CHEMWATCH

Bulletin Board

Contents

SEP. 29, 2023

(click on page numbers for links)

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

Contents

CHEMWATCH
Bulletin Board

Contents

SEP. 29, 2023

ASIA PACIFIC

The following industrial chemical has been added to the Australian Inventory of Industrial Chemicals under section 83 of the Industrial Chemicals Act 2019.

2023-09-19

Chemical added to the Inventory following the issue of an assessment certificate

CAS Number	1000399-21-2
Chemical Name	4,8,11-Dodecatrienal
Molecular Formula	$C_{12}H_{18}O$
Specific Information Requirements	The chemical was assessed for use by professionals and consumers as a fragrance ingredient in cosmetic, personal and household products: imported into Australia at up to 0.2 tonnes per year imported at a concentration of 0.006% or less in finished end-use products
Listing date	12 September 2023
CAS Number	2576531-09-2
Chemical Name	Oils, sandalwood, santalene synthase-modified Rhodobacter sphaeroides-fermented, from D-glucose, oxidized
Molecular Formula	Unspecified
Specific Information Requirements	The chemical has been assessed as a fragrance ingredient in finished products used by workers and consumers and the following: Imported up to 1 tonne per year Household products at a concentration up to 0.02% Cosmetics at a concentration up to 0.1% Fine fragrances at a concentration up to 0.18% Air care products at a concentration up to 2%
Listing date	12 September 2023

CHEMWATCH
Bulletin Board
Regulatory Update
SEP. 29, 2023

Read More

AICIS, 19-09-23

https://www.industrialchemicals.gov.au/news-and-notices/chemical-added-inventory-following-issue-assessment-certificate-early-listing-19-september-2023

Temporary record-keeping provisions for NICNAS introducers extended to 1 April 2024

2023-09-13

Record-keeping provisions for introducers that transitioned from NICNAS to AICIS will continue to be available until 1 April 2024. These arrangements only apply to eligible introducers who are still importing or manufacturing chemicals that were previously on the NICNAS Inventory.

What is the temporary record-keeping arrangement for introducers who transitioned from NICNAS to AICIS?

See Records you can keep for listed introductions if you introduced chemicals under NICNAS. These arrangements were originally set to end on 30 November 2023, but will be extended to 1 April 2024.

Who is eligible to use this record keeping provision until 1 April 2024?

You must meet all 3 below.

1. You imported or manufactured (introduced) a chemical under NICNAS (before 1 July 2020)
2. The chemical you introduced was listed on the NICNAS Inventory and you continued to introduce the same chemical under AICIS after 1 July 2020.
3. You don't know your chemical's CAS name or CAS number.

Why are we extending these arrangements?

We've been exploring ways to resolve challenges that businesses said they faced when complying with AICIS record-keeping obligations under the Industrial Chemicals (General) Rules 2019 (the Rules). As a result, we have developed a suite of proposed changes to the Rules around record-keeping requirements. We will soon announce a public consultation on these proposed changes, along with others relating to AICIS categorisation and reporting obligations.

Our upcoming consultation on changes to record-keeping obligations for listed introductions will be relevant to anyone currently introducing chemicals that were previously on the NICNAS Inventory.

For this reason, we've extended these administrative arrangements to:

- provide enough time to consult with stakeholders on these proposals
- enable the Rules to be considered by the Minister following the end of the public comment period.

Read More

AICIS, 13-09-23

https://www.industrialchemicals.gov.au/news-and-notices/temporary-record-keeping-provisions-nicnas-introducers-extended-1-april-2024

Suspension of specific dimethoate products

2023-09-19

The Australian Pesticides and Veterinary Medicines Authority (APVMA) has suspended the registration and labels of chemical products containing dimethoate used as a post-harvest dip for fruit with inedible peel.

This follows reports received by the APVMA, which indicated the maximum permitted level of pesticide residue (the Maximum Residue Limit; MRL) for omethoate, the main degradation product of dimethoate, had been exceeded in avocados and mangoes.

The information available to the APVMA showed the MRL exceedance was likely due to the use of dimethoate in accordance with the approved instructions for use as a post-harvest dip. The APVMA considers the level of residues detected are unlikely to pose a significant risk to human health but are above the acceptable level for an appropriate margin of safety.

The APVMA has published Notice of the suspension in the APVMA Gazette, 19 September 2023. The Gazette Notice includes instructions for use in a deemed permit that is valid for one year. These instructions allow the continued use of dimethoate but prohibit use of dimethoate as a post-harvest dip on tropical and sub-tropical fruit.

A brief statement of reasons for the decision to suspend the registration of specific dimethoate products and the approval of their labels is also provided in the Gazette Notice.

CHEMWATCH
Bulletin Board
Regulatory Update
SEP. 29, 2023

The APVMA has also varied Permit 87164, held by Horticulture Innovation Australia Ltd, to remove the use of dimethoate as a post-harvest flood spray for assorted tropical and sub-tropical fruits – inedible peel (crop group 006). The permitted use of dimethoate on citrus fruit with inedible peel remains acceptable.

The APVMA remains satisfied that all other approved uses of dimethoate are safe.

Holders of dimethoate product registrations may apply to the APVMA to vary their registration to remove the post-harvest dip use pattern, which will result in the product no longer being suspended.

The decision to suspend the registration and labels of specific dimethoate products follows public consultation, which closed 29 August 2023. No information was provided during consultation to change the APVMA's assessment that the products may not meet the safety criteria and the labels may not meet the labelling criteria set out in the Agvet Code.

Read More

APVMA, 19-09-23

https://apvma.gov.au/node/117576

Singapore passes bill to make recycling of wastewater mandatory for new factories from 2024

2023-09-21

Singapore's Public Utilities (Amendment) Bill was passed by Parliament on August 3, 2023. This bill partially revises the "Public Utilities Act 2001" and legislates the policy announced by the Public Utilities Board (PUB) in March 2023 to require recycling of wastewater from new factories from January 1, 2024 onwards for the wafer manufacturing, electronics, and biomedical industries. In addition, existing provisions have been revised and new provisions have been added to introduce a drainage tax and a water conservation tax for large-scale private water utilities.

The original text of the Bill can be viewed at the following URL: https://www.parliament.gov.sg/docs/default-source/default-document-library/public-utilities-(amendment)-bill-23-2023.pdf

The main contents of the Bill are as follows:

Water efficiency requirements for new facilities (Article 40)

The Bill newly stipulates the obligation to recycle wastewater from new factories.

The following new facilities (*) are subject to water efficiency requirements.

- Belonging to a particular industry and being constructed/constructed for the purpose of carrying out business activities using water; and
- Annual water consumption will be above a predetermined threshold due to its operation

Specific target facilities are expected to be stipulated by separate subordinate laws and regulations. However, according to the PUB's announcement, new facilities (*) with an annual water consumption of 60,000 m3 or more for wafer manufacturing, electronics, and biomedicine are targeted.

(*) Buildings or structures that apply for planning permission and approval of construction plans after January 1, 2024, including the expansion of existing facilities.

The following requirements are imposed on the target facilities:

- Those proposing the construction of a new facility must obtain PUB's approval for the projected water balance of the new facility prior to the commencement of construction work.
- The occupier of the new facility must ensure that the applicable water efficiency requirements (including recycling of wastewater) are met in the operation of the new facility.

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Enviliance, 21-09-23

https://enviliance.com/regions/southeast-asia/sg/report_10924

Textile industry should install air quality monitoring tools: Ministry

2023-09-20

Jakarta (ANTARA) - The Industry Ministry urged the textile industry to install air quality monitoring devices to control harmful gas emissions, especially SOx (sulfur) content, while making semi-synthetic viscose or rayon fabric from wood pulp.

CHEMWATCH
Bulletin Board
Regulatory Update
SEP. 29, 2023

Based on the Circular Letter of the Minister of Industry Number 2 of 2023, the ministry underlines the importance of controlling dangerous gas emissions.

"Companies in this sector are required to install Continuous Emission Monitoring Systems (CEMS) to monitor their exhaust emissions," the ministry's Director General of Resilience, Regional, and International Industrial Access (KPAII), Eko S. A. Cahyanto, conveyed in a statement on Wednesday.

Cahyanto said his side also played an active role by undertaking visits to PT Indo Bharat Rayon and PT South Pacific Viscose that already used CEMS and pollution control equipment, such as an Electrostatic Precipitator (ESP), in their plants.

"The results of field inspections show that the two companies have succeeded in meeting environmental quality standards by the results of emission tests using the Adaptive Monitoring System (AiMS) installed at PT Indo Bharat Rayon," he remarked.

Related news: Cement industry not a source of Jakarta's air pollution: Ministry

As a follow-up step, the ministry has also drafted a Minister of Industry Regulation on Green Industry Standards for the rayon industry.

This draft regulation will apply to all rayon industries in Indonesia to ensure that these industries comply with applicable environmental standards, he remarked.

Cahyanto said this step is expected to reduce the negative impact of the rayon industry on the environment as well as to support nature conservation efforts.

Read More

Antara News, 20-09-23

https://en.antaranews.com/news/294123/textile-industry-should-install-air-quality-monitoring-tools-ministry

AMERICA

FPF comment: US EPA expansion of Safer Choice program

2023-09-14

Via a public comment, the Food Packaging Forum (FPF) is encouraging the US Environmental Protection Agency (EPA) to expand the Safer Choice and Design for Environment (DfE) programs into food contact materials. FPF argues that the ubiquity of packaging as an environmental and human health issue (FPF reported also here and here), along with the known economic costs of chemical exposures of targeted food contact chemicals in the US (FPF reported also here) make food contact materials (FCMs) a prime target market for Safer Choice and DfE.

In August and September 2023, the EPA opened a public comment period for feedback concerning the potential expansion of the agency's programs. The Safer Choice and Design for Environment (DfE) programs aim to promote the use of safer and environmentally friendly products. The Safer Choice program focuses on identifying and encouraging the use of products with safer chemical ingredients, noted in the EPA's Safer Chemical Ingredients List (FPF reported), providing consumers and businesses with a label meant to signify product safety. The DfE program, on the other hand, works to assess and improve the environmental and human health profiles of various products, including chemicals, by collaborating with industries to reduce risks and environmental impacts. Currently, the programs focus on cleaning products with DfE additionally covering pesticides.

A shortened version of the comment follows.

The FPF's key concern revolves around the potential migration of hazardous chemicals from FCMs. Through the combined FCCmigex and Food Contact Chemical databases, FPF has documentation for over 14,000 known food contact chemicals (FPF reported). Some with known hazardous properties and linked to substantial economic costs. For example, ortho-phthalates in plastic FCMs incur annual losses of $39.9–47.1 billion, and long-chain PFAS exposure results in an annual disease burden and costs ranging from $5.52 billion to $62.6 billion.

FPF has developed or contributed to the development of two tools that could help the EPA should it decide to investigate FCMs for the Safer

CHEMWATCH
Bulletin Board
Regulatory Update
SEP. 29, 2023

Choice and DfE programs, (i) Food contact chemicals of concern list, and (ii) the UP Scorecard chemicals of concern metric.

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FPF, 14-09-23

https://www.foodpackagingforum.org/news/fpf-comment-us-epa-expansion-of-safer-choice-program

U.S. FDA ISSUES MORE DRAFT GUIDANCE DOCUMENTS ON COSMETIC FACILITY REGISTRATION AND PRODUCT LISTING

2023-09-22

The U.S. Food and Drug Administration (FDA) has posted three draft documents outlining the cosmetic facility registration and product listing process.

First, is the draft Cosmetics Direct Electronic Submissions Portal document that provides screen shots and step-by-step instructions on how to complete cosmetic facility registration and product listing using the new Cosmetics Direct portal.

Note, the portal is not available as of this time, the FDA has stated that the portal should become available in October.

The other two draft documents are paper forms that may be used instead of electronic submissions. However, the FDA encourages the use of electronic submissions over mail-in paper submissions as the processing time is faster.

For anyone that needs to submit a cosmetic facility registration or cosmetic product listing, these draft guidance documents can provide insight on what kind of information you will need to complete the submission process by the December 29, 2023 compliance date.

Read More

Bureau Veritas, 22-09-23

https://www.cps.bureauveritas.com/newsroom/us-fda-issues-more-draft-guidance-documents-cosmetic-facility-registration-and-product

EDF Urges EPA to "Use TSCA to Turn Off the PFAS Tap"

2023-09-21

The Environmental Defense Fund (EDF) published a blog item on September 18, 2023, entitled "Now's the Time — How EPA Can Use TSCA to Turn Off the PFAS Tap." According to EDF, for both previously approved per- and polyfluoroalkyl substances (PFAS) and for new PFAS, the U.S. Environmental Protection Agency (EPA) should:

- Use the Best Available Science: EDF states that EPA's Toxic Substances Control Act (TSCA) program should rely on the scientific expertise on PFAS across the Agency, such as the Integrated Risk Information System (IRIS), which has been evaluating PFAS, and EPA's proposed drinking water standards "based on robust scientific findings."
- Assess Cumulative Risks: According to EDF, EPA's TSCA program "considers PFAS chemicals in isolation," which is "an outmoded strategy for protecting human health and the environment." EDF states that EPA should "move toward a cumulative risk assessment model, accounting for the effects of exposure to multiple PFAS chemicals, especially to vulnerable populations."
- No Release Is Negligible: EDF states that EPA has argued that some PFAS should be of little concern if they have negligible releases. EDF notes that PFAS are environmentally mobile, highly persistent, and bioaccumulative, and that every release contributes to long-term, cumulative exposure.
- Facilitate Safer Alternatives: EDF suggests that by using TSCA to restrict or ban PFAS, "EPA would incentivize the rapid development and adoption of safer alternatives — a step that is long overdue."

EDF concludes that by using its full authority under TSCA, "EPA can ensure a future where chemicals do not compromise our health and safety."

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Lexology, 21-09-23

https://www.lexology.com/library/detail.aspx?g=465b9630-9640-4403-9884-6d2d9d5b26f4

CHEMWATCH
Bulletin Board
Regulatory Update
SEP. 29, 2023

Canada: Forever Chemicals And Canadian Businesses: What You Need To Know About PFAS

2023-09-21

Global awareness of the risks and liabilities associated with the use and persistence of per- and polyfluoroalkyl substances (PFAS) has been growing over the past two decades. In response, governments in Canada and elsewhere have been grappling with how to regulate these "forever chemicals."

As discussed in our prior article, Understanding PFAS in Canada: An emerging risk, PFAS are a group of over 4,700 synthetic chemicals characterized by a fluorinated carbon chain. The strength of the carbon-fluorine bonds makes PFAS capable of repelling water, oils, and heat. These repellant properties have led to the wide use of PFAS in a variety of applications, including in stain and water repellant textiles, food packaging, consumer products, waxes, paints and cosmetics.

To date, the federal regulation of PFAS in Canada has been restricted to regulations under the Canadian Environmental Protection Act, 1999 (CEPA), which target only the mostly widely known and studied PFAS substances: Perfluorooctane sulfonate (PFOS), Perfluorooctanoic acid (PFOA), and Long-chain perfluorocarboxylic acids (LC-PFCAs). However, on May 20, 2023, the federal government took the next step towards regulating the broad class of PFAS as a whole, publishing a Draft State of Per- and Polyfluoroalkyl Substances (PFAS) Report (the draft state of PFAS Report) and a report summarizing proposed risk management measures for PFAS, entitled Risk Management Scope for Per- and Polyfluoroalkyl Substances (PFAS).

Significantly, the federal government is proposing to take the rare step of concluding that the entire class of PFAS has the potential to cause harm to the environment and human health, and therefore should be considered "toxic substances" pursuant to sections 64(a) and (c) of CEPA. The proposed designation of the entire class of PFAS as toxic is significant, as it will result in greater restrictions (and prohibitions) on the manufacture, use, sale and import of a wide range of products containing PFAS. Proposed changes mean that industry will not be able to turn to using presently unregulated types of PFAS, thus creating the need to find non-PFAS alternatives.

Read More

Mondaq, 21-09-23

https://www.mondaq.com/canada/environmental-law/1368602/forever-chemicals-and-canadian-businesses-what-you-need-to-know-about-pfas

Wildfires are destroying decades of clean air efforts in the U.S.

2023-09-21

Wildfire smoke made an imprint on pollution trends in three-quarters of all U.S. states, according to research published in the journal Nature.

Increases in wildfire smoke are reversing decades of improvements to air quality in some parts of the U.S., according to new research led by Stanford University and published Wednesday in the scientific journal Nature.

Scientists evaluated more than two decades of satellite and air monitoring data to assess the concentration of tiny particles within wildfire smoke and how they affected air quality. The research finds that wildfire smoke is a growing source of pollution the U.S. is struggling to control.

Wildfire smoke made an imprint on pollution trends in three-quarters of all U.S. states, the research found.

In those states, "wildfires have undone 25% of previous progress" that resulted from the Clean Air Act, said Marshall Burke, an associate professor at Stanford University and the study's lead author. "In half a decade, we've ripped out really a lot of the progress we've seen over multiple decades before."

The research comes as wildfires have made headlines across the U.S., killing at least 97 people in Maui, Hawaii, in August and blanketing the East Coast with smoke in June. This year qualifies as the worst year on record for wildfire smoke exposure per person in the United States.

Read More

NBC News, 21-09-23

https://www.nbcnews.com/science/environment/wildfires-are-destroying-decades-clean-air-efforts-us-rcna105140

CHEMWATCH
Bulletin Board
Regulatory Update
SEP. 29, 2023

EUROPE

New online platform to facilitate compliance of Member States with notification obligations

2023-09-19

Today, the Commission is launching a new online platform to help reduce administrative burden and facilitate Member States' compliance with their notification obligations to the Commission under EU law. The new Single Notification WindowEN••• will offer a single-entry point to a broad range of notification obligations relevant to the Single Market, without amending the substance of the existing notification procedures themselves.

The Single Notification Window will gather relevant information about notification requirements in one place, including information on the legal act and legal basis, a summarised description of the Member States' notification obligations, as well as how to submit information to the Commission.

The scope of the Single Notification Window will cover more than 500 notification obligations – including for example those under the Single Market Transparency DirectiveEN•••, the Services DirectiveEN•••, the Energy Tax DirectiveEN••• or the Directive on Unfair Terms in Consumer ContractsEN•••. The platform will not cover Member States' other reporting obligations, rapid alert systems, notification obligations in relation to EU competition rules, obligations to transpose or provisions on penalties.

Read More

European Commission, 19-09-23

https://single-market-economy.ec.europa.eu/news/new-online-platform-facilitate-compliance-member-states-notification-obligations-2023-09-19_en

Updated risk assessment highlights the need for stricter regulation on MOH in food

2023-09-19

On September 13, 2023, the European Food Safety Authority (EFSA) released an updated risk assessment on mineral oil hydrocarbons (MOHs) in food.

MOHs are mainly categorized into mineral oil-saturated hydrocarbon (MOSH) and mineral oil aromatic hydrocarbon (MOAH). The primary findings were that MOSH "very likely… does not raise concerns for human health" while it is "extremely likely" that MOAH is a health concern. According to EFSA, MOH, often derived from crude oil but also from other sources like coal and gas, can enter the food supply through various means such as environmental contaminants and food production machinery.

EFSA's Scientific Panel on Contaminants in the Food Chain (CONTAM Panel) had indicated in 2012 that MOH poses various health risks depending on its type (FPF reported). MOSH can accumulate in human tissues and potentially harm the liver, while MOAH may cause DNA damage and possibly lead to cancer (FPF reported). EFSA was mandated by the European Commission (EC) in 2017 to start monitoring MOHs in food and food contact materials (FPF reported). Following that, in 2020 EFSA was tasked with updating its 2012 scientific opinion, focusing on state-of-the-art research and occurrence data to assess the risk posed by MOHs. According to the FCCmigex, MOHs have been measured most often in paper and board based food contact articles.

Despite the update, uncertainties remain due to the complex chemical makeup of MOH. For instance, insufficient data exist to draw conclusive evidence on the oral toxicity of MOAH with three or more aromatic rings. However, based on what is available, "it is extremely likely (99-100% certain)" that dietary exposure to MOAH is a concern for toddlers, and "likely (more than 66% certain) for other age groups."

The recent update also indicates that the highest levels of MOHs are found in vegetable oils, and the population most at risk is young people, particularly infants through infant formula. MOSH does not raise concerns for human health with 66-95% certainty, but ongoing study is advised for potential long-term effects. Conversely, MOAH with one to two aromatic rings lack reliable toxicity data, thus possibly raising a concern.

Read More

FPF, 19-09-23

https://www.foodpackagingforum.org/news/updated-risk-assessment-highlights-the-need-for-stricter-regulation-on-moh-in-food

CHEMWATCH
Bulletin Board
Regulatory Update
SEP. 29, 2023

Turkey: Data Sharing Agreements Regarding Registration Of Chemicals: Last Call For Registration!

2023-09-21

Regulations on chemical substances play a pivotal role in our daily lives for the protection of human health and the environment as well as for the assessment and mitigation of hazardous effects and risks of chemicals. For this reason, the Regulation on the Registration, Evaluation, Authorization, and Restriction of Chemicals1 ("REACH") governing the manufacture, use, and import of chemical substances in the European Union ("EU") was adopted and the European Chemicals Agency ("ECHA") established by the Regulation is the responsible authority to ensure the implementation of the REACH. Following the REACH Regulation, many similar regulations concerning chemicals entered into force worldwide, and the KKDIK Regulation (Kimyasalların Kaydı, Değerlendirilmesi, İzni ve Kısıtlanması Hakkında Yönetmelik)2, also known as Turkish REACH, was adopted in Turkey. The KKDIK Regulation was directly modelled after the REACH for the harmonization of the chemical safety regulations in Turkey with the EU and aligns closely with its provisions and requirements.

Based on the principle of "no data, no market", chemical substances within the scope of the REACH and KKDIK must be registered by providing the required information by the regulation through the chemicals registration system, REACH-IT of ECHA in the EU and KKS3(Kimyasal Kayıt Sistemi) of the Turkish Ministry of Environment, Urbanization and Climate Change ("Ministry") in Turkey. No permission or restriction has been granted by the Ministry to use or not use the information in the registration dossiers submitted under the REACH Regulation in the EU. There is no agreement between the Ministry and ECHA on this matter, therefore, a registration of chemicals under the REACH will not eliminate any registration obligation under the KKDIK Regulation.

The obligations and duties set forth by the KKDIK Regulation gain more importance for companies operating in the chemicals industry in Turkey considering the registration deadline for chemicals that will expire on December 31, 2023. According to the KKDIK Regulation, substances manufactured or imported in quantities of 1 tonne or more per year, either on their own or in a mixture, before December 31, 2023, must be registered until that date. After December 31, 2023, substances must first be registered before being placed on the market. Therefore, as of January 1, 20124, the chemical substances that are not registered to the KKS will not be allowed to be manufactured or imported.

Read More

Modaq, 21-09-23

https://www.mondaq.com/turkey/chemicals/1365938/data-sharing-agreements-regarding-registration-of-chemicals-last-call-for-registration

HSE inspectors to assess the management of asbestos in schools

2023-09-21

What is happening?

HSE will be carrying out a programme of inspections to primary and secondary schools in England, Scotland and Wales from October 2023 onwards.

The inspections will be assessing how schools are managing the risks from asbestos within the school estate and meeting the 'duty to manage' (DTM) requirements under Regulation 4 of the Control of Asbestos Regulations 2012(CAR).

The regulations place duties on those with responsibility for the maintenance of work premises, including schools, to manage the risk from asbestos. For the majority of schools, this will be the employer.

Who will be carrying out the inspections?

The visits will be carried out by HSE inspectors, who will contact the school before visiting to arrange a suitable date and time for the inspection.

They will need to speak to someone with knowledge of how asbestos is managed by the school and may also ask to see certain documentation in advance of the visit, for example your asbestos register and management plan.

See our guidance on what to expect when an inspector calls for further information.

What should schools do to prepare for these inspections?

In advance of the inspections, schools may wish to review their current arrangements and check that they are meeting their duties under CAR, which includes requirements to:

CHEMWATCH
Bulletin Board
Regulatory Update
SEP. 29, 2023

- take reasonable steps to find out if there are asbestos-containing materials (ACMs) in the school premises, and if so, the amount, where it is and what condition it is in
- presume materials contain asbestos unless there is strong evidence that they do not
- make, and keep up to date, a record of the location and condition of any ACMs - or materials which are presumed to contain asbestos
- assess the risk of anyone being exposed to fibres from the materials identified
- prepare an asbestos management plan (AMP) that sets out in detail how the risks from these materials will be managed
- take the necessary steps to put the plan into action
- periodically review and monitor the plan and the arrangements, and act on the findings, so the plan and arrangements remain relevant and up to date
- provide information on the location and condition of the materials to anyone who is liable to work on, or disturb them

Read More

HSE.gov.UK, 21-09-23

https://www.hse.gov.uk/education/asbestos.htm

INTERNATIONAL

UN Publishes GHS Rev 10

2023-09-22

On July 27, 2023, the United Nations (UN) published an electronic version of the tenth revision (Rev 10) of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) available for free for consultation purposes. The amendments to the ninth revision of the GHS (Rev 9) include the classification procedure for desensitized explosives (Chapter 2.17); the use of non-animal testing methods for classification of health hazards, in particular: skin corrosion/irritation (Chapter 3.2), serious eye damage/eye irritation (Chapter 3.3), and respiratory or skin sensitization (Chapter 3.4); further rationalization of precautionary statements to improve users' comprehensibility while taking into account usability for labeling practitioners; and the review of Annexes 9 and 10 to ensure alignment of the classification strategy, guidance, and tools on

ECHA's Risk Assessment Committee: banning secondary uses of creosote-treated wood necessary

2023-09-20

The Committee for Risk Assessment (RAC) supports France's proposal to restrict the placing on the market, reuse and banning the secondary use of wood treated with creosote and related substances. The draft opinion of the Committee for Socio-Economic Analysis (SEAC) is open for comments until 7 November 2023.

Helsinki, 20 September 2023 – RAC, which adopted its opinion on France's proposal, concluded that an EU-wide restriction is needed to minimise environmental emissions and exposure of the public. Creosote and related substances are carcinogenic, persistent, bioaccumulative and toxic, and can cause harm already at very low levels of exposure.

RAC considered that wood creosote, one of the nine substances in France's proposal, could be removed from scope as it does not share the same hazardous properties as the rest. The committee also agrees with SEAC's suggestion to allow the reuse of railway sleepers and utility poles treated with creosote by all professionals in the same country and not just by the 'same original user' as France proposes. This would lead to higher environmental benefits as opposed to companies buying newly creosote-treated wood, which is the most likely alternative. Newly treated wood is expected to leach more than older treated wood.

RAC agrees that all secondary uses should be banned since safer alternatives are available.

"This is a restriction that will have a direct effect on the market, but also in our lives because creosote-treated wood is still available to the public despite the existing restriction, which was put in place before REACH. This indicates that the current measures are not enough to control the risks", says Roberto Scazzola, Chair of the RAC, in a new episode of the Safer Chemicals Podcast.

The SEAC draft opinion also lends support to the proposed restriction. According to SEAC, the proposal is proportionate, as it offers significant health benefits by banning secondary use to the public, and the costs are relatively low.

SEAC has analysed the comparative benefits of allowing reuse by other professionals than just the original one. The committee supports this option but notes that the benefits of the restriction increase only if

CHEMWATCH
Bulletin Board
REACH Update
SEP. 29, 2023

access to creosote-treated wood by the public is prevented. The potential benefits of the restriction are assessed based on several factors such as the availability of alternatives, adequate worker protection and alignment with the Biocidal Product Regulation.

The 60-day consultation of the SEAC draft opinion is open until 7 November 2023.

"We are looking for more information on whether allowing trade between companies would have a secondary effect on creosote-treated wood getting into the hands of the general public. That's really what we want to prevent. Then, we are also looking into the proposed transition period of 12 months, and whether that is appropriate for all the steps to be implemented to comply with the restriction," says María Ottati, Chair of the SEAC.

The committee is expected to adopt its opinion in December 2023.

***

Other outcomes of the September meetings:

- SEAC adopted its opinion supporting the proposed restriction of chloroalkanes C14-C17;
- RAC adopted nine opinions on harmonised classification and labelling;
- RAC and SEAC adopted an opinion on an application for authorisation of chromium trioxide; and
- RAC adopted the opinion on the scientific evaluation of occupational exposure limits (OELs) for chloroprene.

Read More

ECHA, 20-09-23

https://echa.europa.eu/-/echa-s-risk-assessment-committee-banning-secondary-uses-of-creosote-treated-wood-necessary

Call for an EU-Wide Ban on PFAS in Firefighting Foams

2023-08-23

SEAC has adopted its final opinion supporting a gradual ban on per- and polyfluoroalkyl substances (PFAS) in firefighting foams. The restriction could reduce PFAS emissions into the environment by around 13,200 tonnes over 30 years.

REACH Update

SEP. 29, 2023

Helsinki, 22 June 2023 – ECHA's Committee for Socio-Economic Analysis (SEAC) considers that the proposed restriction on the placing on the market, use and formulation of PFAS in firefighting foams is the most appropriate EU-wide measure to address the identified risks. This takes into account available alternatives and the balance between the restriction's benefits and costs to society. These conclusions follow an opinion on the risks adopted by ECHA's Committee for Risk Assessment (RAC) in March 2023.

SEAC suggests, however, that a review of available fluorine-free alternatives for sites that produce, treat or store dangerous substances (covered by the Seveso Directive) and those neighbouring them is carried out before the end of the 10-year transition period. Similarly, a review would be needed for uses at offshore installations in the oil and gas industry, where SEAC is recommending lengthening the transition period from five to 10 years. The committee considers the reviews important to maintain safety where fires may have high impacts on the environment and human health.

"There are some uses where the committee considered that if there are no alternatives that perform well enough by the end of the transition periods, the consequences of reduced fire safety could be disastrous.

Read More

REACH24, 02-08-23

https://www.reach24h.com/en/news/industry-news/chemical/call-for-an-eu-wide-ban-on-pfas-in-firefighting-foams.html

CHEMWATCH
Bulletin Board

Janet's Corner

SEP. 29, 2023

Eclipse

2023-09-29

https://www.amoebasisters.com/parameciumparlorcomics/happy-solar-eclipse-2017-day

Nitrogen Mustards

2023-09-29

USES [2,3]

- HN-1 originally was designed to remove warts but was later identified as a potential chemical warfare agent.
- HN-2 was designed as a military agent but was later used in cancer treatment. Other treatment agents now have replaced it.
- HN-3 was designed solely as a military agent.

EXPOSURE SOURCES & ROUTES OF EXPOSURE [3]

Exposure Sources

- If nitrogen mustards are released into the air as a vapour, you could be exposed through skin contact, eye contact, or breathing.
- If nitrogen mustards are released into water, you could be exposed by drinking the contaminated water or getting it on your skin.
- You could be exposed by coming in direct contact with liquid nitrogen mustards.
- Because it is heavier than air, nitrogen mustard vapour will settle in low-lying areas.

Routes of Exposure

- **Inhalation:** Inhalation is an important route of exposure. Nitrogen mustard vapours are heavier than air. The LCt50 (the product of concentration times time that is lethal to 50% of the exposed population by inhalation) is approximately 1,500 mg-min/m^3 for HN-1 and HN-3, and 3,000 mg-min/m^3 for HN-2.
- **Skin/Eye Contact:** Exposure to nitrogen mustard vapour can cause injury to the eyes, skin, and mucous membranes at low concentrations. Direct contact with the liquid can cause skin and eye burns. The median incapacitating dose for the eyes is 100 mg-min/m^3 for HN-2 and 200 mg-min/m^3 for HN-1 and HN-3. Absorption may occur after skin or eye exposure to liquid or vapour nitrogen mustard and may cause systemic toxicity.
- **Ingestion:** Ingestion is an uncommon route for exposure but can lead to local effects such as oesophageal or gastrointestinal burns and systemic absorption.

Nitrogen mustards are vesicants (blister agents) and alkylating agents. They are colourless to pale yellow, oily liquids that evaporate slowly. [1] They are also known by their military designations of HN-1, HN-2, and HN-3. [2] HN-1 has a faint, fishy or musty odour. It is sparingly soluble in water but miscible with acetone and other organic solvents. At temperatures greater than 194°C, it decomposes. HN-2 has a fruity odour at high concentrations and a soapy odour at low concentrations. Its solubility is similar to HN-1. HN-3 is odourless when pure but has been reported to have a butter almond odour. It is the most

CHEMWATCH
Bulletin Board
Hazard Alert
SEP. 29, 2023

HEALTH EFFECTS [4]

Acute Health Effects

Nitrogen mustards are vesicants and alkylating agents; however, the mechanisms of action are not clearly understood. They are highly reactive and combine rapidly with proteins, DNA, or other molecules. Therefore, within minutes following exposure intact mustard or its reactive metabolites are not found in tissue or biological fluids.

- **CNS:** High doses of nitrogen mustards have caused tremors, seizures, incoordination, ataxia, and coma in laboratory animals.
- **Respiratory:** Damage to the mucosa of the airways begins within hours and may progress over several days. Nasal and sinus pain or discomfort, pharyngitis, laryngitis, cough, and dyspnea may occur. Pulmonary oedema is uncommon.
- **Gastrointestinal:** Ingestion may cause chemical burns of the GI tract and haemorrhagic diarrhoea. Nausea and vomiting may occur following ingestion, dermal, or inhalation exposure.
- **Ocular:** Exposure to nitrogen mustard vapour or liquid may cause intense conjunctival and scleral inflammation, pain, swelling, lacrimation, photophobia, and corneal damage. High concentrations can cause burns and blindness.
- **Dermal:** Direct skin exposure to nitrogen mustards causes erythema and blistering. Generally, a rash will develop within several hours, followed by blistering within 6 to 12 hours. Prolonged contact, or short contact with large amounts, may result in second- and third-degree chemical burns.
- **Hematopoietic:** Systemic absorption of nitrogen mustard may induce bone marrow suppression and an increased risk for fatal complicating infections, haemorrhage, and anaemia.
- **Delayed Effects:** Chemotherapeutic doses of HN-2 have been associated with menstrual irregularities, alopecia, hearing loss, tinnitus, jaundice, impaired spermatogenesis, generalised swelling, and hyperpigmentation.
- **Potential Sequelae:** Chronic respiratory and eye conditions may persist following exposure to large amounts of nitrogen mustards. Narrowing of the oesophagus and severe corrosive damage to the stomach lining can result from ingesting formalin.

Carcinogenicity

The International Agency for Research on Cancer (IARC) has classified nitrogen mustard as probably carcinogenic to humans (Group 2A). There is some evidence that it causes leukaemia in humans, and it has been shown to cause leukaemia and cancers of the lung, liver, uterus, and large intestine in animals.

Other Effects

Nitrogen mustards may decrease fertility. A few case reports have linked treatment with HN-2 to foetal abnormalities in humans. Nitrogen mustards have produced developmental effects in animals.

SAFETY

First Aid Measures [5]

- **EYES:** First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control centre. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.
- **SKIN:** IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. IMMEDIATELY call a hospital or poison control centre even if no symptoms (such as redness or irritation) develop. IMMEDIATELY transport the victim to a hospital for treatment after washing the affected areas.
- **INHALATION:** IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. IMMEDIATELY call a physician and be prepared to transport the victim to a hospital even if no symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.
- **INGESTION:** DO NOT INDUCE VOMITING. Corrosive chemicals will destroy the membranes of the mouth, throat, and oesophagus and, in addition, have a high risk of being aspirated into the victim's lungs during vomiting which increases the medical problems. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control centre. IMMEDIATELY transport the victim to a hospital. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. Transport the victim IMMEDIATELY to a hospital.
- **OTHER:** Since this chemical is a known or suspected carcinogen you should contact a physician for advice regarding the possible long term health effects and potential recommendation for medical monitoring. Recommendations from the physician will depend upon the specific compound, its chemical, physical and toxicity properties, the exposure level, length of exposure, and the route of exposure. (NTP, 1992)

REGULATION

United States

No occupational exposure limits have been established for nitrogen mustard. However, the United States Military has established a TLV (threshold limit value) of 0.003mg/m3.

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Squeezing more ingredients into the molecule sandwich

2023-09-05

The discovery could eventually help chemists make a range of new materials, including solar cells and pharmaceuticals.

The quirky shapes of metallocenes have intrigued chemists for decades. They're valuable in making polymers, perovskite solar cells, measuring glucose and catalysing thousands of other reactions.

They're made from metal atoms, surrounded – or sandwiched – by carbon-containing (organic) molecules. Two chemists were awarded the 1973 Nobel Prize in Chemistry for the discovery of metallocenes.

In general, these sandwich molecules follow the "18-electron rule": they're most stable when there are 18 valence electrons in the central metal atom. Previously, chemists have been able to fill the sandwich to 20 electrons, but not more than that.

A team of Japanese, Russian and German scientists have made a new metallocene molecule, which can stably hold 21 electrons.

"Having more than 18 electrons is known to be rare because if you deviate from 18, the chemical bonds of the metallocenes start to elongate, break, and change structure," says Dr Satoshi Takebayashi, a researcher at the Okinawa Institute of Science and Technology, Japan, and co-author on a paper describing the research, published in Nature Communications.

"However, we added two more electrons to a 19-electron metallocene and created a 21-electron metallocene.

"I think most people didn't think this was possible, but our 21-electron metallocene is stable in solution and solid states and can be stored for a long time."

The molecule has a cobalt atom at its centre. The researchers are now looking to see how they can use this molecule to catalyse reactions and make new materials, which Takebayashi hopes will be useful in medicine and energy.

Cosmos, 5 September 2023

https://cosmosmagazine.com

Chemists have made a molecule called a metallocene – or a "sandwich compound" – that breaks the conventional limit on how many things you can fit in a sandwich.

CHEMWATCH
Bulletin Board
Gossip
SEP. 29, 2023

CRISPR-Based Diagnostic Tool Rapidly Detects Mpox

2023-09-20

In response to the 2022 global outbreak of the monkeypox virus (MPXV), researchers have harnessed cutting-edge genetic technology to develop Australia's first-of-its-kind tool for the detection of the virus.

In a collaborative study published in The Lancet Microbe, the team of scientists, led by the Peter Doherty Institute for Infection and Immunity (Doherty Institute) and WEHI (Walter and Eliza Hall Institute of Medical Research), revealed MPXV-CRISPR – a powerful diagnostic tool capable of detecting MPXV in clinical samples with acute precision and at a faster rate than any other method, thanks to the power of CRISPR technology. It is the first CRISPR-based diagnostic method in Australia specifically designed to target genetic sequences found only in MPXV.

While the CRISPR technology is most known for its genome editing capability, new applications have emerged, including leveraging it for the design of powerful and highly sensitive diagnostic tools.

The University of Melbourne's Dr Soo Jen Low, a Research Officer at the Doherty Institute and co-first author of the study, said CRISPR-based diagnostic tools were like super-precise detectives that can quickly find specific clues (in this instance, genetic material) related to the presence of specific pathogens.

"To work, MPXV-CRISPR has to be 'programmed' to recognise the virus. We used a database of 523 MPXV genomes to carefully engineer 'guides' to bind to the specific part we are looking for on the viral DNA. Getting this right was crucial for the success of our diagnostic tool," said Dr Low.

"In essence, when viral DNA is present in a clinical sample, the CRISPR system is guided to the target and subsequently emits a signal to indicate the presence of the virus. Our testing method can achieve sensitivity and precision levels comparable to the gold-standard PCR methods, but in a fraction of the time," said Dr Low.

Matthew O'Neill, a Research Assistant at WEHI and co-first author of the paper, explained that the speed at which this new technology can provide a diagnosis is one of the groundbreaking features of MPXV-CRISPR.

"Currently, mpox diagnostics rely largely on centralised laboratory settings, where test results might not be available for up to several days after sample collection, depending on geographical and logistical

Researchers have harnessed cutting-edge genetic technology to develop a tool for the detection of the monkeypox virus.

considerations. In parallel, MPXV-CRISPR can detect the virus in just 45 minutes," said O'Neill.

In line with the WHO standards where diagnostic tests should be accurate, accessible and affordable, the team is working on adapting MPXV-CRISPR into a portable device, that could, one day, be deployed at points of care around the country for rapid, on-site detection of monkeypox virus.

Dr Shivani Pasricha, a Senior Research Officer at WEHI, Junior Laboratory Head at the Doherty Institute, and co-senior author of the paper, said MPXV-CRISPR has the potential to revolutionise the way we manage mpox, making a meaningful impact on public health.

"By improving access to quick and reliable diagnoses around Australia, including in places with limited resources and in remote areas, this decentralised approach to testing could enable faster treatment and improve patient outcomes, while fast-tracking our capacity to manage future outbreaks," said Dr Pasricha.

Reference: Low SJ, O'Neill MT, Kerry WJ, et al. Rapid detection of monkeypox virus using a CRISPR-Cas12a mediated assay: a laboratory validation and evaluation study. Lancet Microbe. 2023;0(0). doi: 10.1016/S2666-5247(23)00148-9

Technology Networks, 20 September 2023

https://technologynetworks.com

Positive trial sets stage for therapeutic use of MDMA in US

2023-09-21

Much-anticipated positive clinical results for psychotherapy assisted by MDMA, otherwise known as ecstasy, in people with Post Traumatic Stress Disorder (PTSD) could prompt a major shift in the mental health drug sector. Findings from a US phase 3 trial open the way to the US Food and Drug Administration (FDA) potentially approving MDMA-Assisted Therapy (MDMA-AT) for PTSD as early as 2024.1 While some welcome the results, others are voicing concerns, including that the treatment doesn't offer value for money.

'If FDA approved, MDMA-assisted therapy would be the first novel treatment for PTSD in decades,' says Amy Emerson, chief executive of trial sponsor MAPS Public Benefit Corporation (MAPS-PBC), based in San Jose,

CHEMWATCH
Bulletin Board
Gossip
SEP. 29, 2023

US. She explains that MAPS-PBC now intends to file for regulatory approval from the FDA by the end of 2023.

MDMA would then be the first previously illicit hallucinogen to gain legal approval for use in psychiatric therapy. In 2019, the FDA approved Johnson & Johnson's esketamine, which also causes hallucinations, for treatment-resistant depression. However, esketamine is the S-enantiomer of ketamine, an approved anaesthetic that can legally be used off-label in psychiatry. MDMA could also be followed by similar therapies involving other drugs like psilocybin, the hallucinogen in magic mushrooms. Australia has allowed clinical psychiatric use of MDMA and psilocybin since June 2023, but the drugs themselves do not have formal regulatory approval.

'This is really positive for the psychedelic space,' says Bill Ciprick, chief executive of Optimi Health from Vancouver, Canada, which produces therapeutic MDMA and psilocybin. 'From a credibility standpoint, that data speaks wonders.'

Hallucinogen-assisted psychiatric treatment heads to regulators, amid cost and other concerns

Cautious verdict

The 104-person trial was the standard second, confirmatory, phase 3 trial, replicating findings from a previous one that MAPS-PBC published in 2021.2 In that first trial, two therapists abused a patient during an MDMA session. In response, MAPS-PBC has since 'carefully developed and implemented policies and practices aimed to prevent, reasonably detect, and thoroughly respond to allegations of misconduct', Emerson says.

The new trial also extended participation to a more racially and ethnically diverse group, and to moderate as well as severe PTSD sufferers. Scores for PTSD symptoms for participants in the MDMA-AT groups significantly reduced compared to participants receiving placebo with therapy.

Bita Moghaddam, from Oregon Health and Science University in Portland, US, is concerned that 'hype and misrepresentation' about the treatment could make people think taking illicit MDMA will cure them. However, the treatment 'is very much about psychotherapy being aided by a drug', she says. The latest trial was needed 'to convince the FDA to approve this mode of treatment and for insurance companies to pay for the expensive psychotherapy aided by MDMA', Moghaddam explains.

Joar Øveraas Halvorsen, from Norwegian University of Technology and Science in Trondheim, also highlights the therapy's high costs. At around $11,000 (£8900) per patient, MDMA-AT costs three to four times as much

as existing PTSD therapies, Halvorsen tells Chemistry World. That's in part because in MDMA-AT patients spend more than twice as long in psychotherapy, he notes. He also highlights that nearly two-thirds of potential patients considered for participation in the trial were excluded. Together, the high costs and exclusion rates indicate that 'MDMA-assisted psychotherapy is for the few and not for the many of patients with PTSD', Halvorsen says.

Floodgates open

The treatment costs result from how MAPS-PBS is funding MDMA-AT's commercialisation. So far, it has mostly paid for its research with philanthropic grants, Emerson says. It is now 'focused on generating revenue from the sale of our MDMA drug product, if approved', which will bring the therapy 'to patients in need', she adds. 'Our team has been working hard to ensure there is a path forward for insurers to cover both the drug and the therapy sessions,' Emerson adds. For the current clinical trial, it used a contract manufacturing company to source the MDMA, she says.

A good supply chain for such a therapy needs at least two suppliers, says Ciprick, and Optimi Health is 'doing what we can to be considered to be one' for MDMA-AT. Optimi Health already supplies MDMA and psilocybin to health professionals and researchers through a long-term distribution agreement with Mind Medicine Australia. Ciprick explains that MAPS-PBC published a four-step synthetic process for MDMA that complies with Current Good Manufacturing Practice (cGMP) rules in 2022.3 While that approach is now public knowledge, not everyone can use it.

'You need the sophistication of a pharmaceutical manufacturer,' Ciprick says. 'Then you also on top of that need permits, protocols, security and to know how to handle controlled substances.' He calls the measures involved 'very stringent'.

If the FDA approves MDMA-AT, it will open the US market's floodgates, Ciprick believes. He suggests that initial demand from therapists seeking to learn how to administer MDMA-AT will be significant. 'You've got one of the largest pharmaceutical markets in the world that will have thousands of therapists that need training,' Ciprick tells Chemistry World.

Chemistry World, 21 September 2023

https://chemistryworld.com

CHEMWATCH
Bulletin Board
Gossip
SEP. 29, 2023

Researchers describe advances in mass spectrometry analysis to improve identification of glycopeptides

2023-09-27

A new study by researchers at Boston University Chobanian & Avedisian School of Medicine set out to improve on existing methods to identify glycopeptides and found that conventional mass spectrometry methods were sufficient to identify peptides with one glycan (essential biomolecules serving structure, energy storage and system regulatory purposes) but that an additional step is necessary for identifying peptides with two or more glycans.

Because one protein can carry many glycans, it can be difficult or impossible to generate peptides that only carry one glycan. The ability to identify peptides with multiple glycans is key to defining different glycoforms of the protein to understand its biological function and the role in the disease.

Due to the lack of information about glycoproteins and how they change during development and disease, corresponding author Manveen K. Sethi, Ph.D., research assistant professor of biochemistry & cell biology, believes they may be missing promising therapeutic avenues. "A more thorough and specific understanding of how glycosylation affects disease, specifically site-specific alterations, may provide novel targets in diseases that currently lack effective treatment options," she says.

"Advances in technology to confidently identify densely glycosylated peptides would assist in differentiating healthy and diseased states on the basis of site-specific glycosylation and thus, enabling the use of glycoproteins as marker and therapeutic target in different diseases," Sethi explains.

Using four different standard proteins, the researchers followed different enzymatic digestion protocols prior to mass spectrometry analysis. For mass spectrometry analysis they used a conventional higher-energy collisional dissociation (HCD) method and compared it to a more recently developed method—electron transfer/higher energy collisional dissociation (EThcD). They then compared the number of glycopeptides identified in the different digestion protocols and in the mass spectrometry methods.

While they found that that HCD is sufficient for glycopeptide identification, EThcD is often necessary to find glycans, particularly in the case of multiply-glycosylated peptides.

Glycosylation is the attachment of carbohydrates to the backbone of a protein through an enzymatic reaction. It plays a critical role in determining protein structure, function and stability. A protein that is glycosylated is known as a glycoprotein. The two most common types of protein glycosylation are known as N-glycosylation and O-glycosylation.

These findings appear online in the journal Analytical and Bioanalytical Chemistry.

Phys Org, 27 September 2023

https://Phys.org

Nearly half of US tap water contains 'forever chemicals'

2023-07-06

At least 45 per cent of the nation's tap water is impacted, the US Geological Survey (USGS), the country's largest water, earth, and biological science and civilian mapping agency, said on Wednesday.

While there are more than 12,000 types of per- and polyfluorinated alkyl substances, or PFAS, in existence not all can be detected with current testing. USGS tested drinking water for 32 types of PFAS.

Cities and locations close to "potential sources" of PFAS were most contaminated by the chemicals, found in a glut of everyday products from takeout containers to non-stick cookware and fire-fighting foam.

The most exposed regions included the Great Plains, Great Lakes, Eastern Seaboard, and central and southern parts of California, the study found. According to USGS, the probability of PFAS not being in tap water is about 75 per cent in rural areas and around 25 per cent in urban areas.

Exposure to certain levels of PFAS may lead to decreased fertility or increased high blood pressure in pregnant women, the US Environmental Protection Agency (EPA) says.

The chemical substances are also linked to developmental effects in children and increased risk of some cancers including prostate, kidney, and testicular. Research is ongoing into other potential health impacts.

PFAS are known as "forever chemicals" due to the length of time they take to break down in the environment.

The USGS study is the first sweeping assessment of PFAS contamination in America's drinking water across both private and government-regulated public water supplies.

Tap water samples were taken at 716 locations including in protected lands, residential and rural areas with no known PFAS sources, and locations with PFAS sources like industry or waste sites. The data,

Nearly half the tap water in the United States contains one or more "forever chemicals" which are linked to health issues like infertility and cancer.

CHEMWATCH
Bulletin Board
Gossip
SEP. 29, 2023

collected between 2016 and 2021, was used to estimate potential PFAS contamination across the country.

"USGS scientists tested water collected directly from people's kitchen sinks across the nation, providing the most comprehensive study to date on PFAS in tap water from both private wells and public supplies," said USGS research hydrologist Kelly Smalling, the study's lead author.

"The study estimates that at least one type of PFAS – of those that were monitored – could be present in nearly half of the tap water in the US."

The most frequently detected compounds were PFBS, PFHxS and PFOA, according to the research. Levels of PFOS and PFOA exceeded EPA health advisories in every sample where they were detected by USGS.

Independent, 6 July 2023

https://independent.co.uk

Poisoner's paradise: why chemicals in toxins can harm or heal

2023-07-19

Make no mistake. Hundreds of people and animals were killed to bring you this story. Poisons are all around us, as are people with motives to use them for their hostile and cruel intentions.

At the molecular level, poisons are chemicals typically with very specific functions. In my professional life as a chemist I've handled many, including well-known substances like cyanide, carbon monoxide and mercury; war gases such as chlorine and arsenicals; and toxic alkaloids such as strychnine and nicotine. Many of these chemicals are reactive, which makes them useful tools in producing new molecules. Others have special properties that help in isolating other desirable molecules. Working with these chemicals takes preparation, good laboratory engineering, imaginative risk management (nerve!), and genuine humility and respect for the dangers in front of you.

Because when you entwine that chemistry above a certain dose with the chemistry of an unsuspecting victim, things start to go wrong very quickly.

Whether a poison is ingested, inhaled, absorbed or injected, the end result is often the same. Death. Untimely, undignified, often painful and frequently gory. But what makes a poison a poison? Where do poisons come from, and how are they useful (other than for poisoning)?

At the molecular level, poisons are chemicals typically with very specific functions. And whether naturally occurring or synthesised by humans, they play an important role in our lives, with many both danger and saviour. Nathan Kilah puts on the gloves to explain why the chemicals in toxins can harm or heal. As he reports, it all depends on the dose.

What is a poison?

On a biochemical level, a poison is a disrupter. The poison may disrupt the packaging of your cells, causing them to leak and lose function, or it may disrupt the information flow of your nervous system, leaving normally rapid-firing neurons perpetually on or off.

The common factor is that above a certain concentration, any chemical can be deadly. Even a molecule considered benign, such as water, can be a killer. In 2007 a radio game-show contestant died after consuming a large volume of water in an attempt to win a prize. The massive amount of water in her body disrupted the distribution of electrolytes in her blood, causing her cells to swell in response to the change of salt concentrations, and ultimately led to the loss of cellular function and death.

Flora and fauna

The majority of well-known poisons come from nature. Your average garden is a poisoner's paradise, with lilies, hellebores, beans, mushrooms and more all capable of delivering death. Our ancestors worked out which plants and fungi could be eaten through the application of an early scientific method, and the safety net of a big enough tribe to survive mistakes.

Many plants have evolved poisonous defences to avoid being eaten. This is often in the leaves but is frequently concentrated in the fruits and seeds as a way to ensure subsequent generations.

The seeds of the strychnine tree (Strychnos nux-vomica) are particularly well known for their poisonous potential. Detailed descriptions of strychnine poisoning are truly horrific.

Ingested strychnine binds to the brain and nervous system, keeping neurotransmitted messages turned on while enhancing the sensory systems of the body. This heightened state makes the body very sensitive to stimulation, and the reaction to stimulation is muscle convulsions. These contort the entire body, so that only the tip of the head and the tip of the heels touch the ground as the torso and legs are tensed into an arch. Fists and jaw clamp shut, the mouth pulls into a grimace and the diaphragm locks tight for minutes at a time. If the poisoned individual lives through this suffocating period, they may restart the cycle, fully conscious, their exhausted body strained by further convulsions. Depending on the dose and the fortitude of the victim, the whole-body contractions may continue for a number of cycles before agonising death.

CHEMWATCH
Bulletin Board
Gossip
SEP. 29, 2023

Despite strychnine's well-deserved reputation, it remains part of Chinese and Ayurvedic traditional medical practices, albeit in very controlled doses, used to treat a range of conditions including diarrhoea, inflammation, paralysis, rheumatism and sexual function.

Poisons are also very effectively employed across the domains of animal life, with frogs, snakes, octopuses and many others capable of causing death. A small number of frogs of the genus Phyllobates produce batrachotoxins, which have been deployed in poison blow darts used in traditional hunting practices in Latin America, alongside the more common plant-based curare. These poisons function within the bloodstream, so prey killed by this method can be eaten without causing any ill effect.

More intentional poisoning involving members of the animal kingdom used extracts of blister beetles (family Meloidae). The active agent cantharidin, which the beetles use to protect their developing eggs, causes blisters and chemical burns. If taken internally, cantharidin can produce blisters that can cause bleeding, followed by vomiting and diarrhoea, and ultimately death.

The first test for cantharidin poisoning was grim. The content of the deceased's stomach was concentrated, then placed on healthy, living skin with a bandage. If blisters formed underneath the bandage, then cantharidin was the poison. Another more obvious sign of cantharidin poisoning was priapism – a prolonged, rigid erection – that persisted after death.

This final display also highlights the blister beetle Lytta vesicatoria's better-known name of "Spanish fly", and its use in aphrodisiac potions made from cantharidin. Aphrodisiac preparations are said to have led to many poisonings throughout history. The most famous case involved the French nobleman Marquis de Sade, who is said to have poisoned two prostitutes with cantharidin-laced sweets in 1772.

Poisonings don't always come packaged with a motive. Take, for example, the mass poisoning of French villagers by grains contaminated with the ergot fungus Claviceops purpurea.

This ergot fungus produces alkaloids that can cause hallucinations. The appearance of these hallucinations is so well-known that they have been called Saint Vitus' dance when accompanied by twitching, burning sensations and feelings of suffocation, and Saint Anthony's fire when the poisoned person appears to be demonically possessed or is behaving

"like a witch". Ergot poisoning has been implicated in witch trials – it's posited that the erratic behaviour of a few poisoned individuals caused an irrational response in a larger group.

Ergot poisonings – also known as ergotoxicosis – can be widespread, as occurred in the French village of Pont-Saint-Esprit in 1951, when hundreds of people were poisoned by ergot through their local bakery. The effects on the body can be more severe. A related class of long-term ergot poisoning known as ergotism causes gangrene of the limbs as the toxin cuts off the blood supply. Plenty of fungal toxins may be present on mouldy food, so reconsider cutting visible mould off and eating the remainder – the threads of mycotoxin-producing mycelium may have travelled further than you realise.

Elemental poisons

There are other poisons from nature that require a bit more chemistry knowledge to obtain: those derived from minerals.

Arsenic has been known as a poison for centuries and kills by damaging cells and interfering with cellular respiration. Of note is the signature brew of the Italian professional poisoner, Guilia Tofana (died 1651). Her Acqua Tofana, thought to contain arsenic, lead and belladonna, was a tasteless liquid that could be added to a glass of wine or a meal.

It's claimed that as many as 600 women used this potion to kill their husbands.

A single dose wasn't fatal, so as the killer nursed their ailing victim they continued dosing them with poison. This gradual progression towards death using Acqua Tofana highlights the challenge of separating poisoning from the symptoms of disease. Common signs of arsenic poisoning – such as vomiting, chills and fever – are consistent with many bacterial and viral infections, which were prevalent in the 17th century.

It was almost two centuries later, in the 1830s, that a reliable test for arsenic was developed by English chemist James Marsh. Motivated by having failed to prove the guilt of an arsenic poisoner (who later confessed to his crime), Marsh set out to construct a glass apparatus that could specifically establish the presence and quantity of arsenic.

His process – known as the Marsh test – was very successful and is considered to have deterred future deliberate poisonings with so-called "inheritance powders". Marsh's efforts represent one of the earliest techniques of modern chemical forensics.

CHEMWATCH
Bulletin Board
Gossip
SEP. 29, 2023

Synthetic poisons

The arrival of modern chemical sciences made many of the old poisons less appealing for those with murderous intent, as restricted availability and ease of tracing meant the poisoner became much easier to identify.

But this hasn't stopped the development of countless poisons. From the gases used in trenches during the Great War to chemical agents that enabled the Holocaust, humans seem to have an endless capacity for ingenious chemical horrors.

Synthetic poisons are often chemical weapons developed by nation-states. The Chemical Weapons Convention currently has 193 member parties, and while some countries have been actively working to lower their stockpiles of chemical weapons, 15 states maintain declared chemical weapon production facilities. Certain countries have dipped into their military stockpiles for attacks, both foreign and domestic, as well as for more personalised targets.

In 2018 in Bristol, England, a synthetic poison of particular strength was deployed against former Russian/UK double agent Sergei Skripal. This "novichok" weapon (Russian for "newcomer") was developed after the nerve gases sarin and VX. These weapons share common chemistry as they are all organophosphate nerve agents. The novichoks are intended to be deadlier, but easier to handle. Some are binary weapons and require two components to be mixed to become active. This works well for a two-person assassination squad, where neither poisoner is in possession of the entire weapon.

Poisons as medicine

A number of poisons from nature have long histories of use in traditional medicine. In these cases, keeping the poison's dose quantity low can have a therapeutic rather than deadly effect. Atropine from the plant belladonna has been used as an antidote to organophosphate and nerve gas poisoning, and is also routinely used for dilating the pupils in eye exams. Hycoscine, also found in belladonna, is extracted from the Australian plant Duboisia myoporoides and chemically modified to make the drug hyoscine butylbromide, often used in the treatment of irritable bowel syndrome, among other ailments.

The highly potent botulism toxin, produced by the bacterium Clostridium botulinum, causes paralysis and damage to the nervous system. Remarkably, this property has been used for a range of

cosmetic procedures. Botox treatments have found application in treating migraines, overactive bladder and even in the treatment of rare gastrointestinal issues preventing patients from burping.

Medicines are also potent poisons when taken at the wrong dose. Even commonplace paracetamol can be deadly. This abundant medication causes severe liver damage when taken in excess, unfortunately resulting in around 50 deaths per year in Australia. The Therapeutic Goods Administration has moved to lower the pack sizes to avoid both intentional and unintentional overdose. The therapeutic range of pharmaceuticals vary widely, and one can easily enter dangerous levels if the instructions aren't carefully followed. So make sure you follow the dose directed by your doctor or pharmacist.

Poisons appear formidable and enigmatic. Whether they are deployed as a cowardly weapon, as a biological defence, as a plot device for the whodunnit writer, or as a safe pharmacological dose, they demand our respect. Uncovering their nature is endlessly alluring – as the true antidote is often not a secret potion, but the chemistry that lies within.

Cosmos, 17 September 2023

https://cosmosmagazine.com

Study shows we can create value from food waste by turning it into a highly desirable material: nanocellulose

2023-09-27

Across the food supply chain, Australians waste around 7.6 million tons of food each year. This costs our economy approximately A$36.6 billion annually.

In a recent study published in Bioresource Technology Reports, we have found a way to use food waste for making a versatile material known as nanocellulose. In particular, we used acid whey—a significant dairy production waste material that it usually difficult to dispose of.

Mixing waste with bacteria

Nanocellulose is a biopolymer, which means it's a naturally produced long chain of sugars. It has remarkable properties—bacterial nanocellulose is strong, chemically stable and biocompatible, meaning it's not harmful to

Food waste is a global problem with approximately 1.3 billion tons of food wasted each year throughout the food lifecycle—from the farm to food manufacturers and households.

CHEMWATCH
Bulletin Board
Gossip
SEP. 29, 2023

human cells. This makes it a highly marketable product with applications in packaging, wound treatments, drug delivery or food production.

The traditional approach for making nanocellulose can be expensive, uses large amounts of energy and takes a long time. Some types of nanocellulose production also use a chemical process that produces unwanted waste byproducts.

By contrast, our new approach uses just food waste and a symbiotic culture of bacteria and yeasts (SCOBY)—something you may be familiar with as a kombucha starter. Our process is low cost, consumes little energy and produces no waste.

We used a runny waste liquid known as acid whey from a local cheese manufacturer in Melbourne, Australia. In the dairy industry, acid whey is often disposed of as wastewater in large amounts (more than 100 million liters of acid whey are produced annually in Australia alone), despite it being rich in carbohydrates and proteins. This is because it's hard to process into other products due to a high lactic acid content.

We heat-treated the liquid and supplemented it with sugar and yeast extract before adding the key ingredient, SCOBY (obtained commercially from a Melbourne-based kombucha company).

Over four days as our mixture fermented, the bacteria worked to create nanocellulose material which floated to the top. Lovers of home-brewed kombucha may actually be familiar with the raw nanocellulose material—it forms as a floating off-white structure called a pellicle. Some people already use this kombucha by-product as vegan leather.) A similar pellicle formed on our acid whey mixture.

A growing market

Demand for nanocellulose is growing worldwide. The global market was valued at US$0.4 billion in 2022 (A$0.6bn) and is expected to grow to US$2 billion by 2030 (A$3.1bn). Bacterial nanocellulose produced from food waste can help to satisfy this demand.

This growth is in part due to how we can use nanocellulose instead of petroleum-based and other non-renewable materials in things like packaging. Among its desirable properties, nanocellulose is also fully biodegradable.

Manufacturers around the globe are seeking sustainable sources of raw material for producing composite materials with various properties.

Nanocellulose is easily customized in this way. For example, infusing nanocellulose with a compound called glycerol enhances its flexibility and makes it more pliant. As a food-safe material, we are now investigating nanocellulose as "smart" packaging by infusing nanocellulose with indicators that signal when food is no longer safe to eat.

Additionally, using a single source of food waste (such as acid whey in our example) means we can produce highly pure nanocellulose—ideal for biomedical applications, such as wound dressings, pharmaceutical compounding and cell cultures.

Efficient circular economy

A circular economy attempts to minimize waste and extend the lifecycle of products for as long as possible. Our study demonstrates an efficient circular economy approach for upcycling a dairy industry waste product into sustainable nanocellulose.

Additionally, the sediment residue we produced has a high nutrient value and potentially has commercial value as a fertilizer or animal feed, while the liquid culture can be reused for the next batch.

Our study was limited to a single source of food waste within a laboratory environment. A future challenge will be taking this approach out of the lab and scaling it up for commercial use. This will involve a series of steps throughout the value chain from waste collection and transport through to commercial production.

We also hope to explore alternative mediums such as mixed food waste. More research also needs to be done on how nanocellulose can be most effectively customized for various applications, such as different types of food packaging.

Overall, our proof-of-concept study demonstrates potential for producing nanocellulose in a sustainable, environmentally sound manner—from food waste to significant value.

Phys Org, 27 September 2023

https://phys.org

CHEMWATCH
Bulletin Board
Gossip
SEP. 29, 2023

Consuming Aspartame Impairs Learning and Memory in Mice

2023-09-23

First authorized for human consumption by the US Food and Drug Administration (FDA) in 1981, aspartame is used as a sugar alternative in over 5,000 food products. As it is ~200 times sweeter than sucrose, its introduction to the food market was intended to tackle obesity rates and support patients with diabetes by reducing sugar consumption.

While the consumption of non-nutritive sweeteners – including aspartame – continues to rise, so too does the body of scientific work assessing their impact on the human body and long-term safety. Some of these studies are required by regulatory bodies; the European Food Safety Authority (EFSA) is obliged to re-evaluate all food additives that were permitted for use prior to 2009, for example. Others are conducted by laboratories with specific interests relating to sweeteners, like that of Pradeep Bhide, the Jim and Betty Ann Rodgers Eminent Scholar Chair of Developmental Neuroscience in the department of biomedical sciences at Florida State University College of Medicine.

Aspartame's effects on the mouse brain are potentially transmitted down future generations.

Bhide's research is in the field of epigenetics, which explores how modifications to our genetic code can alter how genes are read, transcribed and translated into proteins by our cell's machinery. Emerging research suggests that such modifications may be passed down to future generations. "Our lab has been interested in examining how environmental exposures influence traits (behavioral, cellular, molecular, etc.) not only in directly exposed individuals but also in their un-exposed descendants. This research falls into a field of biology that examines heritable effects of environmental exposures, often ancestral exposures," Bhide said in a previous interview with Technology Networks.

Aspartame induced anxiety-like behaviors in mice, which were heritable

Environmental exposures include the foods that we eat as part of our lifestyle. In 2022, Bhide and colleagues published a study that demonstrated anxiety-like behavior in mice, induced by aspartame consumption, is heritable through the paternal line. In behavioral tests, the children and grandchildren of aspartame-exposed mice spent significantly less time in the center of an open-field test, a hallmark of fear and stress in mouse models. Delving into the molecular mechanisms behind this response, RNA sequencing revealed altered gene expression in the

amygdala, an area of the brain associated with fear responses. "We believe that aspartame produces a shift in the excitation–inhibition balance, in favor of excitation," Bhide said.

Bhide and team's newest study, published in Scientific Reports, questioned whether aspartame consumption affects learning and memory deficits in mice, and whether such effects could also be inherited by future generations.

Aspartame exposure leads to working and spatial memory deficits in mice

For the experiment, mice were divided into three groups: a control group that consumed just water, and two groups that consumed either 7% or 15% of the FDA's recommended DIA of aspartame in water over a 16-week period. These levels were replicated from Bhide and colleagues' previous study exploring anxiety.

At 4-, 8- and 12-week intervals, the mice undertook the Y-maze test that assesses spatial working and reference memory. "Aspartame's effects on working memory were present as early as 4 weeks of exposure and persisted over the entire 12-week duration," the authors wrote.

After 14 weeks, all groups of mice undertook the Barnes maze, where they learn the location of a "safe" escape box out of 40 possible boxes organized in a circular arena. The control group mice discovered the safe box quickly, while the mice that had consumed aspartame took longer to learn the task. "We're seeing they use a different strategy, but they do find the escape box," co-author Deirdre McCarthy, research faculty in the department of biomedical sciences and the Center for Brain Repair, said. "They compensate in some sort of way."

"They can function, but they need longer time, or may need extra help," Bhide added. "The second thing we noticed here, unlike the anxiety (research), this went only one generation." The effects were only observed in the children of male mice, not the grandchildren, which Bhide stated as further evidence that these "kinds of transmissions" are occurring due to epigenetic changes in the sperm. The exact mechanisms underlying this heritability are not yet clear.

FDA urged to take a closer look at the effects of aspartame

Bhide and colleagues emphasize that the cognitive functions tested in this study are distinct from anxiety behaviors. The findings of the work therefore imply that the effects of aspartame could be more widespread

CHEMWATCH
Bulletin Board
Gossip
SEP. 29, 2023

than their previous paper suggested – in mice at least. The data cannot be directly extrapolated to humans, and research investigating such effects on learning and memory in the human brain is currently limited.

Aspartame has already received a fair amount of attention this year, most recently through its classification as "possibly carcinogenic" by the International Agency for Research on Cancer. In July, the FDA released a statement expressing its disagreement with this decision. "Aspartame is one of the most studied food additives in the human food supply. FDA scientists do not have safety concerns when aspartame is used under the approved conditions," the statement read. "FDA scientists reassess the science about the exposure and safety of a sweetener each time the agency files a food additive petition or a generally recognized as safe notice for that sweetener. We also stay abreast of published literature and the current level of consumer exposure and participate in international scientific and standard-setting activities related to food ingredient safety."

Based on its findings, the Bhide team suggested that the FDA take a closer "multi-generational" perspective on the effects of aspartame.

Reference: Jones SK, McCarthy DM, Stanwood GD, Schatschneider C, Bhide PG. Learning and memory deficits produced by aspartame are heritable via the paternal lineage. Sci Rep. 2023;13(1):14326. doi: 10.1038/s41598-023-41213-2

Cosmos, 23 September 2023

https://cosmosmagazine.com

Researchers propose 3D printing of high-performance elastomers through vat photopolymerization

2023-09-27

In a study published in Advanced Materials, the research group led by Prof. Wu Lixin from Fujian Institute of Research on the Structure of Matter of the Chinese Academy of Sciences proposed 3D printing of high-performance elastomers through vat photopolymerization.

The researchers analyzed the structure-property relationship between molecular weight and mechanical properties, and selected polytetramethylene ether glycols (PTMGs) with different molecular weights (Mn=1000, 2000, 3000 g mol-1, respectively) as reactants to react with isophorone diisocyanate (IPDI). The obtained polyurethane blocked oligomers (PUBs) exhibited high viscosities.

Acrylate-based ultraviolet (UV)-curable resins are currently used as raw materials to obtain desired performance by adjusting the types and ratios of oligomer and reactive monomers in the resin system. However, due to low degree of free-radical polymerization, the elastomers prepared by vat photopolymerization (VPP) technology show low strength, poor resilience, and unsatisfactory mechanical properties.

To increase the polymerization degree, increasing the proportion of oligomer is the most direct and effective way. However, the viscosity of the resin system also increases dramatically. The previously developed linear scan-based vat photopolymerization (LSVP) can effectively solve this problem by direct 3D printing the high-viscosity resin.

By the merit of the broadened process windows, the researchers synthesized oligomers containing tert-butyl hindered urea bonds (HUBs), which would deblock at high temperatures and re-block at room temperature. During the printing process, the HUBs and viscous compounded oligomers underwent cross-linking via a free radical polymerization mechanism to produce green parts.

With the wide process window capability of the LSVP system, which allows for 3D printing of high-viscosity resin, the researchers replaced the conventional monomer with a high-viscosity oligomer compounded with the as-prepared PUB to create the 3D printable UV-curable resin.

Corresponding mechanical tests revealed that PUB2000-HMDA showed the highest ultimate engineering stress of 25.9 ± 1.6 MPa, along with the highest strain of 1605 ± 63%. The tensile toughness, measured as the integral area beneath the strain–stress curve, was 142.3 MJ m-3, indicating an overall superior mechanical performance.

Besides, to further investigate the structure-property relationship between the chain extender and mechanical properties, the researchers employed three different types of chain extenders to evaluate the corresponding mechanical properties. Experimental results showed that the HMDA-extended samples exhibited the highest tensile strength and elongation at break among the three chain extenders.

This study systematically investigates the mechanical properties of high-viscosity PUB-dominated UV-curable resin upon thermal treatment.

Phys Org, 27 September 2023

https://phys.org

CHEMWATCH
Bulletin Board
Curiosities
SEP. 29, 2023

Drug that mimics exercise triggers weight loss and builds lean muscle

2023-09-25

"This compound is basically telling skeletal muscle to make the same changes you see during endurance training," said lead author Thomas Burris, professor of pharmacy at the University of Florida.

While exercise mimetics have been in the works for some time, the UF researchers found that a compound known as SLU-PP-332 was able to target a specific estrogen-related receptor (ERR), which boosted skeletal fat oxidation, therefore increasing energy expenditure.

In a mouse study, SLU-PP-332 'revved' up a natural metabolic pathway that is normally excited through physical exercise. Compared to a control group of obese mice, the cohort given SLU-PP-332 twice a day for a month gained 10 times less fat and also lost 12% of their body weight in the process, with no changes to diet and exercise.

"They use more energy just living," Burris said.

The mice were also able to run nearly 50% further than prior to treatment, which supports previous research into how it strengthens the heart muscle.

"When you treat mice with the drug, you can see that their whole body metabolism turns to using fatty acids, which is very similar to what people use when they are fasting or exercising," Burris added. "And the animals start losing weight."

The class of drugs is very different to the emerging weight-loss medicines such as semaglutide, which drastically slow down digestion. However, this could potentially be complementary, since rapid weight loss can also result in a loss of lean muscle.

While still early days, researchers believe exercise mimetics can go far beyond treating weight loss, to target all the conditions that physical activity helps lower the risk of, including diabetes and cardiovascular disease. For those who are limited in what exercise they can do, this could be life-changing. Researchers are also studying how these compounds can benefit brain function and cognitive health.

"This may be able to keep people healthier as they age," Burris added.

As a new age of weight-loss therapeutics dawns, heralded by the likes of semaglutide (Ozempic, Wegovy), scientists are one step closer to creating a drug that can coax muscles into behaving as if they've just been put through a vigorous workout. Known as exercise mimetics, this proposed class of drugs essentially 'mimics' the benefits of exercise, triggering a mechanism that supercharges fat metabolism and encourages lean muscle mass.

The study was published in the Journal of Pharmacology and Experimental Therapeutics.

Source: University of Florida via Medical Xpress

New Atlas, 25 September 2023

https://newatlas.com

Blue rayon fibres: microplastics in the Ganges

2023-09-22

The study, which is published in Science of the Total Environment, has found that sediment along the Ganges houses about 57 microplastics per kilogram, while 41 microplastics per square metre settle out of the air and every 20 litres of water contains one microplastic particle.

While scientists are still untangling all the environmental effects of microplastics because they're difficult to assess, they've been shown to be harmful to aquatic life in particular.

"This research is groundbreaking, and we need to make the findings understandable for the key stakeholders, including policy makers," says co-author Dr Gawsia Wahidunnessa Chowdhury, from the University of Dhaka in Bangladesh.

In total, the researchers have estimated that the Ganges and its tributaries deposit 1-3 billion microplastics into the Bay of Bengal every day.

In this study, they found that rayon (a synthetic fibre made from cellulose) was the most common type of microplastic at each site, ranging from 54-82% of the samples found.

Blue was the most common microplastic colour, representing 48-79% of the microplastics found at each site.

"This research based on primary field data has provided clear insight on the levels of microplastics in different environmental matrices of River Ganges and that several major river systems of the world have reported comparatively higher microplastics than the Ganges," says co-author Dr Anju Baroth, a scientist at the Wildlife Institute of India.

"This study could be used to further mature the theory on major sinks and sources of microplastics in major river systems of the world."

The researchers collected water, sediment and air samples from 10 different sites along the Ganges: 3 in Bangladesh and 7 in India.

River sediments and air are major sinks and transporters for microplastics, according to a study done on the Ganges River in India and Bangladesh.

CHEMWATCH
Bulletin Board
Curiosities
SEP. 29, 2023

They found that fibres from cloth were the most common type of microplastic, representing 95%-99% of the microplastics in samples.

"Our research shows that clothing is the major source of microplastics in the air, water and sediment of this vast river system, enabling us to work with partners and policy makers to seek locally appropriate solutions," says co-author Professor Heather Koldewey, from the Zoological Society of London, UK.

"These can be informed and supported by the brilliant scientists from Bangladesh and India who were key members of the team involved in this paper."

Microplastics increased further downriver,and were also higher in proximity to big population centres.

Lead author Dr Imogen Napper, a research fellow at the University of Plymouth, UK, says that researchers have known that rivers are a major source of microplastics for some time.

"However, there has always been uncertainty about the sheer amounts being transported, and whether they represent long-term sinks," says Napper.

"This study goes some way to unravelling that mystery, and revealing the true scale of microplastic contamination that our river systems can represent."

Cosmos, 22 September 2023

https://cosmosmagazine.com

Europeans' BPA exposure still exceeds safety threshold but levels may be starting to fall

2023-09-22

BPA is used to make polycarbonate plastics used in food and drink storage containers, as well as epoxy resins that are used to line food and drinks cans and has been controversial for a couple of decades as it is an endocrine disruptor. In April, the EFSA recommended a 20,000-fold reduction in the tolerable daily intake (TDI), or daily safe level of a compound over a person's lifetime, of BPA. However, the European Medicines Agency quickly stated that there wasn't enough evidence at this stage to warrant such a reduction and argued that EFSA's TDI is too low.

Europeans are exposed to levels of the endocrine disruptor bisphenol A (BPA) that surpass acceptable health thresholds, according to new analysis released by the European Environment Agency (EEA). The levels of total urinary BPA for 92% of the adult participants from 11 European countries exceeded the European Food Safety Agency's (EFSA) safe level of 11.5 nanograms per litre (ng/l), the EEA found.

The German Federal Institute for Risk Assessment concurrently expressed similar views.

In the 11 European countries that participated in the biomonitoring initiative, BPA levels in the populace exceeded TDIs by between 71% and 100%. 'Population exposure to BPA in Europe is therefore too high and constitutes a potential health concern,' the EEA concluded. The agency added that, because of uncertainty in the way excess urinary BPA is measured, it is possible that BPA levels in those monitored are all above safe levels in every one of the 11 countries studied.

The urine samples were collected between 2014 and 2020, and while the newest samples still exceed the guidance value, it appears that there is a trend towards a decrease in urinary BPA levels and a slight increase in the BPA substitute bisphenol S, the EEA says. However, the agency notes that there is insufficient data right now to draw a definitive conclusion.

'Despite two decades of significant focus from national and EU authorities and the introduction of numerous regulatory measures, biomonitoring data show that exposure to BPA is still far too high and constitutes a potential health concern,' EEA concludes.

'Thanks to the EU's groundbreaking human biomonitoring research project we are able to see that bisphenol A poses a much more widespread risk to our health, than previously thought,' stated Leena Ylä-Mononen, the EEA's executive director. 'We must take the results of this research seriously and take more action at EU level to limit the exposure to chemicals that pose a risk to the health of Europeans.'

The European Commission will discuss a ban on the use of BPA and other bisphenols in food contact materials by the first quarter of 2024.

Chemistry World, 22 September 2023

https://chemistryworld.com

New recycling technology deconstructs mixed plastics

2023-09-22

Mixed materials usually end up in landfills because they are very difficult to recycle. A shirt made from 40% polyester and 60% cotton, for instance, has plastic and cotton fibres wound very tightly together. The fibres must be laboriously unwound or taken through a number of energy-intensive chemical reactions before the plastic and cotton can be separated and used again.

A team of US chemists has found a way to convert unrecyclable mixtures of plastic into useful chemicals.

CHEMWATCH
Bulletin Board
Curiosities
SEP. 29, 2023

But now the researchers have developed a catalyst that can efficiently disassemble the polymers that make plastics but leave other things in the mixture intact.

It leaves behind a soup of carbon-based chemicals which can then be turned back into plastic, or into other materials.

The research is published in Materials Horizons.

But the researchers successfully removed and recycled the plastic in a number of mixed materials in a single reaction, including in a fabric that's 40% polyester and 60% cotton.

The catalyst is an "organocatalyst": made mostly from carbon and hydrogen atoms, and lacking the precious metals that many catalysts rely on. It has the catchy name TBD:TFA.

When heated to specific temperatures (between about 100-200°C, depending on the substances), the catalyst could break down four different plastics the researchers tested: polycarbonate, PET, polyurethane and polyamide in under 2 hours.

In each case, it rendered "monomers" of each plastic: the individual molecules that, when linked together, form the long polymer chains that give plastic its properties. These monomers could be turned back into plastics or used to make other chemicals, like dyes or pharmaceuticals.

The catalyst left behind other polymers, like the cellulose that makes up cotton. It could also be re-used with ease.

"The selective deconstruction of mixed plastics by TBD:TFA provides a feasible path for implementing in a practical large pilot scale deconstruction plant," write the researchers in their paper.

They estimate that using their catalyst could lead to "a more than 80% reduction in energy and carbon footprint".

"This concept offers highly efficient and low-carbon chemical recycling of plastics and presents a promising strategy toward establishing closed-loop circularity of plastics," says corresponding author Dr Tomonori Saito, a chemist at Oak Ridge National Laboratory, US.

Cosmos, 22 September 2023

https://cosmosmagazine.com

Copper-based catalysts efficiently turn carbon dioxide into methane

2023-09-25

The lab of Rice University materials scientist Pulickel Ajayan and collaborators developed a way to wrest the carbon from carbon dioxide and affix it to hydrogen atoms, forming methane -- a valuable fuel and industrial feedstock. According to the study published in Advanced Materials, the method relies on electrolysis and catalysts developed by grafting isolated copper atoms on two-dimensional polymer templates.

"Electricity-driven carbon dioxide conversion can produce a large array of industrial fuels and feedstocks via different pathways," said Soumyabrata Roy, a research scientist in the Ajayan lab and the study's lead author. "However, carbon dioxide-to-methane conversion involves an eight-step pathway that raises significant challenges for selective and energy-efficient methane production.

"Overcoming such issues can help close the artificial carbon cycle at meaningful scales, and the development of efficient and affordable catalysts is a key step toward achieving this goal."

The polymer templates, which were made of alternating carbon and nitrogen atoms, have tiny pores where copper atoms can fit at varying distances from one another. The catalysts assemble at room temperature in water with the copper atoms displacing the host metal ions in the polymer templates. When tested in a reactor, the catalysts enabled the reduction of carbon dioxide to methane in one half of the cell, while oxygen was produced from water in the other half.

"We found that modulating the distances between the copper atoms lowered the energy needed for key reaction steps, thereby speeding up the chemical conversion," Roy said. "This cooperative action of nearby copper atoms helped produce methane at a very high rate of selectivity and efficiency."

The catalysts developed by Roy and collaborators yielded one of the most rapid and efficient electrolysis-based conversions of carbon dioxide to methane known so far, helping advance the conversion process both in terms of fundamental scientific insight and performance level.

"If system-level energy and carbon conversion efficiencies can be addressed, inexpensive and efficient materials like these will help catalyze the industrial translation of electrochemical carbon dioxide reduction

Technologies for removing carbon from the atmosphere keep improving, but solutions for what to do with the carbon once it's captured are harder to come by.

CHEMWATCH
Bulletin Board
Curiosities
SEP. 29, 2023

technology," said Jingjie Wu, an associate professor of chemical and environmental engineering at the University of Cincinnati.

Ajayan, Rice's Benjamin M. and Mary Greenwood Anderson Professor of Engineering and chair of the Department of Materials Science and NanoEngineering, added that the "design and development of novel catalysts are central to the energy and sustainability challenges we face."

"Single-atom dispersed catalysts present an exciting approach in this effort," Ajayan said.

Wu and Chandra Veer Singh, a professor of materials science and engineering at the University of Toronto, were key contributors to the study.

https://www.sciencedaily.com/releases/2023/09/230925124812.htm, 25 September 2023

https://sciencedaily.com

Prytium multi-tool glows in the dark without resorting to radioactivity

2023-09-27

Manufactured by Singaporean company Espen, the Prytium has a Grade 5 titanium body that's available in either matte gray or matte black finishes. It measures 127 mm long by 30 mm wide by 11 mm thick (including its belt clip), and tips the scales at a claimed 84 g (3 oz).

The Prytium's tools include a prybar/nail puller; bottle/can opener; 4-mm bit drivers with two hardened steel 4-mm bits (type not specified); regular and high-torque quarter-inch bit drivers; 30-in/80-mm ruler; tungsten glass breaker; nail file; plus a fold-out replaceable Number 16 carbon steel surgical blade – the blade mount can accommodate 10 different blade types.

Like many of its rivals, the Prytium additionally features two slots for vials of glow-in-the-dark tritium. Users are left to supply those vials for themselves, as the stuff is slightly radioactive … so they may want to skip that feature.

That being said, the tool does also incorporate a vial of non-radioactive strontium aluminate. While that chemical glows brighter than tritium, it does have to be charged via exposure to a UV light or bright flashlight first. It should then glow for up to seven hours before requiring a recharge.

The titanium multi-tools continue to run thick and fast on Kickstarter, with the latest offering being a little something called the Prytium. It packs in over a dozen tools, including a glow-in-the-dark light that for once is not radioactive.

Assuming the Prytium multi-tool reaches production, a pledge of US$145 will get you one. The planned retail price is $180.

New Atlas, 27 September 2023

https://newatlas.com

Addressing the saga of nitrosamine contamination in drugs

2023-09-26

'At that time, the risk was related to the manufacture of the drug substance,' explains Andrew Teasdale, senior principal scientist in impurity management at AstraZeneca. 'In the case of valsartan it was due to an issue with the chemistry; they had an impurity that was a secondary amine, and they had a nitrosating agent – sodium nitrite – that was used as a quenching agent. And completely by accident, they created this nightmare scenario.'

Since then, comprehensive assessments have been carried out on APIs, drug products and packaging to understand and evaluate the context and extent of the risk of nitrosamine formation. 'After about three years or so, we thought we were pretty close to solving the whole problem…we thought we understood the chemistry,' Teasdale continues.

But, it slowly became apparent that the drugs themselves could pose a potential risk. 'If the drug itself was a secondary amine, particularly if you're using processes like wet granulation where you've got a fair amount of water present, you can dissolve the trace nitrite that's commonly present in [other ingredients of the formulation] in the water…and again, you've got the chemistry conditions to form a nitrosamine.'

The problem with these more complex nitrosamines, referred to as nitrosamine drug-substance-related impurities (NDSRIs), is there is little to no safety data available. That makes it very difficult to confidently set an acceptable intake limit, which is calculated by assuming a lifelong daily exposure to the medicinal product.

Initially, medicines regulators applied the same precautionary limits for the NDSRIs as they had previously for the simpler dialkyl nitrosamines of 18ng/per day. But these were considered unachievable for the NDSRIs. 'There's no realistic chance of ever being able to hit limits like 18ng/day,' explains Teasdale. 'So, all of a sudden [for maybe] 20%, 30%, even 40% of all existing drugs across major classes – hydrochlorothiazide, beta blockers etc, there is a major risk of having to take these drugs off the market.'

In June 2018, a potentially carcinogenic nitrosamine impurity, N-nitrosodimethylamine (NDMA), was detected in valsartan, a medication used to treat high blood pressure and heart failure. Soon after, NDMA and further small dialkyl N-nitrosamine impurities were discovered in other sartan active pharmaceutical ingredients (APIs), and later in stomach acid regulator ranitidine, and diabetes medicines piaglitazone and metformin.

The pharmaceutical industry sprang into action to develop a greater understanding of the likely carcinogenic potency for different NDSRIs. Was it was possible, in the absence of any safety data, to bracket the NDSRIs into different potency groups? Regulators also made various attempts to come up with interim intake limits, but the problem was more serious than anyone had expected. 'We seemed to be heading towards a catastrophic loss of critical medicines,' recalls Teasdale.

Regulatory review

In September 2019, the European Medicines Agency (EMA), US Food and Drug Administration (FDA) and regulators around the world asked companies to carry out a comprehensive review of all chemical and biological human medicines for the possible presence of nitrosamines, with an initial risk evaluation due by 1 July 2021 and full confirmatory testing by 26 September 2022.

Those that found products containing nitrosamines above a certain level were asked to submit any relevant changes to manufacturing processes, formulation or packaging – intended to prevent or minimise the risk of impurities forming – to their respective regulators by 1 October 2023.

Speaking to Chemistry World in August, a spokesperson for the EMA said that for centrally authorised medicines, the global response rate for the risk evaluation to identify active substances and finished products at risk of N-nitrosamine formation or cross-contamination had exceeded 96%.

The pharmaceutical industry sprang into action to develop a greater understanding of the likely carcinogenic potency for different NDSRIs. Was it was possible, in the absence of any safety data, to bracket the NDSRIs into different potency groups? Regulators also made various attempts to come up with interim intake limits, but the problem was more serious than anyone had expected. 'We seemed to be heading towards a catastrophic loss of critical medicines,' recalls Teasdale.

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There are reasonably well-understood structural features that directly increase or decrease the favourability of this activation mechanism, as well as features that can speed up the removal of a nitrosamine by other biological pathways. Therefore, the CPCA is based on the idea that, in the absence of sufficient substance-specific data to derive an accurate intake limit, a prediction of the mutagenic potential and carcinogenic potency of an N-nitrosamine can be generated based on the structural features.

In addition, the updated guidelines include details of an 'enhanced' Ames test which requires two nitrosamine positive controls that are known to be mutagenic. Since it is the metabolic products of nitrosamines that are mutagenic, rather than the nitrosamines themselves, the revised test also includes metabolic enzymes to activate them.

Evaluation of this enhanced test is ongoing, says Teasdale. 'There are concerns about whether it's overly sensitive,' he explains. 'Do we really need two positive controls? And what should they be?'

Difference in opinion

The majority of API-derived nitrosamines will probably fall into CPCA potency category 5, says Schlingemann, meaning they would need to be controlled to a limit of 1500ng/day. While he says this is 'rather easy going' for most drug products, it does mean that the nitrosamine is still being recognised as a mutagenic impurity.

'If you want to control it as a non-mutagenic substance you have to perform in vivo mutagenicity testing,' says Schlingemann. 'Either a transgenic rodent assay, or there's a new kid on the block called duplex sequencing.' Although Teasdale highlights that there are some grey areas and differences in opinion between the regulators in this regard. While in

CHEMWATCH
Bulletin Board
Curiosities
SEP. 29, 2023

Europe, a negative transgenic rodent assay might be enough to classify a drug as non-mutagenic, 'the FDA isn't saying that,' he says.

Even for compounds still classed as mutagenic, there are differences, he points out. 'As far as Europe is concerned, if I do this revised Ames test and I get a negative, I've got a fighting chance of control, as I can apply a limit of 1500ng/day,' explains Teasdale. 'As far as the FDA is concerned, they're not prepared to go as far as saying a negative Ames will take you to that limit.'

In cases where nitrosamine levels can't be controlled to below the relevant limit, manufacturers will need to implement technical mitigations. This could involve finding additives that help to control low levels of nitrite, or it may mean changing the packaging or reducing the shelf life of the drug.

Theoretically, manufacturers could change the formulation of affected drugs to include nitrosamine scavengers such as ascorbic acid, but any change to the formulation will lead to regulatory complexities as additional stability studies may be needed and the resulting approval process could take years.

A helping hand

Ultimately, all manufacturers will have to demonstrate to the regulators that they understand where all the nitrosamine impurities are, exactly how they are formed and how to control them. However, while some sources of nitrosamine impurities are relatively easy to identify, others that arise during the various stages of making a finished drug can be harder to identify.

Lhasa, a not-for-profit organisation in Leeds, UK, that facilitates collaborative data-sharing projects in the pharmaceutical, cosmetics and chemical industries, has built software to help model and predict potential sources of mutagenic impurities, in a way that is consistent across manufacturers and reassures the regulators that the calculations have been done properly.

Lhasa acts as an 'honest broker' with whom companies can share unblinded data, while preserving their intellectual property. Lhasa can then learn from the data and use it to create algorithms that everyone can benefit from.

'The problem with nitrosamines is that the levels that they have to be controlled to are so super low that proving a negative is, in many cases,

beyond the capability of the testing technology at present,' explains Michael Burns, principal scientist at Lhasa.

The function of the software is to highlight to manufacturers when the various factors combine that could give rise to an important impurity, Burns says. 'Then it's up to them to assess that risk.'

But this is a huge job, Burns explains, because if you've got any secondary amine of any description in your product, it could form a nitrosamine, and secondary amines are everywhere: in drugs but also in food and in our bodies.

'This is part of the context that can get lost with the focus on the pharmaceutical world – that your stomach is an incredible reaction vessel, which is full of nitrites from our natural environment,' Burns says. 'It's very acidic, which is prime conditions for any amines in your stomach, you will generate absolutely tonnes of these chemicals anyway that you can't control.'

The guideline for most drugs allow for cases where a patient is only going to be taking them short term, meaning intake limits can be higher. But at present, this is not being allowed for drugs containing nitrosamines, says Burns, 'which negates the fact that we know there are repair mechanisms in the body to redirect all of this because it deals with it daily'.

However, Burns is positive about the progress that has been made since the review started and says that industry and regulators now know much more about the toxicology of nitrosamines than they did before.

Another positive has been in seeing regulators and industry working together to find a solution. As an intermediate between industry and the regulators, Burns has been involved in a lot of meetings with both. Although he says at first they were 'at loggerheads', with the regulators being 'too cautious', a focus on collaboration has resulted in them being in a 'much better place'.

'The regulators have now reached a point where they have been happy setting some higher limits for certain classes, based on what we know about metabolism; ie that it's not the nitrosamine itself that is mutagenic, it's once it's metabolised.'

And Lhasa's software will continue to develop: 'the better the information that gets put into the software, the better the predictions come out', says Burns.

CHEMWATCH
Bulletin Board
Curiosities
SEP. 29, 2023

A long road ahead

But there is still a long way to go; industry is still collecting data about the mutagenicity and carcinogenicity of nitrosamines and, with each day, more is understood about how they form.

'The science in this area has evolved rapidly,' says Teasdale. 'For example, we've shown that, in the solid phase, in a tablet, tertiary amines really aren't much of a risk.' That immediately brings down the proportion of drug products that are likely to be affected. 'And the CPCA takes it down another notch.'

But Teasdale believes that the ongoing difference in opinion between the regulators will have an impact on progress. 'The FDA is still concerned about the correlation between mutagenicity and carcinogenicity in the case of nitrosamines, and therefore it's difficult to work out how to move them from their current position to the position of Europe. That's the real challenge,' he says. 'If you're ever going to turn this into a business-as-usual activity that becomes just part of the norm, these things still need to be resolved.'

Chemistry World, 26 September 2023

https://chemistryworld.com

Team develops key improvement to cryo-electron microscopy

2023-09-27

But cryo-EM still had a catch: It was only effective for imaging large molecules.

Now, UCLA biochemists, working with pharmaceutical industry scientists, have developed a solution that will make it possible for cryo-EM to acquire high-quality images of smaller protein molecules, too. The scientists engineered a 20 nanometer, cube-shaped protein structure, called a scaffold, with rigid tripod-like protrusions that hold the small proteins in place.

The scaffold can be digitally removed from the picture when the imaging is being processed, leaving a composite 3D image of just the small protein scientists are analyzing.

Small and medium-sized proteins are a hot point for research on potential new drugs that might one day be used to fight some of the most

The scientists who received the 2017 Nobel Prize in chemistry were honored for their development of a technique called cryo-electron microscopy, or cryo-EM. The technology was revolutionary because it enabled scientists to see the atomic structure of biological molecules in high resolution.

intractable human illnesses. The advance, which was tested on a protein that scientists are studying for its possible use in cancer treatments, can be customized for almost any small protein. Researchers expect that expanding cryo-EM's imaging capabilities will help them identify specific locations on proteins that they can target for therapeutic purposes.

A paper about the new research is published in the Proceedings of the National Academy of Sciences.

In cryo-EM, scientists use a cryo-electron microscope to send a beam of electrons through frozen samples of material, leaving behind an image of the thousands of molecules—such as proteins—in the sample. The molecules are imaged exactly as they lie in the sample, producing thousands of 2D photographs of the molecule taken from different angles. Computer processing reconciles all of those photographs to formulate a correct 3D image—separating the background, grouping images with similar orientations together and generating a high-resolution, 3D image of a single molecule.

But when it comes to imaging the smallest protein molecules, their tiny size makes it impossible to ascertain their orientations in the images, which results in relatively low-resolution images.

In previous studies, scientists attempted to solve the problem by attaching small molecules to larger scaffolds, but those experiments demonstrated that if the small molecules were attached too flexibly, they would protrude from the scaffold at different angles and orientations—which would still produce blurry images.

"The images are blurry because the computer can't create a distinct composite image when it can't determine the orientations accurately," said Todd Yeates, a UCLA distinguished professor emeritus of biochemistry, interim director of the UCLA–Department of Energy Institute for Genomics and Proteomics and the paper's corresponding author.

In the new study, the scaffold created by the scientists has tripod-shaped protrusions that capture the proteins and hold them firmly in place, which yielded the higher-resolution images they were aiming for.

"Attaching the small molecules rigidly to larger scaffolds creates particles that are large enough to be imaged, and which all have precisely the same 3D shape," Yeates said. "And from there, the process works as usual to construct the high-resolution 3D image."

CHEMWATCH
Bulletin Board
Curiosities
SEP. 29, 2023

Roger Castells-Graells, a UCLA postdoctoral researcher and the study's lead author, said the scientists first tried another shape for the scaffold before landing on the version with tripod-shaped protrusions.

"At first we used one 'stick' pointing outward and that didn't work as well," he said. "The new scaffold has protrusions that point toward each other in triplets—like tripods—that hold the protein firmly."

The researchers tested their scaffold by attempting to create images of a protein called KRAS. KRAS encourages cells to proliferate and is involved in about 25% of human cancers; it's of particular interest to pharmaceutical researchers because identifying specific locations on the protein that are related to its cancer-causing abilities could help scientists design drugs that neutralize activity at those locations—which could be one path toward treating cancer.

Using cryo-EM and the scaffold they developed, the UCLA-led team was able to observe the atomic structure of KRAS attached to a drug molecule that is being studied as part of a potential treatment for lung cancer. Their work proved that the new scaffolded cryo-EM approach can illuminate how drug molecules bind with and inhibit cellular proteins like KRAS, and could help guide the development of more effective drugs.

The potential applications for the new advance don't stop with cancer drugs, Castells-Graells said.

"Our scaffold is modular and can be assembled in any configuration to capture and hold all kinds of small protein molecules," he said.

Phys Org, 27 September 2023

https://phys.org

Humans Can Serve as Sentinels for "Forever Chemicals" Ecological Harm

2023-09-27

A new paper by Environmental Working Group scientists proposes an intriguing concept: Humans can serve as a valuable resource for understanding the impact on other animal species of the toxic "forever chemicals" known as PFAS.

"PFAS pollution is not just a problem for humans," said David Andrews, Ph.D., senior scientist at EWG. "It's a problem for species across the globe. This new paper delves into how humans serve as an early warning system

"PFAS is not just a problem for humans. It's a problem for species across the globe." How can we understand their impact on other species?

for understanding how PFAS may impact other living creatures in the environment."

Forever chemicals are linked to a wide range of adverse effects in both humans and laboratory animals. These encompass harm to the immune system, disruptions in reproductive and fetal development, hormone disruption and an increased risk of cancer. Scientists are able to tap into existing research on PFAS, including extensive human studies, and employ non-invasive methods to gather information without harming animals, especially endangered species.

EWG President Ken Cook emphasized EWG's 25-year battle against PFAS contamination.

"EWG researchers have analyzed scientific studies, conducted our own investigations, and plotted where people are exposed to toxic PFAS," said Cook. "Now we've shown that humans might signal how these toxic chemicals affect the bodies of polluted animals in almost every corner of the world."

PFAS pose a significant threat to wildlife, especially those that are endangered or risk extinction. These animals often face exposure not only to PFAS but also to other hazards, such as pollution, habitat loss and exploitation.

A global problem

"The PFAS crisis is global," said Alexis Temkin, Ph.D., a toxicologist at EWG. "Like humans, wildlife are exposed to multiple PFAS at a time, through the diet, air, water and soil, highlighting the need to tackle these persistent and toxic chemicals as a class."

A study of North Carolina alligators' immune response and disease-fighting abilities found that elevated levels of PFAS were associated with higher occurrences of skin lesions, as well as wounds that did not heal properly and became infected.

Another study, on sea turtles in the north Pacific, found animals are vulnerable to the effects of PFAS exposure at every stage, from their eggs to immune systems.

In the studies EWG analyzed, animal tests were conducted most often on blood serum and plasma; on organs like the liver, kidney, and muscle, where PFAS are most likely to build up; and on eggs and other tissue samples.

CHEMWATCH
Bulletin Board
Curiosities
SEP. 29, 2023

'Just the beginning'

"There are still countless locations and species across the globe that are likely contaminated but have not yet been tested. PFAS pollution is a global problem. This paper and map are just the beginning," said Cook.

Investigations of the effects of PFAS on human health, as documented in epidemiological studies, can also offer valuable insights into potential harm to wildlife health.

The updated PFAS in wildlife map now plots more than 200 peer-reviewed studies that detected over 120 unique PFAS compounds in 625 animal species. The absence of PFAS in species in some countries is due not to a lack of contamination but instead to a lack of recent test results in the research EWG studied.

The new interactive map plots a great variety of wildlife, including many types of fish, birds, reptiles, frogs and other amphibians, large mammals such as horses and polar bears, and small mammals such as cats. Some are already endangered or threatened.

"The wildlife map is not an exhaustive catalog of all animal studies but mostly those published in the past few years. PFAS are ubiquitous, and this first-of-its-kind map clearly captures the extent to which PFAS have contaminated wildlife around the globe," added Andrews.

PFAS build up in the body and do not break down in the environment. The new study's findings raise serious health concerns for animals, since exposure to PFAS is linked to a range of health harms in people.

The chemicals are found in the blood of virtually everyone, including newborn babies. Very low doses of PFAS in drinking water have been linked to suppression of the immune system, including reduced vaccine efficacy, and an increased risk of certain cancers. PFAS are linked with increased cholesterol, reproductive and developmental problems and other health harms.

PFAS are used in a wide range of consumer products, including personal care products, food packaging, textiles like waterproof clothing, and many other products. They have also been widely used in firefighting foams and gear, a major source of contamination in the environment.

The extent of PFAS pollution is still being studied. EWG will add new studies to this map when new species and locations are tested for PFAS exposure.

"Our research found that the most common methods we have for getting rid of PFAS may end up leading to further pollution," said Tasha Stoiber, Ph.D., a senior scientist at EWG. "And we can expect that contamination to ripple through the food chain, potentially affecting even more species, including humans.

"Our choice is either to keep polluting the planet or take immediate action to stop all nonessential uses of PFAS," added Stoiber.

Industrial pollution

Because of the health risks associated with PFAS exposure, it is important to try to minimize exposure wherever possible.

"We need to accelerate – not delay – efforts to turn off the tap of PFAS pollution from industrial sources," said Scott Faber, EWG's senior vice president for government affairs.

The widespread global contamination of wildlife further shows the need to end industrial discharges of PFAS. EWG estimates there may be more than 40,000 industrial polluters of PFAS in the U.S. Tens of thousands of manufacturing facilities, municipal landfills and wastewater treatment plants, airports and sites where PFAS-containing firefighting foams have been used may be sources of PFAS discharges into surface water.

"For decades, polluters have with impunity dumped as much PFAS as they wanted into our air, rivers, streams, lakes and bays," said Faber. "The Biden Environmental Protection Agency must move faster and not rely on cash-strapped state regulators to turn off the tap."

Technology Networks, 27 September 2023

https://technologynetworks.com

Researchers realize direct conversion of methane with oxygen at room temperature

2023-09-27

Recently, a research group led by Prof. Deng Dehui and Assoc. Prof. Yu Liang from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) realized direct CH4 conversion to C1 oxygenates (CH3OH, HOCH2OH and HCOOH) with O2 at room temperature (25) over an edge-rich MoS2 catalyst. The study was published in Nature Catalysis on Sept. 21.

Direct conversion of methane (CH4) to high-value-added chemicals at room temperature, by directly using abundant and low-cost molecular oxygen (O2) as an oxidant, is an ideal route for CH4 utilization. But it remains a challenge due to the chemical inertness of methane and low activity of O2.

CHEMWATCH
Bulletin Board
Curiosities
SEP. 29, 2023

Catalytic conversion of methane to high-value-added chemicals is a tough problem due to the low polarization rate and high C-H bond energy (439 kJ mol-1) of methane.

Typical catalytic conversion of CH4 usually operates at high temperatures (over 600), or in the aid of strong oxidants (such as fuming sulfuric acid) or external fields (such as plasma). Nevertheless, such harsh reaction easily leads to excessive conversion of the target product, such as overoxidation to CO2.

Direct conversion of CH4 and O2 at low temperatures or even at room temperature is an appealing strategy for CH4 conversion. However, it is challenging due to the difficulty in continuous formation of active oxygen species under mild conditions for C-H activation.

In-situ characterizations and theoretical calculations demonstrated that the unique binuclear molybdenum (bi-Mo) site of sulfur vacancies at the MoS2 edge was able to directly dissociate O2 to form O=Mo=O* active species at 25 , which could activate the C-H bond of CH4 and thereby driving the catalytic conversion of CH4 to C1 oxygenates via CH3O* intermediates at room temperature.

In this study, the researchers achieved CH4 conversion of up to 4.2% with a high selectivity of over 99% for the C1 oxygenates for CH4 conversion with O2 at room temperature.

Phys Org, 27 September 2023

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CHEMWATCH

Bulletin Board

Technical Notes

SEP. 29, 2023

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

CHEMICAL EFFECTS

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ENVIRONMENTAL RESEARCH

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PHARMACEUTICAL/TOXICOLOGY

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OCCUPATIONAL

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