

# Bulletin Board

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

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### ASIA PACIFIC

#### New method to degrade PFAS 'forever chemicals' found effective in the lab

2024-06-24

Scientists at UNSW Sydney are developing catalysts able to break down PFAS chemicals that contaminate water.

Per- and poly-fluoroalkyl substances (PFAS) are known as 'forever chemicals' because they are notoriously resistant to degradation. Due to their stable chemical structure, PFAS – which are found in thousands of variants – are used in oil and grease-resistant food packaging, non-stick cookware, cosmetics, clothing, and fire-fighting foams.

The chemicals are so widespread that they have infiltrated water sources and soil. In fact, recent reports have found that much of our global water resources exceed the drinking limits of PFAS and concerns over their environmental and health impacts have steadily escalated.

Despite ongoing efforts to develop ways of degrading PFAS, current methods are limited by a lack of efficient, scalable and environmentally friendly processes.

Now, a team of scientists from UNSW's School of Chemistry have designed a catalyst system that can activate a reaction to break down common types of branched PFAS. The new method, developed by Dr Jun Sun and Professor Naresh Kumar and recently published in the journal *Water Research*, holds promise for more efficient and sustainable PFAS remediation in the future.

Working alongside Prof Denis O'Carroll, Prof Michael Manefield and Dr Matthew Lee from the UNSW School of Civil and Environmental Engineering, and funded by a \$3 million grant from the Australian Research Council in 2019, the team have designed a catalyst system that could play a key role in solving the problem of PFAS.

"Owing to its robust nature, simple application, and cost effectiveness, the new system we have developed shows successful PFAS remediation in the lab, which we hope to eventually test at a larger scale," says Dr Sun, first author of the paper.

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Read More

UNSW Sydney, 24-06-24

<https://www.unsw.edu.au/newsroom/news/2024/06/new-method-to-degrade-pfas-forever-chemicals-found-effective-in-the-lab>

#### Chemicals added to the Inventory 5 years after issue of assessment certificate - 26 June 2024

2024-06-26

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

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

<b>CAS number</b>	<b>1001416-18-7</b>
<b>Chemical name</b>	1-Propanone, 2-hydroxy-2-methyl-, 1-(4-C10-13-alkylphenyl) derivs.
<b>Molecular formula</b>	Unspecified
<b>Specific information requirements</b>	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
<b>Listing date</b>	11 June 2024
<b>CAS number</b>	956345-12-3
<b>Chemical name</b>	Fatty acids, C18-unsatd., dimers, polymers with glycidyl Ph ether, tall-oil fatty acids and triethylenetetramine
<b>Molecular formula</b>	Unspecified
<b>Specific information requirements</b>	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
<b>Listing date</b>	11 June 2024



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<b>CAS number</b>	<b>68152-95-4</b>
<b>Chemical name</b>	Linseed oil, polymer with pentaerythritol, phthalic anhydride and polymd. linseed oil
<b>Molecular formula</b>	(C8H4O3.C5H12O4.Unspecified)x
<b>Specific information requirements</b>	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
<b>Listing date</b>	11 June 2024
<b>CAS number</b>	143363-32-0
<b>Chemical name</b>	2-Propenoic acid, 2-methyl-, butyl ester, polymer with 2-(dimethylamino) ethyl 2-methyl-2-propenoate and 2-ethylhexyl 2-methyl-2-propenoate
<b>Molecular formula</b>	(C12H22O2.C8H15NO2.C8H14O2)x
<b>Specific information requirements</b>	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
<b>Listing date</b>	12 June 2024

<b>CAS number</b>	<b>1233859-95-4</b>
<b>Chemical name</b>	Linseed oil, maleated, 2-[(2-methyl-1-oxo-2-propen-1-yl)oxy]ethyl ester, ester with polyethylene glycol mono-Me ether, compds. with 2-(dimethylamino)ethanol
<b>Molecular formula</b>	Unspecified
<b>Specific information requirements</b>	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
<b>Listing date</b>	24 June 2024

Read More

AICIS, 26-06-24

<https://www.industrialchemicals.gov.au/news-and-notice/chemicals-added-inventory-5-years-after-issue-assessment-certificate-26-june-2024>

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## Regulatory Update

JUL. 05, 2024

### China Updates OELs Standard for Hazardous Agents in Workplace (Updated on May 9, 2024)

2024-06-20

NHC updated OELs and critical adverse health effects for benzene, and introduced trimethyltin chloride subject to biological monitoring.

Updates: On May 8, 2024, China NHC released the second notice to amend GBZ 2.1-2019 Occupational Exposure Limits for Hazardous Agents in the Workplace Part 1: Chemical Hazardous Agents. The amendment takes effect on May 1, 2025.

As amended, Table 1 in Article 4.1 on occupational exposure limits (OELs) for 358 hazardous chemicals in the workplace introduces one entry as follows:

No.	CAS	OELs (mg/m <sup>3</sup> )	Critical			Remark
			MAC	PC-TWA	PC-STEL	
359	34256-82-1	-	0.12	-	-	-

Accordingly, the main drafting unit and drafters for OELs for acetochlor in the workplace are also incorporated in Table B.1 of Annex B.

Read More

## AMERICA

### Federal Drinking Water Standards for PFAS Will Influence Groundwater Remediation Standards

2024-06-27

EPA recently issued a final rule establishing drinking water standards, known as maximum contaminant levels (MCLs), for six per- and polyfluoroalkyl substances (PFAS). The final rule became effective on June 25, 2024. The rule, among other things, provides public water systems three years to conduct initial PFAS monitoring and five years to make any necessary capital improvements to comply with the new MCLs.



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While the new MCLs principally apply to public water systems, they also will have a less obvious—and more immediate—effect on groundwater remediation standards. At the federal level, MCLs will be used as default groundwater remediation standards at Superfund sites for PFAS which have been designated as hazardous substances under CERCLA. EPA also uses MCLs to inform its Regional Screening Levels (RSLs), which are conservative standards used to screen chemicals at Superfund sites. Thus, PFAS detections at or above the RSLs will generally need to be evaluated at Superfund sites, and the burden will be on the remediator to show why EPA should accept groundwater remediation standards that are less stringent than the new MCLs.

The federal MCLs for PFAS also will have an effect on some state-level groundwater remediation standards. For example, Pennsylvania has regulations providing that federal MCLs automatically become default groundwater remediation standards for Act 2 sites. In New Jersey, existing groundwater remediation standards will remain in effect until the New Jersey Department of Environmental Protection (NJDEP) promulgates new state MCLs which meet or exceed the new federal MCLs, which it has two years to do. At that point, the new state MCLs will become Ground Water Quality Criteria.

In many states, however, federal and state MCLs do not automatically become groundwater remediation standards (all states have two years to align their MCLs with federal MCLs). While some of these states have previously promulgated groundwater remediation standards for PFAS or are in the process of developing such standards, other states do not have PFAS groundwater remediation standards and do not appear likely to develop them soon.

Read More

JD Supra, 27-06-24

<https://www.jdsupra.com/legalnews/federal-drinking-water-standards-for-3802185/>

### EPA Announces Initiatives to Improve Efficiency, Worker Protections and Transparency in New Chemical Reviews

2024-06-26

Today, the U.S. Environmental Protection Agency (EPA) is announcing four new initiatives in its review of new chemicals under the Toxic Substances

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Control Act (TSCA) to improve efficiency, better protect workers and increase transparency.

Under TSCA, EPA must review the potential risks of new chemicals before they enter the U.S. market and, when necessary, put safeguards in place to protect human health and the environment from those risks. EPA continues to improve that process, strengthen those safeguards, and provide more information to the public about its work. In FY23, EPA completed 70% more risk assessments compared to FY22, and has maintained this pace in FY24. Since the beginning of FY23, 60% of FY22 and older back-logged cases and 50% of FY23 cases have been cleared. And since January 2024, cases that support the climate goals of the Inflation Reduction Act have been completed in about a third of the time compared to non-prioritized cases.

Read More

US EPA, 26-06-24

<https://www.epa.gov/>

### Engineering checklist

2024-06-24

In May 2024, EPA began implementing an internal engineering checklist to systematically review new chemical submissions and identify potential data gaps at the beginning of the review process. The engineering checklist addresses some of the most common missing information that EPA has identified in submissions, including lack of clarity about the intended end use or process (i.e., how many days per year it is expected to be used), the physical form of the chemical (i.e., is it a spray that could create mist), and the lifecycle of the chemical (i.e., how it is expected to be disposed of).

If any missing information is identified, EPA can proactively notify the submitter of the issue and allow them to provide it before the Agency starts its risk assessment. Waiting to address these data gaps later in the process can require additional work that increases the review time for both the submitter and other submitters whose new chemical reviews are delayed.



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JUL. 05, 2024

Read More

US EPA, 26-06-24

<https://www.epa.gov/>

### Worker protections

2024-06-26

When EPA reviews a new chemical submission, one potential outcome is issuing an order under TSCA Section 5(e) that allows the chemical to be manufactured only under the terms of the order. Most TSCA Section 5(e) orders are consent orders that are negotiated between EPA and the notice submitter and use standard “boilerplate” text.

In June 2024, EPA updated the boilerplate language it will use for consent orders to strengthen worker protections and provide further clarity to the text. This update to the boilerplate language requires that workers, including contractors, and their representatives have ready access to information in orders. It also restores and strengthens prior requirements in orders issued before 2020 for hazard communication, labeling, safety data sheets and training. EPA also made a number of housekeeping revisions to the boilerplate that include updating example terms, restoring text, removing extraneous text, adding definitions, and editing for clarity and to improve formatting. EPA encourages stakeholders to review the new boilerplate language and submit input to the Agency.

Read More

US EPA, 26-06-24

<https://www.epa.gov/>

### Updated statistics for new chemical review timelines

2024-06-26

Today, EPA will begin including completed “rework” risk assessments when reporting monthly statistics on new chemical reviews. Rework cases occur when supplemental work is required after the initial risk assessment has been completed. This work could include evaluation of new information not provided with the original submission and development of new assessment reports or memos as a result of the submitter later providing new information or questions.

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### EPA has updated its Statistics for the New Chemicals Program webpage

to include a category that lists all completed rework risk assessments since the beginning of 2024. From January to May 2024, EPA completed 218 risk assessments, 26 of which were rework cases representing approximately 12% of all risk assessments completed during that period. This statistic, along with all the other statistics on the webpage, will continue to be updated on a monthly basis.

Read More

US EPA, 26-06-24

<https://www.epa.gov/>

### Reference Library

2024-06-26

Today, EPA is launching the New Chemicals Division Reference Library, an index of EPA documents related to the work of the New Chemicals Division. This resource includes guidance documents, compliance advisories, templates, manuals and other materials useful to a variety of stakeholders. These materials were previously available on various webpages across the EPA website, which could make them challenging to locate. By centralizing them in one location, the public will be able to more easily find documents, as well as identify ones they may not have been aware of.

The Reference Library has a search function or can be organized by topic, subtopic, title, publication date or source. The reference library currently contains over 90 entries and will continue to be updated as new materials are developed.

Read More

US EPA, 26-06-24

<https://www.epa.gov/>



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### EUROPE

#### Publication of GB mandatory classification and labelling (GB MCL) Agency Opinions

2024-05-20

A GB MCL Agency Opinion formally proposes the GB mandatory classification and labelling for chemical substances, based on the scientific and technical assessment of the scientific data in line with the GB CLP Regulation, together with an assessment of the policy and socio-economic impacts on the UK.

It sets out whether there is adequate scientific evidence to support a new or revised GB MCL of a substance and what the potential impact of the proposed GB MCL may be.

The next batch of 7 GB MCL Agency Opinions are now available for download in the GB MCL publication table (.xlsx).

These GB MCL Agency Opinions relate to substances for which HSE (as the GB CLP Agency) published an Agency Technical Report under Article 37 of the GB CLP Regulation in May 2023.

At the time of publication, the classification and labelling proposed in this Agency Opinion has not been agreed and/or adopted in GB.

For information on the next steps in the process, please see our webpage on the GB MCL system.

We expect to publish our next batch of Agency Opinions in August 2024. CLP ebulletin alerts will be issued when Agency Opinions are published on the HSE website.

If you have any questions or feedback on the GB MCL Agency Opinions, please contact us at: [GBCLP.GBMCL@hse.gov.uk](mailto:GBCLP.GBMCL@hse.gov.uk)

[Read More](#)

UK HSE, 20-06-24

[https://www.hse.gov.uk/chemical-classification/gb-mcl-list.htm?utm\\_source=govdelivery](https://www.hse.gov.uk/chemical-classification/gb-mcl-list.htm?utm_source=govdelivery)

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#### UK Introduces Recycling Labelling Requirements for Packaging Producers

2024-05-22

On May 1, 2024, UK notified WTO of a draft regulation titled The Producer Responsibility Obligations (Packaging and Packaging Waste) Regulations 2024. The provisions under the notification process are outlined in Chapter 2 under Part 3 of this draft, which impose recycling labelling requirements on packaging producers established in the UK. The draft is now open for comments until June 30, 2024, and scheduled to come into force on January 1, 2025.<sup>1</sup>

Extended Producer Responsibility (EPR) is a globally adopted policy that encourages producers to make sustainable decisions during product design, facilitating easier re-use and recycling at the product's end of life. The UK's EPR scheme encompasses a packaging producer responsibility system, where the UK government intends to reform regulations to further enhance resource efficiency and waste reduction. In the notified Chapter, UK outlines the obligations for designated producers, and provides detailed requirements for mandatory recycling labelling on the packaging.

[Read More](#)

Chemlinked, 22-05-24

<https://sustainability.chemlinked.com/news/uk-introduces-recycling-labelling-requirements-for-packaging-producers>

#### EU to Increase Control on E-waste

2024-06-12

On June 5, 2024, the European Union published initiatives to amend Regulation (EC) No 1013/2006 on Shipments of Waste. Since Regulation (EC) No 1013/2006 will be repealed by Regulation (EU) 2024/1157 as of May 21, 2026, Regulation (EU) 2024/1157 has also been proposed with amendments to ensure continuity in implementing the changes. The amendments are made following the changes to the Basel Convention, as the EU is a party to the Convention.

[Read More](#)

Chemlinked, 12-06-24

<https://sustainability.chemlinked.com/news/eu-to-increase-control-on-e-waste>



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### INTERNATIONAL

#### The Outdoor Industry's PFAS Challenge

2024-06-27

##### OIA Works Through Issue

At the Outdoor Industry Association, members are committed to the responsible phase out of PFAS from their supply chains and products, according to Julie Brown, director of sustainable business innovation for OIA.

"Without adequate transition periods, the logistical challenges presented by phaseout become particularly challenging," Brown said. "Product development cycles can take 18-24 months of lead time, and once those products hit shelves, they may remain on the shelf for months at a time."

Products at the point of sale may have been developed years ago, Brown pointed out, and brands and retailers are trying to avoid incinerating products or filling landfills in places where new restrictions have been introduced.

"Brands are working hard to make sure products will be sold only in places they are allowed," she said.

To help work through the issue, an effective strategy for brands is to engage with your supply chain early and often, according to Brown.

"Start by communicating to your suppliers your intention to transition to PFAS-free alternatives by a specific date," she said. "Ask your suppliers what experience they might have with PFAS-free alternatives in the form of materials, functional attributes, certifications, and testing. You may be able to leverage their previous experience to expedite your PFAS phase-out transition."

It is also good practice for brands to consult a lawyer to ensure that they are interpreting each law correctly and that their solutions will be compliant, Brown added.

##### PFAS Podcast Takeaways

Meg Carney, a podcast producer who released a 10-part series investigating PFAS earlier this year called "Forever Chemicals," said one of the key takeaways from her reporting and conversations is that the

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businesses in the outdoor industry, especially in the U.S., were late to take action.

"It feels very reactionary," Carney said. "They're just reacting to the California regulations because they have to, instead of taking accountability early on."

Even some of the major brands and retailers that are leaders in sustainability in the industry were "laggards" regarding PFAS specifically, according to Carney. She called out Patagonia and REI as examples of this.

"It took a lot of advocacy to get them to recognize the changes that needed to be done," Carney said. "My question as a consumer is, 'What took so long?'"

Another takeaway Carney highlighted was that brands leading in moving away from PFAS, including Keen, Fjällräven, Jack Wolfskin, and Houdini Sportswear, have women in leadership positions.

Some of the brands that have been leaders in not using PFAS have been honest and transparent in communicating to customers that while these new chemistries might be just as good at waterproofing, the products probably won't repel oil as well.

"That's something a lot of consumers are going to learn as they start to use the new products," Carney said. "Their sunscreen and other oil-based substances might infiltrate these fabrics when they wouldn't have before."

Other consumers might notice these waterproof, PFAS-free products are not quite as breathable, she added.

Carney also suggested brands look for proven solutions that already exist rather than try to formulate their own waterproofing chemistry in-house.

"I get that you want to have in-house research, but when there's proven, cleaner chemistry it seems like collaboration would be an easier route," she said.

##### Regulations Breakdown

In the United States to date, 34 states have introduced 270 policies to protect people from toxic chemicals. Maine, Minnesota, and Washington state have given state agencies the authority to ban PFAS in a wide range of products.



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Twelve states have enacted phase-outs of PFAS in food packaging: California, Colorado, Connecticut, Hawaii, Maine, Maryland, Minnesota, New York, Oregon, Rhode Island, Vermont, and Washington.

Eight states – California, Colorado, Maine, Maryland, Minnesota, New York, Vermont, and Washington – have adopted restrictions on PFAS in carpets, rugs, and/or aftermarket treatments.

California, Colorado, Maryland, Minnesota, Oregon, and Washington are taking action to eliminate PFAS in cosmetics.

Twelve states – California, Colorado, Connecticut, Hawaii, Illinois, Maine, Maryland, Minnesota, New Hampshire, New York, Vermont, and Washington – have banned the sale of firefighting foam containing PFAS.

Read More

The Daily, 27-06-24

<https://thedaily.outdoorretailer.com/news/brands-and-retailers/the-outdoor-industrys-pfas-challenge/>

# Bulletin Board

## REACH Update

JUL. 05, 2024

### ECHA Consults on Uses and Alternatives of Certain Chromium (VI) Substances

2024-06-13

ECHA is calling for evidence and information on the uses and alternatives of certain chromium (VI) substances for a restriction proposal under EU REACH.

At the request of European Commission, the European Chemicals Agency (ECHA) is calling for evidence and information on certain chromium (VI) substances to prepare for a restriction proposal in line with the requirements of REACH Annex XV.

This consultation follows the first round of call for evidence held from December 2023 until February 2024, which was successful in terms of gathering data for a thorough analysis of some of the Cr(VI) substances and some of their uses.

The second call for evidence will be split in two separate surveys (identified as 2a and 2b).

The survey 2a targets companies using Cr(VI) substances and in particular:

- Any company that did not respond to the first call for evidence
- Users of Cr(VI) substances in the transportation (maritime, rail, road, aviation), aerospace and defence sectors
- Users of Cr(VI) in electroplating on plastics, painting, spraying, brushing and slurry coating, and speciality surface treatment incl. chemical conversion coating, anodization and passivation
- Users of Cr(VI) substances other than chromium trioxide and chromium acids including users of barium chromate.

The survey 2b targets providers (e.g. manufacturers, formulators, suppliers, importers, distributors) of alternative(s) to Cr(VI) substances as well as to companies that have substituted Cr(VI) substances or are just completing such substitution.

The list of substances in the scope of this restriction proposal now includes:

Chromium trioxide (entry 16)

- Chromic and Dichromic acids (entry 17)
- Sodium dichromate (entry 18)
- Potassium dichromate (entry 19)



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- Ammonium dichromate (entry 20)
- Potassium chromate (entry 21)
- Sodium chromate (entry 22)
- Dichromium tris(chromate) (entry 28)
- Strontium chromate (entry 29)
- Potassium hydroxyoctaoxodizincatedichromate (entry 30)
- Pentazinc chromate octahydroxide (entry 31)
- Barium chromate

Consultation period is from June 5, 2024 to August 15, 2024. Interested parties including but not limited to private companies, sector associations, scientific organisations, NGOs and other stakeholders or Member State Authorities holding relevant information are encouraged to participate.

[Read More](#)

Chemlinked, 13-06-24

<https://chemical.chemlinked.com/news/chemical-news/echa-consults-on-uses-of-certain-hexavalent-chromium-substances-for-reach-restriction>

## ECHA adds one hazardous chemical to the Candidate List

2024-06-27

The Candidate List of substances of very high concern (SVHC) now contains 241 entries for chemicals that can harm people or the environment. Companies are responsible for managing the risks of these chemicals and giving customers and consumers information on their safe use.

Helsinki, 27 June 2024 – The newly added chemical, bis( $\alpha,\alpha$ -dimethylbenzyl) peroxide, is toxic for reproduction and is used as a processing aid, e.g. as a flame retardant.

Entries added to the Candidate List on 27 June 2024:

Substance name	EC number	CAS number	Reason for inclusion	Examples of uses
Bis( $\alpha,\alpha$ -	201-279-3	80-43-3	Toxic for reproduction (Article 57c)	Flame retardant

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ECHA's Member State Committee (MSC) has confirmed the addition of this substance to the Candidate List. The list now contains 241 entries – some are groups of chemicals so the overall number of impacted chemicals is higher.

This substance may be placed on the Authorisation List in the future. If a substance is on this list, companies cannot use it unless they apply for authorisation and the European Commission authorises its continued use.

### Other substances

The MSC agreement seeking process to identify triphenyl phosphate (TPhP; EC no. 204-112-2) as an SVHC was foreseen for the committee's June meeting. However, having consulted the committee members and the dossier submitter, ECHA decided to suspend the agreement seeking process for this substance because substantial new information became available in the days preceding the meeting.

This suspension ensures that the newly provided data will be properly evaluated and considered in the SVHC identification process. This is an exceptional arrangement and applies only in the conditions specific to this case.

### Consequences of inclusion on the Candidate List

Under REACH, companies have legal obligations when their substance is included – either on its own, in mixtures or in articles – in the Candidate List.

If an article contains a Candidate List substance above a concentration of 0.1 % (weight by weight), suppliers have to give their customers and consumers information on how to use it safely. Consumers have the right to ask suppliers if the products they buy contain substances of very high concern.

Importers and producers of articles have to notify ECHA if their article contains a Candidate List substance within six months from the date it has been included in the list (27 June 2024).

EU and EEA suppliers of substances on the Candidate List, supplied either on their own or in mixtures, have to update the safety data sheet they provide to their customers.

Under the Waste Framework Directive, companies also have to notify ECHA if the articles they produce contain substances of very high concern



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in a concentration above 0.1 % (weight by weight). This notification is published in ECHA's database of substances of concern in products (SCIP).

Read More

ECHA, 27-06-24

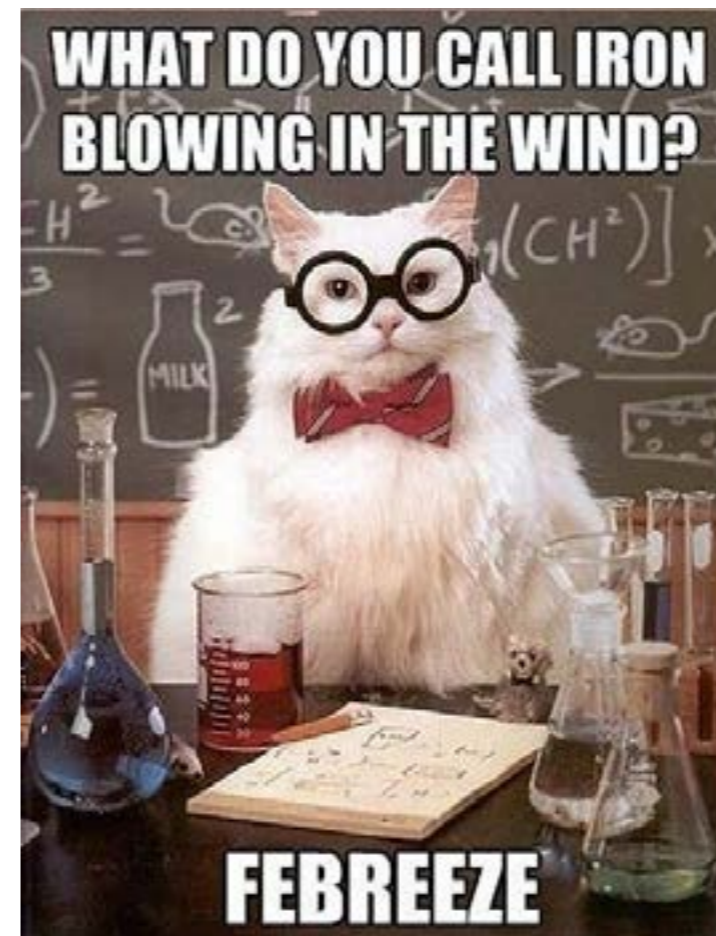
<https://echa.europa.eu/-/echa-adds-one-hazardous-chemical-to-the-candidate-list>

# Bulletin Board

## Janet's Corner

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2024-07-05



<https://www.chemistryjokes.com/>



# Bulletin Board

## Hazard Alert

JUL. 05, 2024

### Diazomethane

2024-07-05

#### USES [2,3]

Diazomethane is used as a methylating agent for acidic compounds such as carboxylic acids, phenols, and enols.

#### EXPOSURE SOURCES & ROUTES OF EXPOSURE [3]

##### Exposure Sources

Occupational exposure to diazomethane may occur through inhalation if the gas supplied in its pure form or when it is formed in situ during organic syntheses. Dermal contact with solutions of this compound in organic solvents may also occur at workplaces where diazomethane is produced or used. The general population is not likely to be exposed to diazomethane since it is primarily used in a laboratory setting.

##### Routes of Exposure

Diazomethane can affect the body if it is inhaled or comes into direct contact with the skin or eyes. It can also affect the body if ingested.

#### HEALTH EFFECTS [4]

##### Acute Health Effects

- Diazomethane is a strong respiratory irritant. Acute inhalation exposure of humans to diazomethane may cause irritation of the eyes, cough, wheezing, asthmatic symptoms, pulmonary oedema, pneumonia, dizziness, weakness, headache, chest pains, fever, moderate cyanosis, malaise, tremors, liver enlargement, hypersensitivity, and shock.
- Severe respiratory tract irritation, haemorrhagic emphysema, pulmonary oedema, and bronchopneumonia have been observed in animals acutely exposed by inhalation.
- Acute animal tests in cats have demonstrated diazomethane to have high acute toxicity by inhalation.

##### Carcinogenicity

- No information is available on the carcinogenic effects of diazomethane in humans.

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- Increased incidences of pulmonary adenomas have been observed in rats and mice exposed to diazomethane by inhalation and in dermally exposed mice.
- EPA has not classified diazomethane with respect to its potential carcinogenicity.
- The International Agency for Research on Cancer (IARC) has classified diazomethane as a Group 3, not classifiable as to its carcinogenicity to humans.

##### Other Effects

- No information is available on the chronic effects of diazomethane in humans or animals.
- EPA has not established a Reference Concentration (RfC) or a Reference Dose (RfD) for diazomethane.

#### SAFETY

##### First Aid Measures [5]

- Eye Contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.
- Skin Contact: After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.
- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.
- Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.
- Ingestion: Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

**Diazomethane is the chemical compound with the molecular formula CH<sub>2</sub>N<sub>2</sub>. It is the simplest diazo compound. In the pure form at room temperature, it is an extremely sensitive explosive yellow gas. [1] Solutions containing undiluted and concentrated diazomethane may explode violently. It is soluble in ether and dioxane and will decompose slowly in either solvent. It will decompose more rapidly if water or alcohols are present. [2] Diazomethane has a musty odour. [1,2]**



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### Engineering Controls [4]

- Handle in accordance with good industrial hygiene and safety practice.
- Wash hands before breaks and at the end of workday.
- Use only with adequate ventilation.

### Personal Protective Equipment [5]

- Eye/face protection: Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).
- Skin protection: Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands. The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.
- Body Protection: Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
- Respiratory protection: Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

## REGULATION

### United States

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

- General Industry: 0.2 ppm, 0.4 mg/m<sup>3</sup>
- Construction Industry: 0.2 ppm, 0.4 mg/m<sup>3</sup> TWA

**ACGIH:** The American Conference of Governmental Industrial Hygienists has set a Threshold Limit Value (TLV) for diazomethane of 0.2 ppm, 0.34 mg/m<sup>3</sup> TWA; Appendix A2 (Suspected Human Carcinogen)

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**NIOSH:** The National Institute for Occupational Safety and Health has set a Recommended Exposure Limit (REL) for diazomethane of 0.2 ppm TWA

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## Could “Love Hormones” Treat Obesity and Postnatal Depression?

2024-07-02

Scientists from the University of Cambridge have identified a gene that can cause obesity, behavioral issues and postnatal depression when missing or impaired. The study, published in *Cell*, points to oxytocin as a potential treatment.

**Obesity and postnatal depression are major global health concerns**

Around 1 in 10 pregnant women experience a mental health condition, which can sometimes become so severe that it leads to suicide. These mental health issues can negatively impact the child’s growth and development, affecting their physical, emotional and cognitive well-being.

Obesity affects one in eight people and can increase the risk of many health conditions, such as type 2 diabetes and cardiovascular disease. Since 1990, rates of obesity have more than doubled worldwide, and the global obesity crisis is becoming a major public health concern that necessitates urgent action to implement effective prevention and treatment strategies.

Previous studies have identified the role of hypothalamic neural circuits in regulating human behaviors such as food-seeking and maternal care. These circuits sense changes in the internal and external environment and select the most adaptive behavior response, leading to variability in hard-wired innate behaviors. Understanding how these internal mechanisms impact human behavior is vital for developing prevention and treatment techniques for obesity and postnatal health.

**TRPC5 impacts human and animal behavior**

A team of researchers investigated two boys, from separate families, who suffered from severe obesity, anxiety, autism and behavioral issues triggered by sounds or smells. Both patients were missing a single gene, TRPC5, which is found on the X chromosome. TRPC5 is in a family of genes that plays a role in detecting sensory signals such as heat, taste and touch. The gene acts on a pathway found in the hypothalamus region of the brain, which also impacts appetite.

Upon further investigation, they found both boys had inherited the gene deletion from their mothers who also had the gene missing on one of their X chromosomes. Strikingly, the mothers also suffered from obesity and had both experienced postnatal depression.

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The researchers used animal models to test the role of TRPC5 in the development of the issues identified in the boys and their mothers. They identified similar phenotypes in mice genetically engineered to harbor a defective version of the gene. They also exhibited increased weight gain, anxiety, issues with social interactions and aggression. Both male and female mice displayed the same behavior – however, when the female mice became mothers, they displayed depressive behavior and impaired maternal care. Female mice that did not become mothers and male mice did not show any depression-like symptoms, despite carrying the same mutation.

“What we saw in those mice was quite remarkable. They displayed very similar behaviors to those seen in people missing the TRPC5 gene, which in mothers included signs of depression and difficulty caring for their babies. This shows us that this gene is causing these behaviors,” said Dr. Yong Xu, associate director for basic sciences at the Children’s Nutrition Research Center at Baylor College of Medicine.

**TRPC5 acts on oxytocin neurons**

The researchers took a closer look at how TRPC5 acts on the hypothalamus and found it impacts oxytocin neurons, the nerve cells responsible for producing the hormone oxytocin. Oxytocin, known as the “love hormone”, is often released in response to displays of affection and bonding.

Deleting the TRPC5 gene from oxytocin neurons in healthy mice resulted in a similar display of behavior as seen in the TRPC5-impaired mice. Restoring the gene caused a reduction in body weight and in symptoms of anxiety and postnatal depression.

TRPC5 was also found to act on POMC neurons, a group of neurons that play a role in regulating weight. Previous research has identified a defective POMC gene in children results in an insatiable appetite and increased weight gain from an early age.

**Restoring oxytocin in TRPC5-impaired individuals**

Although TRPC5 deletions are rare, an analysis of DNA samples from individuals in the UK Biobank discovered that those that did had a higher-than-average body mass index.

“There’s a reason why people lacking TRPC5 develop all of these conditions. We’ve known for a long time that the hypothalamus plays a key role in regulating ‘instinctive behaviors’ – which enable humans and animals to survive – such as looking for food, social interaction, the



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flight or fight response and caring for their infants. Our work shows that TRPC5 acts on oxytocin neurons in the hypothalamus to play a critical role in regulating our instincts," said Dr. Sadaf Farooqi, a professor from the Institute of Metabolic Science at the University of Cambridge.

The researchers hope their study could lead to treatment options in the future for people who are missing or have a defective TRPC5 gene.

"While some genetic conditions such as TRPC5 deficiency are very rare, they teach us important lessons about how the body works. In this instance, we have made a breakthrough in understanding postnatal depression, a serious health problem about which very little is known despite many decades of research. And importantly, it may point to oxytocin as a possible treatment for some mothers with this condition," said Farooqi.

"This research reminds us that many behaviors which we assume are entirely under our control have a strong basis in biology, whether that's our eating behavior, anxiety or postnatal depression. We need to be more understanding and sympathetic towards people who suffer with these conditions," said Farooqi.

Technology Networks, 2 July 2024

<https://technologynetworks.com>

### Recall of 7 Major Shampoo Brands in 43 States Warns of Toxin Risk

2024-07-01

What did we do before dry shampoo, especially in the heat of summer? A few spritzes save time when your wash is still relatively fresh, and act as a life-saver when you simply don't have time to re-style.

However, research has identified dangers from dry shampoo—and a new alert hints at how important it is to consider what's inside that aerosol can.

#### Get The Healthy by Reader's Digest newsletter

On July 1, the United States Food and Drug Administration (FDA) published an update to a major hair care manufacturer's recall of 19 dry shampoo aerosol products. The recall by Unilever was originally initiated in October 2022 to include products from the brands Dove, Nexxus, Suave, TIGI (Bed Head and Rockaholic) and TRESemmé, which had been produced as early as in October 2021. According to a press release from the U.S. Food

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and Drug Administration (FDA), the shampoos were recalled "because testing of the product showed low levels of Benzene." At that time, the FDA referred to the reason for the recall announcement as "product safety/unapproved ingredient."

Benzene has been classified as a human carcinogen, as the National Cancer Institute has noted the chemical can lead to cancers such as leukemia and "other blood disorders." Benzene also happens to be an ingredient in gasoline, according to the CDC.

As part of the original recall, Unilever said an internal investigation had identified the propellant as the source of the benzene. (Propellants in cosmetics and food products such as cooking sprays are often notorious nuisances for concerning chemical exposure.)

The FDA's update suggests the total recalled products were 1,559,190 cases of Dove, Nexxus, TRESemmé and Suave, plus 559,844 units of the two TIGI brands.

The recalled products are as follows:

- Dove Dry Shampoo Volume and Fullness: 1.15 oz, 5 oz and 7.3 oz cans
- Dove Dry Shampoo Fresh Coconut: 1.15 oz, 5 oz and 7.3 oz cans
- Dove Dry Shampoo Fresh and Floral: 5 oz cans
- Dove Dry Shampoo Ultra Clean: 5 oz cans
- Dove Dry Shampoo Invisible: 5 oz cans
- Dove Dry Shampoo Detox and Purify: 5 oz cans
- Dove Dry Shampoo Clarifying Charcoal: 5 oz cans
- Dove Dry Shampoo Go Active: 5 oz cans
- Nexxus Dry Shampoo Refreshing Mist: 5 oz cans
- Nexxus Inergy Foam Shampoo: 6.7 oz cans
- Suave Dry Shampoo Hair Refresher: 5 oz cans
- Suave Professionals Dry Shampoo Refresh and Revive: 4.3 oz cans
- TRESemmé Dry Shampoo Volumizing: 1.15 oz, 5 oz and 7.3 oz cans
- TRESemmé Dry Shampoo Fresh and Clean: 5 oz and 7.3 oz cans
- TRESemmé Pro Pure Dry Shampoo: 5 oz cans
- Bed Head Oh Bee Hive Dry Shampoo: 5 oz cans
- Bed Head Oh Bee Hive Volumizing Dry Shampoo: 5 oz cans
- Bed Head Dirty Secret Dry Shampoo: 2.1 oz cans
- Bed Head Rockaholic Dirty Secret Dry Shampoo: 2.5 oz cans



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If you own any of these dry shampoos, you can check their UPC and lot code against the list of recalled products to see whether they were included.

The products were distributed to 43 states: Alaska, Alabama, Arkansas, Arizona, California, Colorado, Connecticut, Florida, Georgia, Hawaii, Iowa, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Massachusetts, Maryland, Maine, Michigan, Minnesota, Missouri, Montana, North Carolina, Nebraska, New Hampshire, New Jersey, Nevada, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Virginia, Vermont, Washington and Wisconsin. It appears the recall also affected products distributed into Anguilla.

Though the FDA reports an independent health hazard evaluation found that daily exposure to the level of benzene in the affected products would likely not cause health complications, Unilever recalled them out of an “abundance of caution.” According to the FDA, Unilever had received “no reports of adverse events” at the time of the original recall.

If you have any of the recalled products, you can visit [UnileverRecall.com](https://UnileverRecall.com) for instructions on how to get a refund. You can also contact Unilever by calling (877) 270-7412 on Monday through Friday, between 8:30 a.m. and 9 p.m. EST.

It’s an important reminder to shop clean beauty. And if you’re passionate about narrowing down your purchase of cruelty-free products, consider shopping apps like Cruelty Cutter.

The Healthy, 01 July 2024

<https://thehealthy.com>

### Microscopy method unlocks ‘materials genome,’ opening possibilities for next-generation design

2024-07-02

A new microscopy method has allowed researchers to detect tiny changes in the atomic-level architecture of crystalline materials—like advanced steels for ship hulls and custom silicon for electronics. The technique could advance our ability to understand the fundamental origins of material properties and behavior.

In a paper published today in *Nature Materials*, researchers from the University of Sydney’s School of Aerospace, Mechanical and Mechatronic

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Engineering introduced a new way to decode the atomic relationships within materials.

The breakthrough could assist in the development of stronger and lighter alloys for the aerospace industry, new generation semiconductors for electronics, and improved magnets for electric motors. It could also enable the creation of sustainable, efficient and cost-effective products.

The study, led by University of Sydney Pro-Vice-Chancellor (Research Infrastructure) Professor Simon Ringer, harnessed the power of atom probe tomography (APT) to unlock the intricacies of short-range order (SRO). The SRO process is key to understanding the local atomic environments essential for development of innovative materials which could underpin a new generation of alloys and semiconductors.

SRO is sometimes likened to the “materials genome,” the arrangement or configuration of atoms within a crystal. This is significant because different local atomic arrangements influence the electronic, magnetic, mechanical, optical, and other properties of materials, which have a bearing on the safety and functionality of a range of products.

Until now, SRO has been challenging for researchers to measure and quantify because atomic arrangements occur at a scale so small that they are difficult to see with conventional microscopy techniques.

The new method using APT, developed by Professor Ringer’s team, overcomes these challenges, paving the way for advances in materials science that could have far-reaching implications across steels for ship hulls and custom silicon for electronics in a range of industries.

“Our research presents a significant breakthrough in materials science,” said Professor Ringer, a materials engineer in the School of Aerospace, Mechanical and Mechatronic Engineering (AMME).

“Beyond crystal structure and symmetry, we wanted to know more about the atomic-scale neighborhood relationships within the crystal—are they random, or non-random? If the latter, we want to quantify that. SRO gives us this information in detail, opening up vast possibilities for materials that are custom-designed, atom-by-atom, with specific neighborhood arrangements to achieve desired properties like strength.”

The study focused on high entropy alloys, which are promising for various advanced engineering applications.



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“These alloys are the subject of an enormous worldwide research effort because of the interest in using them in situations requiring high-temperature strength, such as in jet engines and power plants, as well as for neutron irradiation shielding in nuclear reactors, where protection against radiation damage is necessary,” said Professor Ringer.

The team used advanced data science techniques drawing on data from APT—a sophisticated imaging technique that visualizes atoms in 3D, allowing the team to observe and measure SRO, comparing how it changes in alloys under different processing conditions.

The research focused on observations of a cobalt-chromium-nickel high entropy alloy, revealing how different heat treatments can change SRO.

“This provides a template for future studies in which SRO controls critical material properties. There is lots more to do on various aspects of the analysis of SRO—it’s a hard problem, but this is an important step forward,” said Professor Ringer.

Dr. Mengwei He, postdoctoral research fellow in the School of Aerospace, Mechanical and Mechatronic Engineering said, “The ability to measure and understand short-range order has transformed our approach to materials design. It gives us a new set of eyes to see how small changes at the atomic level architecture can lead to giant leaps in materials performance.”

Critically, the study enhances the capabilities of researchers to computationally simulate, model and ultimately predict materials behavior because SRO provides the detailed atomic-scale blueprint.

Senior postdoctoral fellow Dr. Andrew Breen said, “We have demonstrated that there are regimes where the SRO really can be measured using atom probe tomography. Not only have we pioneered an experimental approach and computational framework to measuring SRO, we have produced a sensitivity analysis that bounds the precise range of circumstances whereby such measurements are valid, and where they are not valid.”

Dr. Will Davids, who completed his doctorate with Professor Ringer and now works for engineering firm Infravue said, “This is an exciting advance because we’ve shown that SRO measurements are possible in multicomponent alloys, which will no doubt be of benefit to the materials science and engineering community. The community are now going to

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want to learn how to further expand the measurable regime of SRO, so a big space in this research field has just opened up.”

Phys Org, 2 July 2024

<https://phys.org>

### Chemists Successfully Synthesize Ruddlesden-Popper Compounds for the First Time

2024-06-28

Ruddlesden-Popper compounds are a class of materials with a special layered structure that makes them interesting for numerous applications – as superconductors or catalysts, for example, or for use in photovoltaics. There have been many halides and oxides of this structural type before now, but no nitrides. Although scientists expected Ruddlesden-Popper nitrides to have outstanding material properties, they were unable to actually manufacture them.

Now researchers led by Dr. Simon Kloß from the Department of Chemistry at LMU have developed a special synthetic pathway which has enabled them to manufacture nitride materials that crystallize in the Ruddlesden-Popper structural type, as they report in the journal Nature Chemistry.

#### Stability of nitrogen posed a challenge

The stability of the triple bond in the nitrogen molecule (N<sub>2</sub>) and the low electron affinity of the element made it very challenging for the chemists to manufacture the nitrogen-rich Ruddlesden-Popper nitrides. They achieved a breakthrough by carrying out the syntheses under extreme conditions. Employing large-volume presses, they compressed their samples at pressures of eight gigapascals, which is equivalent to 80,000 bars. Then they used an active nitrogen source such as sodium azide to prepare the rare-earth transition-metal nitride compounds.

“We think we can systematically investigate Ruddlesden-Popper nitrides compounds with our new synthesis strategy,” says Kloß. The scientists demonstrated this by investigating three new compounds of this materials class – a cerium-tantalum nitride (Ce<sub>2</sub>TaN<sub>4</sub>) and praseodymium- and neodymium-rhenium nitrides (Ln<sub>2</sub>ReN<sub>4</sub> (Ln = Pr, Nd)). “These three initial materials already exhibit a rich variety of structural, electronic, and magnetic properties,” says Kloß.

The praseodymium and the neodymium compounds displayed exciting magnetic characteristics. For example, the neodymium compound is



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a remarkable hard ferromagnet with irreversible magnetic behavior. Meanwhile, the tantalum compound is a semiconductor with properties that make it exciting for applications in the energy conversion domain or as a ferroelectric material. "The same synthetic method will probably lead to other Ruddlesden-Popper nitride compounds and their derivatives," explains Kloß. "Consequently, a large new class of nitrides is waiting to be researched."

Technology Networks, 28 June 2024

<https://technologynetworks.com>

### Researchers discover photo-induced charge-transfer complex between amine and imide

2024-07-03

A research team led by Prof. Zhang Guoqing from the University of Science and Technology of China (USTC) of the Chinese Academy of Sciences (CAS) has discovered a highly reactive photo-induced charge-transfer complex (PCTC) between amine and imide. Their findings are published in the journal Chem.

Charge transfer between molecules, a critical process in both natural and synthetic systems, plays a fundamental role in photosynthesis, respiration, and various organic synthesis and energy conversion applications.

Despite extensive research, creating stable, light-responsive charge-transfer complexes in artificial systems remains challenging. The discovery of PCTCs addresses this challenge, offering new insights into complex photochemical processes.

The researchers first discovered that aromatic imides and alkyl amines, which did not interact significantly in their ground state, form stable PCTCs when exposed to UV light. This interaction resulted in a highly fluorescent complex resembling a Meisenheimer complex.

The use of various spectroscopic techniques, including high-resolution mass spectrometry and time-resolved spectroscopy, confirmed the formation and stability of these complexes.

The researchers conducted a series of experiments to explore the formation mechanism. They observed that the interaction between naphthalimide and triethylamine in solution resulted in no significant changes in the absorption or emission spectra in the absence of light.

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However, upon UV irradiation, new spectral features emerged, indicating the formation of the PCTC. These features included a distinct absorption band and enhanced fluorescence, which were absent in the individual components.

Moreover, researchers applied PCTC to initiate the polymerization of acrylic esters under UV light, demonstrating its potential in creating new polymeric materials with unique properties. Additionally, the complex showed efficacy in reducing carbon dioxide, a crucial reaction for addressing environmental challenges and developing sustainable energy sources.

One of the most intriguing applications of the PCTC was its ability to store UV energy and release it in the dark. This capability enabled processes traditionally dependent on continuous light exposure to proceed in the absence of light.

The discovery of highly reactive PCTCs between amines and imides under UV light not only enhances our understanding of photo-induced charge-transfer processes but also opens up new avenues for practical applications in polymer science, environmental technology, and energy storage.

Phys Org, 3 July 2024

<https://phys.org>

### Green hydrogen breakthrough swaps in water for iridium

2024-06-21

Hydrogen shows a lot of promise as a powerful, clean fuel source – as long as the process that creates it is also green. A new report shows how tough it might be to get to truly green hydrogen, while a new study removes a barrier to its creation.

According to a paper published today in the journal Nature Energy, by researcher Kiane de Kleijne from Radboud University and Eindhoven University of Technology in the Netherlands, the production of hydrogen more often than not leads to gains in atmospheric carbon dioxide (CO<sub>2</sub>). That's only in part because some of it comes from natural gas production.

There are greener ways to produce hydrogen such as using solar or wind to power the process that splits it off from water molecules, but De Kleijne argues that in such cases, the carbon footprint of creating those



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facilities needs to be considered. So does the fact that green power is most effective in places with lots of sun and wind like Africa or Brazil, which means that hydrogen produced there then needs to be transported to the rest of the world for use, which again, raises its carbon footprint.

"If you look at the entire life cycle in this way, green hydrogen often, but certainly not always, leads to CO<sub>2</sub> gains," De Klijne said. "CO<sub>2</sub> gains are usually higher when using wind power rather than solar power. This will improve further in the future as more renewable energy will be used to manufacture the wind turbines, solar panels and steel for the electrolyzer, for example."

**Aquatic elephant in the room**

Until that time, a new breakthrough in a popular hydrogen-production process called a proton-exchange-membrane (PEM) may help.

PEM is a water electrolysis process that splits off hydrogen from water molecules. Aside from the carbon cost of the electricity that powers the process, PEM is considered a green technology because its only output is oxygen, rather than carbon dioxide. The problem is that iridium is one of the only elements that can stand up to the harsh acidic environment in which water molecules are sheared apart. And iridium is very hard to find, as it's one of the rarest metals on Earth, so PEM facilities are difficult to create at scale.

Basically, the ICFO researchers created an anode catalyst made from more common elements: cobalt and tungsten. But to protect the anode from the predicted degradation from the electrolysis process, they took a unique turn by impregnating a cobalt-tungsten oxide with water – the very substance in which it is made to operate.

"At the beginning of the project, we were intrigued about the potential role of water itself as the elephant in the room in water electrolysis," said Ranit Ram, first author of the study. "No one before had actively tailored water and interfacial water in this way"

The result was that during the electrolysis process, as the new anode degraded by losing material, water and hydroxide – two compounds prevalent in the process – rushed in to fill the holes it left behind. The result was a kind of aqueous shield that kept the anode from degrading too quickly.

**The whole periodic table**

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In tests using a PEM reactor, the new material performed admirably.

"We increased five times the current density, arriving to 1 A/cm<sup>2</sup> – a very challenging landmark in the field," said leading co-author Dr. Lu Xia. "But, the key is that we also reached more than 600 hours of stability at such high density. So, we have reached the highest current density and also the highest stability for non-iridium catalysts."

While the researchers admit that the new water-impregnated alloy doesn't remain stable as long as current anodes, they say the finding makes up for it in demonstrating an efficient PEM approach that doesn't rely on scarce metals. In fact, the team says the process could even work with other materials, which is desirable because cobalt is often sourced from mines making use of child labor.

"Cobalt, being more abundant than iridium, is still a very troubling material considering from where it is obtained," said study participant and ICFO professor, García de Arquer. "That is why we are working on alternatives based on manganese, nickel and many other materials. We will go through the whole periodic table, if necessary. And we are going to explore and try with them this new strategy to design catalysts that we have reported in our study."

The PEM study has been published in the journal Science.

New Atlas, 21 June 2024

<https://newatlas.com>

**Chemists synthesize an improved building block for medicines**

2024-07-03

The research, which could expand the toolkit available to drug developers in improving the safety profiles of medications and reducing side effects, was published in Science by organic chemists at the University of British Columbia (UBC), the Massachusetts Institute of Technology (MIT), and the University of Michigan.

"Azetidines are a particularly useful, stable form of heterocycle, but synthesizing them has been incredibly challenging," says Dr. Corinna Schindler, Canada Research Chair in synthetic solutions for bioactive compounds at UBC and senior author on the paper.



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Heterocycles play a major role in the design of modern drug families -- including cancer drugs and antibiotics.

Some reviews indicate 85 per cent of all biologically active chemical entities contain a heterocycle.

But many heterocycles currently used in pharmaceutical design tend to oxidize under physiological conditions.

This can lead to off-target effects and challenges with the safety profiles of medications.

Azetidines -- organic compounds that contain three carbon atoms and one nitrogen atom, and are liquid at room temperature -- are known to be metabolically robust and don't undergo oxidation reactions under physiological conditions.

"This is something that synthetic organic chemists have tried to achieve for a long time, and we're hopeful this will enable researchers to develop new synthetic transformations of azetidines with more useful chemical and medical functions," says Dr. Schindler, whose lab conducted the research at the University of Michigan with graduate student Emily Wearing and in conjunction with Dr. Heather Kulik's lab at the Massachusetts Institute of Technology.

The team used light-driven reactions and a computational approach to the problem and for the first time were able to engage compounds called imines productively in reactions to form new azetidines.

Science Daily, 03 July 2024

<https://sciencedaily.com>

### Researchers Build Soft Robotic "Hand" Using Graphene and Liquid Crystals

2024-06-24

In our future hospitals, soft robots might be used as surgical robots. But before that can happen, researchers need to figure out how to precisely control and move these deformable robots. Added to that, many current soft robots contain metals, which means that their use in water-rich environments -- like the human body -- is rather limited. TU/e researchers led by PhD candidate Laura van Hazendonk, Zafeiris Khalil (as part of his master's research), Michael Debije, and Heiner Friedrich have designed a soft robotic hand or gripper made from graphene and liquid crystals (both

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organic materials). This opens the possibilities for such a device to be potentially and safely used in surgeries in the future.

Robots have an enormous influence on our world. For instance, in industry, robots build automobiles and televisions. In hospitals, robots -- such as the da Vinci robotic surgical system -- assist surgeons and allows for minimally invasive operations. And some of us even have robots to do our vacuum cleaning at home.

"Society has become dependent on robots, and we're coming up with new ways to use them," says Laura van Hazendonk, PhD researcher in the Department of Chemical Engineering and Chemistry. "But in devising new ways to use them, we need to think about using different types of materials to make them."

### Thinking soft

The different materials that Van Hazendonk is referring to are fluids, gels, and elastic materials -- which are all easily deformable. "Typically, robots are made from metals, which are rigid and hard. But in certain applications, robots made from hard and rigid materials limit the performance of the robot," says Van Hazendonk. "The solution is to think soft."

In soft robotics, the goal is to make robots from materials like fluids or gels that can deform in certain situations and then can act like robots made from traditional rigid and hard materials.

One area where soft robots look set to have a major impact is in surgical procedures. Van Hazendonk: "For a surgeon, many operations can be complex and delicate, and therefore require precise dexterity on the part of the surgeon. Sometimes this just isn't possible, and they turn to robots. But rigid robots may not be able to access some areas with ease either. That's where soft robots can come to the fore, and our goal was to offer the potential new helping hand for use in clamping and suturing used devices in surgeries, for example."

### Tangible and useful

For Van Hazendonk -- who combines her PhD research with being a member of the provincial parliament of Noord-Brabant (Provinciale Staten) -- this research has been eye-opening for her.

"I love how this work combines a useful and tangible application. The gripper device is based on fundamental technologies, but the actuator



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itself could form the basis for a suite of robots for use in biomedical or surgical applications in the future.”

**Fully printed robot**

And, in the future, Van Hazendonk and her colleagues have some interesting plans. “We want to make a fully printed robot by figuring out a way to 3D-print the liquid-crystal layer. For our gripper, we made the layer by casting materials in a mould. Other researchers in the group of Michael Debije have shown that liquid crystals can be printed. For this gripper, we have printed the graphene layer, so it would be cool to have a fully printed device.”

Technology Networks, 24 June 2024

<https://technologynetworks.com>

### Eco-friendly solution for battery waste: New study unveils novel metal extraction technique

2024-07-03

A new study led by researchers in Canada introduces a novel process for the extraction and separation of metals from spent alkaline batteries, offering a promising solution for efficient recycling of critical materials.

As global energy demands continue to rise, the role of batteries is becoming increasingly critical. However, the improper disposal of spent batteries poses significant environmental hazards due to their metal content. Recycling these metals not only mitigates environmental risks but also provides a sustainable source of valuable materials.

The paper, published in the *Journal of Chemical Technology and Biotechnology*, presents a technique for the extraction of potassium, zinc and manganese that is cheaper and more energy efficient than other existing methods.

Noelia Muñoz García, a Researcher at the Université de Sherbrooke in Canada, and lead author of the study, explained the significance of the research. García said, “We focused on the extraction of the main minerals present in alkaline batteries because they represent more than 70% of the volume of spent batteries in North America.

“This research supports the principles of the circular economy, where materials are reused and recycled, creating a closed-loop system. This reduces waste and can lead to long-term economic sustainability by

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maximizing the utility of resources, which is one of the main objectives in current treaties such as the Paris Agreement.”

Importantly, efficient recycling of battery materials is critical to mitigating harmful environmental impacts. “The main problem of improper disposal of spent alkaline batteries is that compounds of potassium, zinc and manganese can leach into the soil and pollute groundwater, posing threats to the environment and human health, such as ecotoxicity and abiotic depletion,” noted García.

The technique hinges on a process called hydrometallurgy, which uses aqueous solutions to extract the metals—known as “leaching.” Hydrometallurgy can be carried out at room temperature, making it more energy-efficient than methods that require high temperatures.

The novelty of the process developed in this study lies in the use of three separate steps for the extraction of the metals. In other hydrometallurgical processes, all metals can be extracted in one leaching step producing a complex leachate composition that is costly to separate out into its components.

By removing the metals in three phases using different leaching agents, the researchers were able to produce higher quality leachates, lowering the costs of downstream purification. Overall, the process resulted in a total extraction efficiency of 99.6% for zinc and 86.1% for manganese.

Antonio Avalos Ramirez, a Researcher at the Université de Sherbrooke in Canada and corresponding author of the study commented on these high extraction efficiencies. He said, “The most important factor was to find a suitable leaching agent (in this case sulfuric acid) and a reducing agent (hydrogen peroxide), which increased the extraction of these minerals.”

The researchers are now looking ahead to scaling up their extraction technique. Ramirez noted, “The next steps will be to develop separation and purification units for obtaining zinc and manganese at a quality good enough to introduce them to the market and use them in the production of new goods. Further research is needed to address the scalability of the process at an industrial/commercial scale.”

Phys Org, 3 July 2024

<https://phys.org>



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**First sleep apnea drug also boosts weight loss and heart health**

2024-06-24

An existing drug has shown it can significantly improve the quality of sleep for those suffering from obstructive sleep apnea (OSA), so much so that many trial participants were able to hang up their CPAP machines. It could be the first therapeutic to effectively treat the condition that affects an estimated 936 million people worldwide.

In a study of 469 participants with OSA and weight issues, researchers from the University of California San Diego's School of Medicine trialed the use of tirzepatide to improve sleep and quality of life. Currently, this drug is best known in treatment of type 2 diabetes and obesity, and is sold under the brand names Mounjaro and Zepbound.

"This study marks a significant milestone in the treatment of OSA, offering a promising new therapeutic option that addresses both respiratory and metabolic complications," said lead author Atul Malhotra, MD, professor of medicine at University of California San Diego School of Medicine and director of sleep medicine at UC San Diego Health.

The participants, recruited from nine countries including the US and Australia, were part of two Phase III, double-blinded, randomized, controlled trials. They all had moderate-to-severe OSA and clinical obesity, and some regularly used a continuous positive airway pressure (CPAP) machine, while others were not receiving any treatment for their sleep disorder.

Each week, the participants received either 10 mg or 15 mg of tirzepatide via injection, or a placebo, and monitored for 52 weeks. Evaluation at the end of the year found that the drug significantly decreased the number of disrupted breathing events each night, which was used as the indicator of efficacy for OSA.

In the first trial, participants initially experienced an average of 51.5 disturbance events per hour of sleep. After 52 weeks, the tirzepatide cohort had 25.3 fewer events per hour. In the second trial, the initial average of 49.5 events had been more than halved, with an average of 29.3 fewer events per hour. The placebo cohorts in both trials also had reduced events, but only by 5.3 and 5.5 per hour, respectively.

"Historically, treating OSA meant using devices during sleep, like a CPAP machine, to alleviate breathing difficulties and symptoms," Malhotra

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said. "However, its effectiveness relies on consistent use. This new drug treatment offers a more accessible alternative for individuals who cannot tolerate or adhere to existing therapies. We believe that the combination of CPAP therapy with weight loss will be optimal for improving cardiometabolic risk and symptoms. Tirzepatide can also target specific underlying mechanisms of sleep apnea, potentially leading to more personalized and effective treatment."

The results are not a complete surprise to scientists, as OSA is much more prevalent in people who also have weight management issues. So a reduction in weight saw a corresponding reduction in sleep disturbances. However, tirzepatide didn't just affect weight; it improved the participants' cardiovascular health. Given that OSA sufferers are at an increased risk of heart disease and hypertension, due to a reduction in blood oxygen levels, this treatment could offer a broader range of benefits than existing sleep apnea treatment options.

Bear in mind, however, the best results came through consistent use of tirzepatide, which isn't without side effects – most notably, stomach issues, which have already been associated with this dual gastric inhibitory polypeptide (GIP)/glucagon-like peptide-1 (GLP-1) drug and other GLP-1 therapeutics such as semaglutide.

The study was also funded by Eli Lilly, the makers of Mounjaro and Zepbound.

Given the fairly recent arrival of these GIP/GLP-1 drugs, the researchers now plan another clinical trial to assess tirzepatide's long-term efficacy in treating OSA.

"This breakthrough opens the door to a new era of OSA management for people diagnosed with obesity, potentially transforming how we approach and treat this pervasive condition on a global scale," said Malhotra. "It means we can offer an innovative solution, signifying hope and a new standard of care to provide relief to countless individuals and their families who have struggled with the limitations of existing treatments."

The study was published in the New England Journal of Medicine.

New Atlas, 24 June 2024

<https://newatlas.com>



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### Researchers Create “Glassy Gels”, A New Class of Materials

2024-06-20

Researchers at North Carolina State University have created a new class of materials that blends the hardness of glass with the stretchability of gels. The new materials – which they have termed “glassy gels” – can stretch up to five times their original length without breaking, while still being extremely tough and fracture-resistant.

The easy-to-make materials could have applications in 3D printing, batteries and soft robotics, the researchers say. Their research is published in *Nature*.

#### What is a glassy gel?

Polymer gels and glassy polymers are both types of polymer material, with radically different properties.

A plastic chair would be an example of a glassy polymer – it is stiff and strong because the polymer chains it is made up of are all interacting with each other, keeping them held together in a very rigid shape.

These interactions can be lessened by adding liquid to the polymer, which will turn it into a gel. A good example of a polymer gel is a contact lens, which contains a large proportion of water to make it pliable and comfortable on the eye. Anyone who has ever fallen asleep with their contact lenses in can tell you that this is not the case for a dry contact lens.

These polymer gels and glasses are extremely useful materials, with almost completely opposite properties. Glassy polymers are stiff and strong, but they are also brittle; gels are stretchier, but they are not very strong.

But what if there was a way to combine the most favorable properties of both materials? Enter the glassy gels.

“We’ve created a class of materials that we’ve termed glassy gels, which are as hard as glassy polymers, but – if you apply enough force – can stretch up to five times their original length, rather than breaking,” said study author Michael Dickey, a professor of chemical and biomolecular engineering at North Carolina State University (NC State). “What’s more, once the material has been stretched, you can get it to return to its original shape by applying heat. In addition, the surface of the glassy gels is highly adhesive, which is unusual for hard materials.”

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### Making a glassy gel

Just like a regular polymer gel, glassy gels are made by adding liquid to a precursor glassy polymer. This high liquid content is also responsible for one of the material’s most interesting properties – its ability to conduct electricity despite being a tough plastic.

“A key thing that distinguishes glassy gels is that they are more than 50% liquid, which makes them more efficient conductors of electricity than common plastics that have comparable physical characteristics,” said Meixiang Wang, a co-lead author of the paper and a postdoctoral researcher at NC State. “Considering the number of unique properties they possess, we’re optimistic that these materials will be useful.”

So how do you make a glassy gel and not just a regular gel? The trick is in what type of liquid is added. To make their glassy gels, the NC State researchers added an ionic liquid to a mix of glassy polymer precursors. This mixture is then poured into a mold, cured with ultraviolet light and demolded to reveal the finished glassy gel material.

“The ionic liquid is a solvent, like water, but is made entirely of ions,” explained Dickey. “Normally when you add a solvent to a polymer, the solvent pushes apart the polymer chains, making the polymer soft and stretchable. That’s why a wet contact lens is pliable, and a dry contact lens isn’t.”

“In glassy gels, the solvent pushes the molecular chains in the polymer apart, which allows it to be stretchable like a gel,” he continued. “However, the ions in the solvent are strongly attracted to the polymer, which prevents the polymer chains from moving. The inability of chains to move is what makes it glassy. The end result is that the material is hard due to the attractive forces, but is still capable of stretching due to the extra spacing.”

While not every class of polymer that the researchers tested was able to form a glassy gel, they found that a significant number of different polymer types were compatible with this straightforward synthesis process.

“Polymers that are charged or polar hold promise for glassy gels, because they’re attracted to the ionic liquid,” Dickey said.



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### Future applications

The researchers report that their glassy gels exhibit “enormous” fracture strength, toughness, yield strength and a high Young’s modulus (a measure of stiffness) comparable to that of strong thermoplastics such as polyethylene. But the novelty of this new material class is that, unlike thermoplastics, they can be stretched up to five times their original length without breaking.

The gels also have shape memory, which can be programmed by deforming the material as it is heated and cooled to “fix” it in a certain shape, which is reset easily through further heating. Heat can also be used to self-heal the glassy polymer or join two fragments of the polymer together.

Additionally, despite consisting of between 50-60% liquid, the new glassy gels did not appear to naturally evaporate and dry out as seen with traditional polymer gels.

“Maybe the most intriguing characteristic of the glassy gels is how adhesive they are,” Dickey added. “Because while we understand what makes them hard and stretchable, we can only speculate about what makes them so sticky.”

While this suite of material properties certainly makes for some interesting potential applications in robotics or 3D printing, the researchers believe that their ease to make could be the thing to set these materials apart as an option for further development.

“Creating glassy gels is a simple process that can be done by curing it in any type of mold or by 3D printing it,” said Dickey. “Most plastics with similar mechanical properties require manufacturers to create polymer as a feedstock and then transport that polymer to another facility where the polymer is melted and formed into the end product.”

“We’re excited to see how glassy gels can be used and are open to working with collaborators on identifying applications for these materials,” he added.

Technology Networks, 20 June 2024

<https://technologynetworks.com>

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### 5:2 diet proves better than meds for new diabetics

2024-06-24

Compared to some antidiabetic medications, a 5:2 intermittent diet provides better blood sugar control and weight loss in newly diagnosed type 2 diabetics, a new study found. It may be a viable alternative to medications in the early stages of the condition.

Being overweight and obese are significant risk factors for developing type 2 diabetes. While losing weight can optimize blood sugar levels and reduce the dosage of prescribed antidiabetic drugs, weight loss can be challenging to achieve and maintain. In a new study, Chinese researchers examined the effect that intermittent fasting utilizing a 5:2 diet had on blood sugar control in overweight type 2 diabetics.

The 5:2 intermittent fasting diet involves eating normally for five days and fasting for two nonconsecutive days by eating a quarter of the usual energy intake. Popularized by the late medical journalist Dr Michael Mosley, many find the diet appealing because of its flexibility; it doesn’t matter which two days are ‘fasting days’ as long as they’re not consecutive.

The researchers recruited 405 adults aged 18 to 65 who’d been diagnosed with type 2 diabetes in the preceding year and had not used antidiabetic medications in the past three months. The participants, of which 34.6% were women, had an average body mass index (BMI) of 29.5, meaning they were overweight, and an average HbA1c of 7.9%. HbA1c, or glycated hemoglobin, is a blood test that shows a person’s average blood sugar levels for the last two to three months. The normal range is between 4% and 5.6%.

Participants were randomly assigned to receive antidiabetic medications metformin (Glucophage) or empagliflozin (Jardiance) or to follow the 5:2 diet for 16 weeks. The primary outcome was an improvement of HbA1c from baseline. Secondary outcomes included changes in weight, blood pressure, fasting blood sugar level, fasting insulin level, blood fats (lipids) and cholesterol.

At week 16, study participants in the 5:2 diet group showed the greatest reduction in HbA1c, a drop of 1.9% (so, from the mean value of 7.9%, it fell to 6%). This was significantly greater than the effect of metformin (–1.6%) and empagliflozin (–1.5%). Fasting blood sugar levels in the diet intervention group also decreased. At the end of an eight-week follow-up, 76.6% of participants in the 5:2 diet group maintained an HbA1c of less than 6.5%.



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Additionally, at week 16, those on the 5:2 diet showed greater weight loss (−9.7 kg/21.4 lb) compared to metformin (−5.5 kg/12.1 lb) and empagliflozin (−5.8 kg/12.8 lb). And, compared to the antidiabetic drugs, the diet intervention produced a significant reduction in waist and hip circumference, blood pressure, and blood lipids.

In the 5:2 diet group, one participant experienced constipation, and 5.9% of participants had symptoms of low blood sugar (hypoglycemia). In the metformin group, 6% had hypoglycemia and 19.4% mild gastrointestinal symptoms. In the empagliflozin group, 3.7% experienced hypoglycemia, 2.2% urinary symptoms, and one participant reported being thirsty. Two participants on empagliflozin reported serious adverse events, including severe rash and hospitalization due to elevated blood ketones, which resolved with treatment.

“We found that among Chinese adults with overweight or obesity and newly diagnosed type 2 diabetes, the 5:2 MR [meal replacement diet] approach achieved significant improvements in glycemic control and weight loss within a 16-week period, while also improving blood pressure and triglyceride and HDL-C levels,” said the researchers. “Therefore, 5:2 MR may potentially serve as an effective initial lifestyle intervention instead of antidiabetic drugs for early-stage type 2 diabetes.”

The study has some limitations. It only enrolled participants with an HbA1c of less than 9%, so the diet’s effectiveness in people with an HbA1c higher than that requires further research. Additionally, a longer period without antidiabetic medication might offer more insights into the effect of the previously stopped medication. Also, the long-term effectiveness of the 5:2 diet remains untested. Long-term follow-up studies are underway to assess the diet’s robustness.

The study was published in the journal JAMA Network Open.

New Atlas, 24 June 2024

<https://newatlas.com>

### Melanin from cuttlefish ink shows promise as sustainable biomass resource

2024-07-01

Every year, the negative effects of human activities on the environment become increasingly clear. From climate change and microplastics to the endangerment and extinction of countless species, it is evident that

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we need to find new ways to achieve sustainability. Fortunately, many research groups in prominent fields like chemistry and materials science are tirelessly working to develop solutions to get us closer to circular and sustainable economies.

One area that has attracted much attention in this regard is biomass upcycling. It refers to the transformation of naturally available organic materials into valuable products, such as biofuels and bioplastics. While many scientific studies have focused on plant-derived biomass, such as cellulose fibers, the potential of melanin as a biomass resource remains understudied. One of the main reasons for this is that the decomposition of melanin—a complex yet ubiquitous biopolymer—needs to be further explored.

In a recent study published in ACS Sustainable Chemistry & Engineering, a research team led by Associate Professor Michinari Kohri from the Graduate School of Engineering at Chiba University, Japan, set out to address this knowledge gap. Using both artificially and naturally sourced melanin, they performed a detailed analysis of the decomposition of melanin and showcased its upcycling potential.

Their paper, which was made available online on April 19, 2024, was co-authored by Mr. Takumi Morita and Prof. Keiki Kishikawa from the Graduate School of Engineering at Chiba University, Prof. Toshihiko Matsuura from the Laboratory of Biotechnology and Bioengineering at Hokkaido University of Education, and Prof. Hironori Izawa from the Faculty of Engineering at University of Miyazaki.

First, the researchers synthesized artificial melanin from polydopamine, obtaining a polymer that is structurally very similar to natural melanin. Using powdered samples as a model substance, they ran a series of decomposition tests under various conditions, followed by a series of analytical experiments on the resulting decomposition products.

Afterward, they repeated many of these tests on natural melanin, which they extracted from the ink sacs of cuttlefish. “From a resource perspective, the melanin concentrated in the ink sacs of cuttlefish and squid is easily recoverable natural melanin. The catch of squid and octopus has been increasing yearly and hovering around three million tons for the past few years,” explains Dr. Kohri.

Interestingly, the researchers found that both artificial and natural melanin were decomposed into pyrrole derivatives containing carboxylic acids. This result suggests that melanin derived from other renewable and



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easily accessible sources, such as insect exoskeletons, animal hair, or melanin-producing microorganisms, could be equally useful as a chemical precursor.

Finally, using the decomposition products obtained from artificial and natural melanin as raw materials, the researchers prepared various polymer films and particles. These experiments serve as a demonstration of the untapped potential of melanin in biomass upcycling.

“Since melanin is naturally abundant biomass and eventually gets degraded by microorganisms, polymeric materials produced using melanin decomposition products are probably also biodegradable,” highlights Dr. Kohri.

“Biodegradable polymers can be disposed of without harming the environment, and thus, the proposed approach for making polymers from melanin decomposition products could lead to the development of sustainable materials.”

Overall, the findings of this study could pave the way to the widespread adoption of melanin upcycling, which could ultimately help us protect the environment.

“Just as research on cellulose biomass has advanced because cellulose can be extracted from a variety of underutilized plants, we hope our efforts bolster the use of melanin as a biomass resource,” concludes Dr. Kohri.

Phys Org, 1 July 2024

<https://phys.org>

### Novel spectroscopy technique sheds light on NO<sub>x</sub> reduction

2024-07-01

One way to curb such emissions is with a catalytic converter, similar to what's used in a vehicle.

“The catalytic converter injects ammonia into the plant's emissions stream, and the hydrogen in the ammonia reacts with the oxygen in the NO<sub>x</sub>, and the products are nitrogen and water molecules, which are nontoxic and have no environmental impact,” says Israel E. Wachs, the G. Whitney Snyder Professor of Chemical and Biomolecular Engineering at Lehigh University and Director of the Operando Molecular Spectroscopy and Catalysis Research Lab.

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The process that can convert pollution into benign by-products is called selective catalytic reduction, or SCR.

Until now, it has been unclear how this reaction actually occurs, and contradictions have long existed between reaction models within the literature.

Wachs and his team used a novel, cutting-edge technology called modulation excitation spectroscopy, or MES, to finally identify the correct pathway.

Their results were recently published in Nature Communications.

“Very few people have this capability at the moment,” says Wachs, referring to MES.

“It allowed us to monitor weak signals that were not detectable in the past, and revealed the details of how the reaction proceeded.”

The finding is significant because having the right reaction model can indicate how to modify or redesign the catalytic converter for greater efficiency.

Wachs points out that the methodology is general enough that it can be applied across a range of catalytic reactions, including those emitting NO<sub>x</sub> from automobiles, ships, tractors, and even riding lawn mowers.

“The products that catalysts manufacture represent 20 to 30 percent of the American economy,” says Wachs. “They're used to make fuel, chemicals, fertilizers, and even pharmaceuticals. Having the hard data that shows the correct reaction mechanism means we now have the potential to positively impact thousands of catalytic reactions.”

Science Daily, 1 July 2024

<https://sciencedaily.com>

### Ozempic associated with up to 7x increased risk of rare 'eye stroke'

2024-07-03

Being prescribed semaglutide for diabetes or weight management is associated with an increased risk, up to seven times, of developing a relatively rare form of untreatable blindness, sometimes referred to as an 'eye stroke,' a new study has found.



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Better known as the antidiabetic-slash-weight loss drugs Ozempic and Wegovy, semaglutide has become something of a 'wonder drug,' with research regularly discovering its additional medical benefits. However, a new study has found that the drug potentially has a serious downside.

New research led by the Massachusetts Eye and Ear Hospital (Mass Eye and Ear) found that semaglutide use was associated with nonarteritic anterior ischemic optic neuropathy (NAION), or 'eye stroke,' a condition that can cause sudden vision loss.

"The use of these drugs has exploded throughout industrialized countries and they have provided very significant benefits in many ways, but future discussions between a patient and their physician should include NAION as a potential risk," said Joseph Rizzo, MD, director of the Neuro-Ophthalmology Service at Mass Eye and Ear and the Simmons Lessell Professor of Ophthalmology at Harvard Medical School, and the study's senior author.

NAION is a relatively rare condition caused by impaired blood circulation to the optic nerve (what 'ischemic' refers to in the condition's name), which transmits information from the eye to the brain. It's called 'nonarteritic' because the reduced blood flow isn't associated with true blood vessel inflammation (as seen in arteritis). 'Anterior' refers to the front-most part of the optic nerve, where it meets the eye, while 'optic neuropathy' is because it causes injury to the optic nerve, leading to sudden, painless vision loss. In severe cases, NAION can cause blindness. There is no current treatment for the condition.

The exact mechanism that causes NAION isn't known. What is known is that the condition is seen more often in patients with diabetes, high blood pressure, and sleep apnea. After noticing a rise in patients taking semaglutide presenting with vision loss caused by NAION, the researchers undertook a retrospective study to investigate whether there was a link between the two.

Semaglutide mimics a naturally produced hormone called glucagon-like peptide 1 (GLP-1). It connects with GLP-1 receptors in the body, lowering blood sugar levels and making people feel fuller and less hungry.

The researchers examined data from 16,827 Mass Eye and Ear patients seen by neuro-ophthalmologists – medical doctors who specialize in treating vision issues linked to neurological conditions – between December 2017 and November 2023. The average age was 47, and 52% were female. The patients were divided into those with type 2 diabetes

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and those who were overweight or obese. Those groups were then further divided into those prescribed semaglutide or a non-GLP-1 medication to treat their respective conditions. None of the participants had a history of NAION.

Propensity matching – a statistical matching technique that attempts to estimate the effect of a treatment by accounting for covariates that predict receiving the treatment – was used to assess whether prescribed semaglutide was associated with NAION. Factors such as sex, age, high blood pressure, type 2 diabetes, obesity, obstructive sleep apnea, high blood lipids and coronary artery disease were accounted for.

Among 710 participants with type 2 diabetes, 194 were prescribed semaglutide, and 516 were prescribed a non-GLP-1 antidiabetic medication. The researchers found that 17 NAION events occurred in patients prescribed semaglutide versus six in the patients taking non-GLP-1 meds. The cumulative incidence of NAION over three years was 8.9% for the semaglutide-prescribed group compared to 1.8% for the non-GLP-1-prescribed group. These findings suggest that type 2 diabetics prescribed semaglutide were four times more likely to be diagnosed with NAION.

Of the 979 overweight or obese participants, 361 were prescribed semaglutide, and 618 were prescribed a non-GLP-1 weight loss medication. For these patients, 20 NAION events occurred in the patients prescribed semaglutide and three occurred in the non-GLP-1-prescribed cohort. The cumulative incidence of NAION over three years was 6.7% in the semaglutide group and 0.8% in the non-GLP-1 group, meaning they were seven times more likely to develop the condition.

There are limitations to the study. All participants attended Mass Eye and Ear, which sees a high number of people with rare eye diseases. They were mostly white, and the number of NAION cases seen over the study period was relatively small. Additionally, the researchers couldn't determine whether participants actually had their prescriptions dispensed or had started taking semaglutide and then stopped.

Further, as this is an observational study, the researchers could not say that semaglutide caused an increased risk of developing NAION, just that the data suggest an association between the two. Further research is needed to assess causality.

"Our findings should be viewed as being significant but tentative, as future studies are needed to examine these questions in a much larger and more



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diverse population," Rizzo said. "This is information we did not have before, and it should be included in discussions between patients and their doctors, especially if patients have other known optic nerve problems like glaucoma or if there is preexisting significant visual loss from other causes."

The study was published in the journal JAMA Ophthalmology.

New Atlas, 3 July 2024

<https://newatlas.com>

### Tackling Plastic Waste for More Sustainable Science

2024-06-18

Life sciences research produces plastic waste weighing a stunning 5.5 million tons, according to researchers from the University of Exeter – roughly the equivalent of 67 cruise ships.

The need to handle biological hazards and prevent contamination has led to a reliance on single-use plastics in the life sciences. While it may not be possible to completely remove plastic from the equation in the laboratory, approaches are being developed to reduce the amount of plastic waste generated as well as increase its reuse and recycling.

Sustainability is becoming an ever-growing issue, not just in the lab, with numerous governments imposing restrictions on single-use plastics and plastic waste.

At SLAS Europe 2024, Technology Networks had the pleasure of speaking with Tim Dillon, market manager (Nordics) at Mettler-Toledo Rainin, to learn more about sustainability in the context of a laboratory environment, and how more sustainable options can be implemented into scientists' daily workflows.

**Sarah Whelan (SW):** The word "sustainability" is widely used in today's world, but how would you define sustainability?

**Tim Dillon (TD):** There's a very simple definition of sustainability – to embrace doing something today in a way that it doesn't negatively impact your ability to do it tomorrow. In other words, don't make a mess today that you can't clean up tomorrow. That's the common-sense approach, to stop doing things that are a net negative in the long term that can't be recovered from and that are going to stockpile problems in the future.

**SW:** What would you say are some of the main problems when it comes to sustainability in a laboratory environment?

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**TD:** There are often difficulties with the materials that are being used in a lab. Biosafety and health and safety considerations mean the materials used can't always go into the usual sustainable waste streams. For example, some labs must incinerate or autoclave waste before it leaves the lab.

There are also more general problems, which I put into the "naivety" category. This is where people have false assumptions about what's happening with their waste, or they aren't aware of the wider costs of the materials they're using. They don't understand that there are better options, or they haven't thought about it, so they haven't had the opportunity to think about the impact of what they're doing, how to mitigate it and what choices they have.

In science, if something works and it gives you results, you're often very reluctant to change things around in case things don't work. But you need to have an open mind and a willingness to consider the risks of changing what you're doing. Often, it's an irrational fear, inertia or sometimes a lack of motivation.

**SW:** At SLAS Europe 2024 you displayed some examples of more sustainable options for pipette tips. Can you run through the various generations of products?

**TD:** Generations is a good way to put it because we started way back in the early 90s, before sustainability was as recognized as it is today. We produce single-use plastic products, so it's at the front of our minds that we have a responsibility to make sure that resource is used wisely and that we apply the principles of good design and innovation.

Our first innovation was to develop the tower rack system, which allows you to refill your polypropylene rack. Rainin developed them in the first instance, and the rest of the market followed. This took about 80% of the plastic out of the equation, allowing energetically expensive polypropylene racks to be reused. Our next innovation was to develop a single rack refill for that energetically expensive polypropylene rack, which allowed it to be refilled with filter tips. Filter tips can't be used in a tower system because the top row nests inside the bottom row, and the filter gets in the way. So, we have an individual polyethylene terephthalate (PET) plastic clamshell refill that takes a lot of the plastic out of the equation for filter tip racks.

We also developed a hinged rack that is made entirely of PET. This takes half the plastic out of the equation and is half the weight, substituting



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energetically expensive grade five polypropylene for much easier to recycle and energetically less expensive grade one PET.

Our next generation – the EarthRack™ – moves away from plastic as much as possible. We've taken all the plastic out of the rack lid and rack base and replaced it with a purified cellulose material. This is compostable, in either an industrial composting setting, or what's termed a "home composting" setting. Home composting doesn't mean that you take it home, but that it doesn't need special conditions and will rot when it comes into contact with the soil, leaving the soil in an improved state after it decomposes. That's the latest evolution. After all, the most sustainable plastic is the plastic you don't use.

**SW:** How are these increasingly sustainable products being integrated into day-to-day workflows for scientists?

**TD:** With minimal effort. It's a matter of being aware that you have choices, and making the choices that offer you the most sustainable product. When it comes to the pipette tips that go inside of all these racks, Rainin believes that there's no compromise to be made there. All our tips are the same high-quality material, which we call BioClean Ultra – or BioClean Green, in the case of EarthRack. That is non-negotiable, so the tips don't change – the only thing that changes are the racks the tips come in, so you don't have to change anything that you do in the lab.

**SW:** What is the status of the development of the EarthRack?

**TD:** EarthRack is an ongoing story. We're quite advanced in prototyping – all I can say is watch this space. Everything is in development with Rainin and we have a culture of innovation and change; we don't stand still. We always seek to address what the market and the consumer want. If the consumer demands more sustainable products and puts their practice where their demand is, then the market will develop those products. We realize this is going to be a continuous process, and there will be further iterations taking more plastic out of the equation.

**SW:** What do you think needs to be done to aid sustainability while avoiding "greenwashing"?

**TD:** In a nutshell, it's education. People need to know what the pitfalls and common failings are. Greenwashing often has a negative connotation and people feel they're being misled; often it's innocence or a naïve misunderstanding of the relevant points.

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Take recycling polypropylene, for example. Most pipette tip racks are made from polypropylene, which is a grade five resin. The international resin scale goes from one to seven, with one being almost universally recyclable and seven being virtually non-recyclable. Polypropylene is at the wrong end of the scale – it requires specialist recycling, so if it goes in your general plastic waste stream it's more than likely going to be diverted to either landfill or thermal energy recovery, so that's one innocent mistake.

Even with dedicated polypropylene recycling, you assume that the polypropylene is going to make a new rack – and that is also a false assumption. It generally can't be used to make the same material again and recycled polypropylene isn't particularly valuable or sought after material on the aftermarket. This is because the average chain length mix of the polymer changes during recycling (the molar mass distribution changes). This changes its mechanical properties like tensile strength, brittleness, flexibility and its ability to flow through an injection mold. Though you may send your polypropylene to a dedicated polypropylene recycler, it's not going to make a new rack, so it's not stopping the flow of oil into the product life cycle – something you thought you were doing when recycling.

For the plastic we do need to use in the racks, we can use PET. This is a grade one resin that is almost universally recyclable and goes in any mixed recycling stream, so you can be confident that it will be recycled. It also has a higher value on the aftermarket because PET recycling is an even and regular process in which the polymer is cleaved one molecule at a time, resulting in a recyclate with the same properties as virgin PET, so you can make the same product and recycle it up to 10 times. This stops the flow of new oil into the product cycle and cuts it off at the product manufacturing stage. In this way, naivety or lack of education about recycling plastics can often lead people to do the wrong thing or not act effectively. There's nothing deliberate, we just need education.

Tim Dillon was speaking to Dr. Sarah Whelan, Science Writer for Technology Networks.



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### About the interviewee:

Tim Dillon is the market manager (Nordics) at Mettler-Toledo Rainin. He holds a BSc in biology and a postgraduate diploma in analytical techniques from the University of Bedford.

Technology Networks, 18 June 2024

<https://website>

### From waste to value: The right electrolytes can enhance glycerol oxidation

2024-07-01

In 2023, around 16 billion liters of biodiesel and HVO diesel were produced in the European Union, based on maize, rapeseed, or partially on waste materials from agricultural production. A by-product of biodiesel production is glycerol, which can be used as a building block for the production of valuable chemicals such as dihydroxyacetone, formic acid, glyceraldehyde and glycolaldehyde via a glycerol oxidation reaction (GOR). Glycerol can be oxidized electrochemically in (photo)electrochemical (PEC) reactors, which are currently being developed specifically for the production of green hydrogen.

However, this path in PEC-plants is still hardly exploited at present, even though it could significantly increase the economic efficiency of the PEC Power-to-X process, since the oxidation of glycerol requires a much lesser energy input than hydrogen production through water splitting, but at the same time produces more valuable chemicals.

#### Examining the influence of different electrolytes

Many studies have already investigated the role of photocatalysts in PEC electrolyzers, while the role of the electrolyte had not yet been systematically analyzed. A team led by Dr. Marco Favaro at the Institute for Solar Fuels has now unveiled the influence of electrolyte composition on the efficiency and stability of glycerol oxidation.

The team's paper is published in the journal Chemical Science.

They used a PEC cell with photoanodes made of nanoporous bismuth vanadate (BiVO<sub>4</sub>). They tested acidic electrolytes (pH = 2) with various cations and anions, including sodium nitrate (NaNO<sub>3</sub>), sodium perchlorate (NaClO<sub>4</sub>), sodium sulfate (Na<sub>2</sub>SO<sub>4</sub>), potassium sulfate (K<sub>2</sub>SO<sub>4</sub>) and potassium phosphate (KPi).

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"Our results showed that BiVO<sub>4</sub> photoanodes perform best in NaNO<sub>3</sub> and outperform the commonly used Na<sub>2</sub>SO<sub>4</sub> in terms of photocurrent, stability, and production rates of high-quality glycerol oxidation reaction products," summarizes Favaro.

#### Sodium nitrate performs best

The team also investigated the reasons for this difference in performance. Their hypothesis is that the size of the ions, their different salting in/out capabilities (Hofmeister series), and their different pH buffering capacity play a role.

"The composition of the electrolyte has a surprising clear effect on the glycerol oxidation efficiency, and we were able to observe this trend in both bismuth vanadate and polycrystalline platinum anodes," says Ph.D. student Heejung Kong. This supports the assumption that these findings could generally apply to different materials and processes.

The choice of electrolyte is therefore of great importance for the efficiency and stability of glycerol oxidation.

"Our research could help to convert biomass by-products into valuable chemicals more efficiently and to produce valuable chemicals from waste materials while minimizing the impact on the environment," says Favaro.

Phys Org, 1 July 2024

<https://phys.org>

### New gene-editing tool found in bacterium could carry out extensive genome remodelling

2024-07-05

Bacteria are known to use 'jumping genes' to reorder their genome and fast-forward evolution. Now, scientists have discovered a mobile genetic element from this microbial world that might be able to rearrange large sections of our own DNA.<sup>1</sup>

This 'takes us beyond the DNA and RNA cutting abilities of Crispr and RNA interference and towards a broader suite of capabilities' for genome design, Patrick Hsu, geneticist at the University of California, Berkeley, said at a media briefing.

His group has found an enzyme that uses an RNA bridge in two parts: one binds to a sequence of donor DNA and another to the target DNA to insert



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the donor sequences. The discovery stemmed from investigations of a transposable element that can cut and paste itself into microbial genomes. The non-coding RNAs flanking the sequence controls an enzyme called a DNA recombinase.

'This new study has dipped into bacterial genomes again and found some distant cousins of the Crispr-Cas genes known as recombinases,' says Antony Adamson, who leads the Genome Editing Unit at the University of Manchester, UK. 'Recombinases have been known for some time and can facilitate the rearrangement of very long DNA sequences, but to date none of these systems have been "programmable".'

Recombinases are widespread in bacteria and this research focused on one found in some strains of *Escherichia coli*.

By engineering the target and donor RNA, the researchers were able to remove, insert and flip bacterial DNA sequences using this recombinase. 'This programmable mechanism allows us to specify any two DNA sequences that we want to combine,' says Hsu, delivering 'an unprecedented level of controllability for manipulating genomes.'

Crispr was discovered in 1987 and developed as a gene-editing tool in 2012. Crispr with the Cas9 protein is akin to a molecular scissors that recognises and cuts a single target site. Crispr cuts DNA and then relies on repair machinery from the host cell to repair the sliced genome, which can result in long deletions or unexpected rearrangements. The new RNA-bridging mechanism completes its DNA edit in a single step. Another advantage is that the recombinase protein is smaller than many Cas enzymes of the Crispr system, making it easier to pack editing machinery into the viruses needed to deliver into human cells.

A big drawback of Crispr is our inability to control repair, says Adamson. 'This means we may have to screen many extra cells to find ones with the desired outcome,' he notes. 'If someone wanted to treat a person with a genetic condition then the lack of precision presents a huge safety issue.'

In a second paper, the US team collaborated with structural biologist Hiroshi Nishimasu at the University of Tokyo, Japan.<sup>2</sup> They revealed that the cryo-electron microscope structures of the recombinase complexed with its bridge-DNA, target DNA and donor DNA at different stages of the recombination.

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Separately, a team in Sydney reported on the structure of the recombinase and a family of related molecules, also highly selective and programmable, which they term SeekRNA.

The new bridge-DNA mechanism has only been demonstrated in bacteria so far. The next challenge is to put it to work in mammalian cells. 'If this is successful, then very precise, large-scale alterations of mammalian cells may become possible,' says Adamson.

'This is an important step forward towards the broader vision of genome design, where we'll one day want to change not just individual or hundreds of bases, but thousands, tens of thousands, hundreds of thousands, millions of bases,' Hsu explains.

Chemistry World, 5 July 2024

<https://chemistryworld.com>

## Using visible light to make pharmaceutical building blocks

2024-07-02

University of Michigan chemists have discovered a way to use visible light to synthesize a class of compounds particularly well suited for use in pharmaceuticals.

The class of compounds, called azetidines, had been previously identified as a good candidate to build therapeutic drugs, but the compounds are difficult to produce in chemical reactions. Now, a team led by University of Michigan chemist Corinna Schindler has developed a method to produce a specific class of azetidines called monocyclic azetidines using visible light and a photocatalyst. Their results are published in the journal *Science*.

Approximately 60% of pharmaceutical drugs contain building blocks in the form of compounds called nitrogen heterocycles. Nitrogen heterocycles are structures of atoms organized in a ring that contain at least one nitrogen atom, the most common of which have five- and six-membered ring systems. These systems are often used as building blocks in pharmaceuticals.

"These building blocks are very accessible and you can put them together like Legos to build compounds that we can then use for chemical or medicinal testing. But the problem is that a lot of these five or six membered ring systems are not as stable as you'd want them to be," Schindler said.



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“The ring systems can break down in the body after a patient has ingested a therapeutic drug. Because the compound can be metabolized by the human body, what you give initially to a patient may not necessarily be what you would find in the body after the patient has taken it, and that is a problem.”

Instead, researchers suggest using monocyclic azetidines, a more stable four-membered ring system. But, says Emily Wearing, lead author of the study who recently earned her doctorate from Schindler’s lab, the key reactions chemists use to produce azetidines have specific challenges.

The reactions either can’t be widely applied or they only produce azetidines with specific substitution patterns. Researchers want to produce azetidines with different substitution patterns because this allows researchers to try a variety of the molecule as building blocks in drug synthesis and drug screening.

Further, the U-M researchers used a method called a [2+2]-cycloaddition to create monocyclic azetidines. This method usually requires photoexcitation, or the excitation of atoms or molecules in a compound through the absorption of energy, according to Schindler. In other words, the reaction needs light.

In the reaction, the researchers used two classes of compounds called acyclic imines and alkenes, which are highly desirable as starting materials because they can be easily varied to produce different products, Wearing says. However, when you use light to excite the imine, the acyclic imine decays from the excited state before it can undergo the cycloaddition, Schindler says.

Previously, there has been a successful example of this reaction, Wearing says, but it used ultraviolet light, which presents safety challenges, and it used different imines and alkenes.

“This also means access to these highly desirable monocyclic azetidine building blocks is much more limited using this approach,” Wearing said. “The use of visible light versus UV light is an important benefit, but our key discovery was being able to use a visible light approach to produce monocyclic azetidines.”

Their method uses visible light and a photocatalyst to allow access to the required excited state intermediates in what’s called an aza Paternò-Büchi reaction. To determine exactly why the reaction worked, Schindler’s lab

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teamed up with the lab of Heather Kulik, associate professor of chemical engineering at the Massachusetts Institute of Technology.

Her lab ran a computational analysis that found using specific classes of the imines and alkenes starting materials would facilitate a better match in energy between those starting materials, which lowered the barrier for reaction. They also analyzed what factors led to high yields of azetidines.

When researchers develop a new reaction like this, they also need to show that it can work for many combinations of substrates, according to Seren Parikh, a graduate student in Schindler’s lab. He and postdoctoral research fellow Yu-Cheng Yeh showed that the team’s reaction could work on multiple versions of imine and alkene compounds.

“Someone might show that a new reaction works, but if it only works on a single compound, it is not useful to anyone because pharmaceutical companies are likely wanting to use the reaction on their unique compound,” Parikh said. “What we can do is show that the reaction works on a diverse range of substrates to essentially prove that the reaction is worth the pharmaceutical company’s time to try.”

Parikh and Yeh were able to show that they could produce six biologically relevant azetidine compounds, including using the reaction to attach an azetidine to an estrogen derivative, a natural steroid in the human body. Yeh also used this method to synthesize analogues of penaresidin B, which has been shown to be toxic to tumor cells. This is the first total synthesis of this natural product using the [2+2]-cycloaddition

“The synthesis of these azetidine compounds are examples to demonstrate that this synthetic methodology can be applied to make complicated molecules and medicine-like molecules,” Yeh said.

Understanding what makes this chemical reaction work will allow the group and the field of medicinal chemistry to design related reactions in the future. New work can build upon this design principle to access other azetidines to be incorporated into new pharmaceuticals, Schindler says.

“Now we can access these types of building blocks that people have wanted for a long time, but couldn’t directly access,” she said. “The process we have developed can now be used in the future as basically a blueprint for future reaction development.”

Science Daily, 2 July 2024

<https://sciencedaily.com>



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### Super-fast automated synthesis promises to make chemistry accessible to many more

2024-07-04

Chemists behind Lego-like automated synthesis of complex organic molecules have unveiled the next generation of this technology, cutting cycle times down by an order of magnitude from 30 hours to just three. 'To date, this approach has been limited because each carbon-carbon bond-forming step takes about a day,' wrote the team led by Martin Burke at the University of Illinois at Urbana-Champaign.

Over the last decade, Burke's group has pioneered this 'snap-and-go' approach to synthesis, weaving together complex organic structures using Suzuki-Miyaura cross-coupling reactions and N-methyliminodiacetic acid (Mida)-protected boron as the linchpin.

Burke's Mida ligand was a game-changer, stabilising boronic acids traditionally prone to decomposition due to boron's Lewis acidity. By altering boron's hybridisation, Mida significantly reduced unwanted reactivity, enabling sequential Suzuki-Miyaura reactions for the first time under mild conditions.

The concept, says Burke, was born from a desire to level the playing field when it comes to molecular discovery. 'There are 8 billion imaginations in the world but, at present, those that can meaningfully participate in the search for tomorrow's medicines and materials represent just a fraction of a fraction of a fraction of this greatest natural resource,' he says. 'Automated iterative small molecule synthesis has the potential to democratise molecular innovation and thereby revolutionise the search for the undiscovered small tools that could transform our society.'

While Mida was revolutionary, a key limitation of the current platform is the long cycle time of more than one day per carbon-carbon bond-forming step resulting from the slow and variable kinetics of the Suzuki cross-coupling reaction. This is at least an order of magnitude slower than analogous, state-of-the-art peptide synthesisers widely used in the pharmaceutical industry.

To bring their synthesiser up to speed, they reported a major overhaul to the platform in which 'each step of the iterative cycle has been reimagined and re-optimised for speed, efficiency and generality.'

Alongside engineering optimisations, key to the synthesiser's newfound success is tetramethyl-N-methyliminodiacetic acid (Tida) boronates

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developed by the Burke group in 2022. 'Tida boronates are more than 1000 times more stable than their Mida boronate counterparts,' explains Burke. This stability allows them to withstand reaction condition optimisations to the Suzuki-Miyaura coupling previously reported in the literature, which speeds up the reaction but is not tolerated by Mida boronates.

'This system leverages [Tida's] hyperstability,' Burke adds, enabling the team to perform cross-couplings in just minutes and accelerating the rate by an order of magnitude per automated carbon-carbon bond-forming step.

'[This is] an impressive ... change in efficiency in the automated synthesis of small molecules based on iterative cross couplings,' comments Varinder Aggarwal at the University of Bristol who was not involved in the study. 'It is currently limited to [Suzuki-Miyaura] couplings but once it can do other iterative C-C bond-forming reactions, it will be even more powerful.'

Whether this is significant enough for widespread adoption in the pharmaceutical industry remains to be seen. 'I am convinced that it will be adopted over time, but there is always resistance to new technology,' adds Aggarwal.

Burke also emphasises that this is not the last iteration of this technology. 'Peptide and oligonucleotide synthesisers revolutionised science, medicine and technology, because their continued improvement was relentlessly improved.'

'We are very inspired by this history and likewise plan to continue seeking relentless optimisation of this platform until the traditional synthesis bottleneck that currently limits access to small molecule innovation are shattered.'

Chemistry World, 4 July 2024

<https://chemistryworld.com>



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