into storable hydrogen but often requires pure water and land for plant installation, while generating unusable waste heat. With water being a precious resource, a photocatalytic device that uses any untreated water source, such as a river, sea, water reservoir or industrial waste water, would be a more sustainable option.

So researchers from the University of Cambridge, inspired by the process of photosynthesis, created a solar-powered device capable of producing clean hydrogen fuel and clean drinking water simultaneously from polluted water or seawater.

“Bringing together solar fuels production and water production in a single device is tricky,” said Chanon Pornrunroj, the study’s lead author. “Solar-driven water splitting, where water molecules are broken down into hydrogen and oxygen, need to start with totally pure water because any contaminants can poison the catalyst or cause unwanted chemical side-reactions.”

The researchers wanted to mimic a plant’s ability to photosynthesize, but unlike previous devices that produced green hydrogen fuel from clean water sources, they wanted their device to use contaminated water, making it usable in regions where clean water is hard to find.

“In remote or developing regions, where clean water is relatively scarce and the infrastructure necessary for water purification is not readily available, water splitting is extremely difficult,” said Ariffin Mohamad Annuar, a study co-author. “A device that could work using contaminated water could solve two problems at once: it could split water to make clean fuel, and it could make clean drinking water.”

They deposited a UV-light-absorbing photocatalyst on an infrared-light-absorbing nanostructured carbon mesh, a good absorber of both light and heat, to generate the water vapor used by the photocatalyst

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to create hydrogen. The porous carbon mesh, treated to repel water, helped the photocatalyst float and kept it away from the water below so contaminants didn’t interfere with its functionality. In addition, this configuration allows the device to use more of the Sun’s energy.

“The light-driven process for making solar fuels only uses a small portion of the solar spectrum – there’s a whole lot of the spectrum that goes unused,” Annuar said.

So, the researchers used a white, UV-absorbing layer on top of the floating device for hydrogen production via water splitting. The rest of the light in the solar spectrum is transmitted to the bottom of the device, which vaporizes the water. This, say the researchers, more closely mimics transpiration, the process of water movement through a plant and its evaporation from aerial parts such as leaves, stems and flowers.

“This way, we’re making better use of the light – we get the vapor for hydrogen production, and the rest is water vapor,” said Pornrunroj.

“This way, we’re truly mimicking a real leaf since we’ve now been able to incorporate the process of transpiration.”

The researchers tested their device using real-world open water sources, including water from the River Cam in central Cambridge and turbid industrial waste from the paper industry. In artificial seawater, the device retained 80% of its initial performance after 154 hours. The researchers say that because the photocatalyst is isolated from contaminants in the water source and remains relatively dry, the device can maintain its operational stability.

“It’s so tolerant of pollutants, and the floating design allows the substrate to work in very cloudy or muddy water,” said Pornrunroj. “It’s a highly versatile system.”

The researchers say their device has the potential to address issues of sustainability and the circular economy.

“Our device is still a proof of principle, but these are the sorts of solutions we will need if we’re going to develop a truly circular economy and sustainable future,” said Erwin Reisner, corresponding author of the study. “The climate crisis and issues around pollution and health are closely

Researchers have created a floating, solar-powered device that converts contaminated water or seawater into clean hydrogen fuel and drinking water. Because it works with any open water source and doesn’t require external power, the device could be used in resource-limited or remote places.

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related, and developing an approach that could help address both would be a game-changer for so many people.”

New Atlas, 13 November 2023

<https://newatlas.com>

Royal Society of Chemistry announces grant to fund 10 projects tackling diversity issues

2023-11-10

The Missing Elements Grants Scheme funding, which comes just over a year after the publication of the RSC’s Missing Elements report which highlighted the problems affecting those from minority ethnic backgrounds, will be shared between projects at 10 universities in the UK and Ireland.

The projects were selected based on their potential to create lasting systemic change in the chemistry field by improving the representation, progression and retention of chemical scientists from Black and minority ethnic backgrounds and supporting a culture of allyship and belonging. All 10 started on 30 October and the majority are set to run until 30 November 2026.

‘Our Missing Elements report laid bare the barriers faced by members of the chemical sciences community from minoritised ethnicities to progress in their careers,’ said Helen Pain, chief executive of the RSC. ‘Through this grant scheme, we are providing the critical financial support needed to ensure that the community is empowered to join us in addressing these barriers.’

‘We were encouraged by the response from the community to the call for applications, particularly in the diversity of approaches, and expect these projects will produce tangible results and ultimately change people’s lives for the better.’

Each of the projects are expected to provide bi-monthly progress updates and a summary of their plans, works and milestones hit on a regular basis. A final detailed report is expected to be ready within two months of the completion of each project.

The RSC’s Missing Elements report revealed that in the past decade there had been no real improvement in the representation of Black people in academic chemistry with Black chemists being lost at ‘an alarming rate’ after a first degree.

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It also found that Black and Asian students are less likely to go to a Russell Group university than their white peers and are more likely to be unemployed than to pursue further study following a degree.

Chemistry World, 10 November 2023

<https://chemistryworld.com>

Research team develops antiaromatic molecules that exhibit absorption and fluorescence bands in near-infrared region

2023-11-15

Their findings, published in *Angewandte Chemie International Edition*, suggest applications for the advancement of the fields of health care, optoelectronics, and materials science.

Absorption and fluorescence are fundamental research subjects in spectroscopy, a field that explores the interaction between light and matter. These photophysical properties are crucial for understanding how molecules and materials behave when exposed to light.

An absorption band represents the specific range of wavelengths where a material absorbs light, causing electrons within the molecules or atoms to transition to higher energy states. Fluorescence bands, on the other hand, relate to the emission of light by a substance that has previously absorbed light, with the emitted light having a longer wavelength than the absorbed light.

The significance of this research lies in the development of organic molecules that emit light in the NIR region, specifically wavelengths between 800 and 1100 nm. This region, known as the “optical window of living tissue,” offers unique advantages in medical applications, including deep biological imaging, photodynamic therapy, and photothermal therapy. NIR light can penetrate tissues more deeply with reduced scattering and minimal photodamage, making it an invaluable tool in health care and life science research.

“Organic molecules exhibiting absorption and emission properties in the near-infrared region are in strong demand for optoelectronic materials in health care applications and fluorescence imaging, such as fluorescent probes for deep biological imaging, photodynamic therapy, and photothermal therapy,” Murai explained.

A research group led by Associate Professor Masahito Murai of the Graduate School of Science and Professor Shige-hiro Yamaguchi of the Functional Organic Materials Laboratory has successfully developed antiaromatic molecules that exhibit absorption and fluorescence bands in the near-infrared (NIR) region, a region that is important for medical devices.

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“However, conventional dyes often suffer from reduced solubility and increased lipophilicity due to the strong interactions between largely extended π -electron systems. These problems make it difficult to mold and process the molecules for use as electronic materials and to apply them to biological imaging.”

The key to the team’s success lays in the fusion of thiophene, a less aromatic heterocyclic ring, with azepine. This fused ring structure effectively balanced antiaromatic and polymethine characters to make electronic transitions of antiaromatic compounds more likely to occur, and as a result, enabling the acquisition of absorption and fluorescence wavelengths in the NIR region. This breakthrough holds the potential to lead to the creation of diverse NIR luminescent materials.

The team designed and synthesized a series of azepine derivatives with electron-accepting groups and used single-crystal X-ray structure analysis to reveal significant structural differences between them.

While the curved dibenzoazepine exhibited absorption and fluorescence at shorter wavelengths, the highly planar dithienoazepine analog exhibited absorption and fluorescence at wavelengths longer than 700 nm. The molecular framework’s utility was further demonstrated by synthesizing a dithienoazepine with cationic indolium groups, which displayed a strong absorption band at 846 nm and a narrow fluorescence band at 878 nm.

Overall, their research introduces a promising avenue for the development of materials with strong absorption and fluorescence properties in the NIR range. Dithienoazepine was a useful core that could achieve long-wavelength absorption and emission despite its small tricyclic skeleton.

The application potential spans a wide array of fields, including fluorescence imaging, sensing, and materials science, with a particular focus on deep-tissue imaging and non-invasive diagnostics, highlighting Nagoya University’s commitment to pushing the boundaries of science and innovation to improve health care using cutting-edge technology.

Phys Org, 15 November 2023

<https://phys.org>

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Curiosities

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US moves to regulate tyre chemical that was found to have killed salmon

2023-11-10

The EPA’s decision to grant the petition, announced earlier this month, comes after a University of Washington study published in December 2020 conclusively linked 6PPD or N-(1,3-dimethylbutyl)-N’-phenyl-p-phenylenediamine to mass die-offs of coho salmon in urban waterways around Seattle.

The researchers, funded by the EPA and others, identified the poisonous substance 6PPD-quinone (6PPD-q) as originating from worn tyre fragments. When 6PPD reacts with ground-level ozone it breaks down into 6PPD-q. The amounts of the substance measured flowing into salmon streams during autumn rainstorms are similar to those that killed coho salmon in hours in the lab.

The petition that spurred EPA action was filed by Earthjustice in August on behalf of the Yurok Tribe, the Port Gamble S’Klallam Tribe and the Puyallup Tribe of Indians, and it requested that the agency consider prohibiting the manufacturing, processing, use and distribution of 6PPD.

Yesterday, West Coast fishing groups filed a federal lawsuit in California against 13 of the largest tyre manufacturers in the US, claiming that they are illegally killing or harming endangered salmon and oceangoing trout by using chemicals like 6PPD in their products. The complaint alleges that the tyre makers violated the US Endangered Species Act by discharging 6PPD-quinone. The Pacific Coast Federation of Fishermen’s Associations and the Institute for Fisheries Resources’ complaint outlines two dozen endangered populations of salmonids along the West Coast that have been affected by the chemical.

By autumn 2024, the EPA intends to publish an advanced notice of proposed rulemaking under the Toxic Substances Control Act (TSCA) that governs US chemical policy. The goal is to obtain more data to inform a subsequent regulatory action. Currently, the agency says there is limited data to inform a human health risk assessment for 6PPD-quinone, and therefore it plans to use other TSCA authorities to collect more information that can better elucidate and characterise risks associated with 6PPD-quinone and those linked to 6PPD.

Chemistry World 10 November 2023

<https://chemistryworld.com>

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Technical Notes

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CHEMICAL EFFECTS

[Deep eutectic solvents for the determination of endocrine disrupting chemicals](#)

[Participant-collected household dust for assessing microorganisms and semi-volatile organic compounds in urban homes](#)

[Radiocarbon \(¹⁴C\) accelerator mass spectrometry as a convenient tool for differentiation of flavor chemicals of synthetic origin from biobased sources and their in-vivo toxicity assessment](#)

ENVIRONMENTAL RESEARCH

[Catchment area, fate, and environmental risks investigation of micropollutants in Danish wastewater](#)

[Occurrence, behavior and fate of liquid crystal monomers in municipal wastewater](#)

PHARMACEUTICAL/TOXICOLOGY

[Global, regional and national burdens of non-melanoma skin cancer attributable to occupational exposure to solar ultraviolet radiation for 183 countries, 2000-2019: A systematic analysis from the WHO/ILO Joint Estimates of the Work-related Burden of Disease and Injury](#)

[Review on heavy metal contaminants in freshwater fish in South India: current situation and future perspective](#)

OCCUPATIONAL

[Effects of personal exposure to the oxidative potential of PM_{2.5} on oxidative stress biomarkers in pregnant women](#)

[Application of Nanoconfinement Technology for Highly Effective Monitoring of Chemical Exposure During Military Service](#)

[HBM4EU e-waste study: Occupational exposure of electronic waste workers to phthalates and DINCH in Europe](#)