

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
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ASIA PACIFIC

Agricultural chemical products and approved labels

2025-04-15

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

Table 1: Agricultural products based on existing active constituents

Application no.	146745
Product name	Agro-Essence Terbutylazine 875 WG Herbicide
Active constituent	875 g/kg terbutylazine
Applicant name	Agro-Alliance (Australia) Pty Ltd
Applicant ACN	130 864 603
Date of registration	24 March 2025
Product registration no.	95656
Label approval no.	95656/146745
Description of the application and its purpose, including the intended use of the chemical product	Registration of 875 g/kg terbutylazine water dispersible granule (WG) for the control of weeds in chickpeas, faba beans, fallows, field peas, lentils, lupins, sorghum and triazine tolerant canola.

Application no.	142933
Product name	Goliath Plus Gel Bait
Active constituents	0.4 g/kg fipronil, 0.4 g/kg chlorfenapyr
Applicant name	BASF Australia Ltd.
Applicant ACN	008 437 867
Date of registration	26 March 2025
Product registration no.	94607
Label approval no.	94607/142933

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Application no.	142933
Description of the application and its purpose, including the intended use of the chemical product	Registration of a 0.4 g/kg fipronil and 0.4 g/kg chlorfenapyr ready-to-use gel bait for the control of ants, cockroaches and silverfish in domestic, commercial, industrial and public buildings and facilities.

Read More

APVMA, 15-04-25

<https://www.apvma.gov.au/news-and-publications/publications/gazette/gazette-8-15-april-25>

~ Veterinary chemical products and approved labels

2025-04-15

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

Table 3: Veterinary products based on existing active constituents

Application no.	144731
Product name	Aurazol Minidose Cattle Drench
Active constituent	112.5 g/L albendazole
Applicant name	Aura Laboratories Limited
Applicant ACN	N/A
Date of registration	25 March 2025
Product registration no.	95117
Label approval no.	95117/144731

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Application no.	144731
Description of the application and its purpose, including the intended use of the chemical product	Registration of a 112.5 g/L albendazole oral drench product for the control of benzimidazole sensitive mature and immature gastrointestinal roundworms (including inhibited type II Ostertagia larvae), lungworms, tapeworms and to aid in the control of adult liver fluke in cattle.

Application no.	146729
Product name	Terminator Allwormer Paste for Horses
Active constituents	167 mg/g morantel tartrate, 4 mg/g abamectin
Applicant name	Randlab Australia Pty Ltd
Applicant ACN	114 948 837
Date of registration	26 March 2025
Product registration no.	95654
Label approval no.	95654/146729
Description of the application and its purpose, including the intended use of the chemical product	Registration of 167 mg/g morantel tartrate, 4 mg /g abamectin, oral paste product for the treatment and control of tapeworms (<i>A. perfoliata</i>) and roundworms in horses.

Read More

APVMA, 15-04-25

<https://www.apvma.gov.au/news-and-publications/publications/gazette/gazette-8-15-april-25>

AMERICA

Americans Agree: Chemistry Is Essential, Fix TSCA

2025-04-15

Speaking at the American Chemistry Council's (ACC) 38th Annual Global Chemical Regulations Conference and Exhibition (GlobalChem), ACC President and CEO, Chris Jahn, shared the results of a new Morning

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Consult survey of American voters, which found strong support for reforming the Environmental Protection Agency's (EPA) implementation of the Toxic Substances Control Act (TSCA). The survey asked voters across the country and political spectrum about their views on the chemical industry's role in supporting the economy, national priorities, regulations and EPA priorities.

"Americans want affordability and national security. They want to reduce unnecessary regulations and want to boost domestic manufacturing here in the U.S. To deliver on these needs, Americans agree that it is imperative that policymakers enhance TSCA so that the chemical industry can continue to innovate and thrive while maintaining the highest standards of safety and environmental protection.

"The data overwhelmingly shows that people understand the critical importance of the chemical industry to our nation's economic and technological advancements. American voters recognize the essential role of the chemical industry in driving economic growth, energy independence, innovation, and national security – all priorities of the Trump Administration. They agree that growing U.S. chemical production will lead to more jobs, capital spending and investments domestically, instead of offshoring our industry to foreign adversaries.

Learn more at: <https://www.americanchemistry.com/chemistry-in-america/news-trends/press-release/2025/americans-agree-chemistry-is-essential-fix-tsca>

Read More

ACC, 15-04-25

<https://www.americanchemistry.com/chemistry-in-america/news-trends/press-release/2025/americans-agree-chemistry-is-essential-fix-tsca>

Young Children's Exposure to Chemicals of Concern in Their Sleeping Environment: An In-Home Study

2025-04-14

Sleeping microenvironments (SMEs) can expose young children to chemicals of concern. Using passive samplers, we measured the concentrations of ortho-phthalates (PAEs), organophosphate esters (OPEs), and UV-filters (benzophenones, salicylates, and phenolic benzotriazoles) in the bedroom air, SME, and released from mattresses in 25 bedrooms of children aged 6 months to 4 years in Toronto and Ottawa, Canada.

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We detected 28, 31, and 30 compounds in bedroom air, SME air, and mattresses, respectively. SME exceeded bedroom air concentrations, indicating elevated exposure while sleeping and sources from SME contents, with two exceptions. Higher concentrations of two PAEs and five OPEs (including isomers) in mattress versus SME samplers indicated that mattresses were a source. Bedding items were likely sources of tris(2-butoxyethyl) phosphate (TBOEP) where SME concentrations were significantly higher than those in mattress samplers. Older mattresses had higher concentrations of di-2-ethylhexyl phthalate (DEHP) and benzyl butyl phthalate (BzBP).

Read More

ACS, 14-04-25

https://pubs.acs.org/doi/full/10.1021/acs.estlett.5c00051?ref=utm_source%3Dpubsw

FDA Testing Finds Bottled Water Samples Do Not Exceed EPA Limits for PFAS in Drinking Water

2025-04-16

The U.S. Food and Drug Administration (FDA) has shared results from a sampling and testing assignment of bottled waters for per- and polyfluoroalkyl substances (PFAS), in which no samples were found to have levels of "forever chemicals" that would exceed maximum contaminant levels (MCLs) for public drinking water recently set by the U.S. Environmental Protection Agency (EPA).

Between 2023 and 2024, FDA sampled 197 domestic and imported bottled waters of purified, artesian, spring, and mineral varieties. The samples were tested for 18 different types of PFAS. A total of ten samples contained detectable levels of the chemicals, eight of which tested positive for between one and four different types of PFAS, and were either bottled or spring water samples. The other two samples were imported artisan waters, which contained one or two types of PFAS.

Of the PFAS detected, four were present at levels below EPA MCLs, and two do not have MCLs established by EPA. In April 2024, EPA set MCLs for five PFAS known to occur individually and as mixtures in drinking water: PFOA, PFOS, PFNA, PFHxS, and HFPO-DA (also known as GenX Chemicals). EPA

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also set a limit for mixtures of any two or more of four PFAS: PFNA, PFHxS, PFBS, and GenX chemicals.

[Read More](#)

Food Safety Magazine, 16-04-25

<https://www.food-safety.com/articles/10327-fda-testing-finds-bottled-water-samples-do-not-exceed-epa-limits-for-pfas-in-drinking-water>

EUROPE

Active substances no longer supported in GB

2025-04-16

Non-approval decisions to be taken for unsupported active substances in GB.

Following an opportunity for any person, company or task force/consortium to support the active substance/product type combination listed in the GB Review Programme, no compliant dossier was received:

- Monolinuron (CAS 1746-81-2 EC 217-129-5) in product type 2

In cases where active substance/product type combinations are not supported, GB biocides regulations require that these active substance/product type combinations are subject to a GB non-approval decision.

Once a decision is taken, the active substances will no longer be able to be used in biocidal products of the relevant product type in GB. In addition, articles treated with such products will no longer be able to be placed on the market in GB. HSE will provide separate updates on the decision and relevant phase-out periods.

Please note:

If you are aware of any disproportionate negative impacts that are likely to arise from the non-approval of the active substance/product type combination listed, please contact us by 16 May 2025.

[Read More](#)

UK HSE, 16-04-25

<https://www.hse.gov.uk/biocides/index.htm>

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Upcoming GB active substance renewal submission deadlines

2025-04-16

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

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

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

30 July 2025

- Hydrogen peroxide (CAS 7722-84-1 EC 231-765-0) in product types 1, 2, 3, 4, 5 and 6
- N-((6-chloro-3-pyridinyl)methyl)-N'-cyano-N-methylethananimidamide (acetamiprid) (CAS 135410-20-7 EC N/A) in product type 18

28 October 2026

- Calcium dihydroxide / calcium hydroxide / caustic lime / hydrated lime / slaked lime (CAS 1305-62-0 EC 215-137-3) in product types 2 and 3
- Calcium magnesium oxide / dolomitic lime (CAS 37247-91-9 EC 253-425-0) in product types 2 and 3
- Calcium magnesium tetrahydroxide / calcium magnesium hydroxide / hydrated dolomitic lime (CAS 39445-23-3 EC 254-454-1) in product types 2 and 3
- Calcium oxide / lime / burnt lime / quicklime (CAS 1305-78-8 EC 215-138-9) in product types 2 and 3
- Chlorocresol (CAS 59-50-7 EC 200-431-6) in product types 1, 2, 3, 6, 9 and 13
- Coco alkyltrimethylammonium chloride (ATMAC/TMAC) (CAS 61789-18-2 EC 263-038-9) in product type 8

Any person, company or task force/consortium can support an active substance/product type combination for renewal – it doesn't have to be the original supporter.

Check the GB Article 95 List to see who the original supporters were.

If any of these active substance/product type combinations are important to you, consider contacting your supplier to let them know.

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If a renewal application is not submitted for the above active substance/product type combinations under GB BPR, the approvals will expire. This means the active substances will no longer be able to be used in biocidal products of the relevant product types.

[Read More](#)

UK HSE, 16-04-25

<https://www.hse.gov.uk/biocides/index.htm>

Analysis of the EPC template in Annex V to the EPBD recast proposal

2025-04-09

According to the Proposal for a Directive of the European Parliament and of the Council on the Energy Performance of Buildings (recast), by 2025 Energy Performance Certificates (EPCs) across the European Union shall comply with a common template, presented in Annex V to the Proposal.

This report presents a review study regarding the indicators of the EPC templates across Europe in comparison to the proposed ones within Annex V of the EPBD recast. To this end, the authors developed a methodology based on a qualitative and quantitative approach. The study provides a comprehensive overview, presented in tabular and graphical forms, where each indicator listed in Annex V is clustered and analyzed for compliance verification. The report also includes a section about the estimation of additional burden/costs that might impact the overall costs for both assessors and building owners, derived from the inclusion of those new indicators into the EPC template.

A second part of the study aims at highlighting synergies between EPCs and other building-related certification tools, namely the Smart Readiness Indicator (SRI), LEVEL(s), Building Renovation Passports (BRP), and Digital Building Logbooks (DBL). Data are often spread over many places and tools and in some cases are re-created several times leading to a lack of transparency and clarity. The study set the basis for a comprehensive overview, implementable over time, presenting in tabular and graphical form the correlation among the energy efficiency-related tools and the potential synergies with the EPC scheme. Finally, the report highlights how the framing of information can lead an EPC to be more or less effective at encouraging the choice of more energy efficient buildings.

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[Read More](#)

European Commission, 09-04-25

<https://publications.jrc.ec.europa.eu/repository/handle/JRC134100>

Toy safety: deal on new measures to protect children's health

2025-04-10

- Aim is to reduce the high number of unsafe toys in the EU, especially those sold online or imported from non-EU countries
- Toys should not contain any carcinogenic substances, endocrine disruptors, or PFAS
- Digital product passports will help speed up customs checks and improve consumers access to safety information

The agreed draft legislation comes in response to a number of emerging challenges, such as risks relating to digital toys and the surge in online shopping.

On Thursday evening, Parliament and Council negotiators reached a provisional agreement on new EU toy safety rules to enhance the protection of children's health and development. The deal strengthens the role of economic operators in improving toy safety, and clarifies requirements for safety warnings and the digital product passport (DPP). It expands the list of prohibited substances in toys.

Ban on harmful chemicals

In addition to the existing prohibition of carcinogenic, mutagenic, or reproductive toxic (CRM) substances, the agreed text also bans chemicals that pose particular risks to children, such as endocrine disruptors, substances harmful to the respiratory system, and chemicals that are toxic for the skin and other organs. At Parliament's insistence, the new rules will ban the intended use of per- and polyfluorinated alkyl substances (PFASs) and the most dangerous types of bisphenols. Allergenic fragrances will be banned in toys for children under 36 months and in toys meant to be placed in the mouth.

Safety assessment

Before placing a toy on the market, manufacturers will have to carry out a safety assessment on all potential hazards – chemical, physical, mechanical, and electrical. The assessment will also have to test toys'

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flammability, hygiene, and radioactivity, and take children's specific vulnerabilities into account. For example manufacturers should, where appropriate, ensure that digital toys do not pose risks to children's mental health – as requested by Parliament negotiators.

Economic operators and online marketplaces

The agreed rules clarify the obligations of economic operators, such as manufacturers, importers, and distributors. This also includes fulfillment service providers (companies responsible for storing, packaging, and dispatching toys). Changes were also introduced to align the agreed text with other legislation, such as the General Product Safety Regulation, the Ecodesign framework and the Digital Services Act.

The text clarifies requirements for online marketplaces, reflecting their growing role in the sale and promotion of toys. For example, marketplaces will have to design their platforms so as to allow sellers to display the CE mark, safety warnings, and a link (such as a QR code) to the digital product passport, to be visible before the purchase is completed.

Digital product passport

All toys sold in the EU will have to bear a clearly visible digital product passport (DPP) showing compliance with the relevant safety rules. The DPP will enhance the traceability of toys and make market surveillance and customs checks simpler and more efficient. It will also offer consumers easy access to safety information and warnings, via a QR code, for example.

[Read More](#)

European Parliament, 10-04-25

<https://www.europarl.europa.eu/news/en/press-room/20250407IPR27704/toy-safety-deal-on-new-measures-to-protect-children-s-health>

French Agency Proposes Effective EU Ban On CBD In Foods And Cosmetics

2025-04-14

The French Agency for Food, Environmental and Occupational Health & Safety (ANSES) has proposed a strict classification of cannabidiol under European chemicals regulations that would remove the ingredient from the region's wellness and cosmetics markets.

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"Studies in monkeys, rats, and mice have shown adverse effects of CBD on spermatogenesis and fertility, as well as increased perinatal mortality and alterations in neurodevelopment," ANSES notes in the announcement.

"Based on the weight of evidence accumulated in animals, ANSES proposes that CBD be classified as follows under the European Union classification, labelling and packaging of substances and mixtures (CLP Regulation): Reproductive toxicity; category 1B (H360FD: May damage fertility. May harm the unborn child. H362: May be harmful to breast-fed babies)."

Reproductive toxicity category 1B would mean an effective ban on CBD in cosmetics and foods. The European CBD skincare market alone was worth just under \$750m in 2024 and is expected to grow by 20% by 2030, according to Grand View Research.

The proposal is out for public consultation on the European Chemicals Agency's (ECHA's) website until 16 May 2025.

[Read More](#)

Citeline, 14-04-25

<https://insights.citeline.com/hbw-insight/wellness/policy-and-regulation/regulation/french-agency-proposes-effective-eu-ban-on-cbd-in-foods-and-cosmetics-5LCYRG3WSJFNPK7JLZQ5JCUYN4/>

INTERNATIONAL

UN Conference Calls for Halving Health Impacts of Air Pollution by 2040

2025-04-16

The Second Global Conference on Air Pollution and Health called on all stakeholders to pledge voluntary actions to achieve a 50% reduction in the health impacts of air pollution by 2040. This target will be monitored at country level and aggregated to derive a global estimate of progress, with 2015 values serving as the baseline.

Co-organized by the World Health Organization (WHO) and the Government of Colombia, with the support of the Government of Spain and the UN Environment Programme (UNEP), the World Meteorological Organization (WMO), and the World Bank, among other UN agencies, the Conference took place in Cartagena, Colombia, from 24-28 March 2025. In

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an effort to accelerate action for clean air, clean energy access, and climate change mitigation, the Conference highlighted policy solutions to catalyze evidence-based, multi-sectoral actions in cities, countries, and regions.

“Today air pollution is the first risk factor for disease burden,” said WHO’s Director of Environment, Climate Change and Health Maria Neira. “It’s the number one risk factor for getting sick.” Noting the overlap between the causes of climate change and air pollution, Neira called for clean air solutions, including renewable energy, better urban design, and fossil fuels phaseout. “We have a lot to gain for health, for the economy, and for society... if we accelerate this transition,” she underscored.

[Read More](#)

SDG, 16-04-25

<https://sdg.iisd.org/news/un-conference-calls-for-halving-health-impacts-of-air-pollution-by-2040>

EPR is not enough

2025-03-18

Garments cause environmental pollution at every stage of the product phase. The extended producer responsibility approach makes the manufacturers responsible for the post-consumer products. Textiles and garments constitute a significant proportion of the waste generated. It is estimated that in 2015, 92 million tonnes of such waste were generated worldwide. However, a distinction must be made between waste generated during the manufacturing process and that created after use. A significant proportion of the material is lost during production, estimated at 10 to 30 per cent. This is due to the product design, the type of product and the precision of the manufacturing process.

The waste generated during production is usually mixed and subsequently disposed of. However, the material is a potentially high-quality resource for recyclers. With better handling, it could be kept clean. In addition, manufacturers know exactly what the composition is, which makes recycling easier.

Households frequently dispose of their clothing waste through separate collection. This method keeps the material relatively clean and facilitates reuse or recycling. However, an increasing proportion of used clothing is being found in residual waste. According to the OECD, this is due to the increase in production and the short useful life. The clothing and textile

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sector is also a major factor in the generation of plastic waste. The amount for 2019 is estimated at 20 million tonnes.

The ecological advantages of reuse and recycling would primarily result from the hypothetical displacement of the use of primary resources. However, there is a risk of a rebound effect with reuse. In general, it is still unclear as to what extent reuse actually contributes to savings in primary resources. The separate collection includes items of clothing that are suitable for reuse. However, in most cases only the high-quality part is used domestically, while the rest is usually exported. Most of the exports go to the Middle East and Africa.

The net ecological benefit of exporting garments for reuse is still unclear. Although the period of use is extended, the importing countries are also responsible for the waste at the end of the garments’ lifespan. In addition, the imports compete with domestic production.

[Read More](#)

Recycling Magazine, 18-03-25

<https://www.recycling-magazine.com/2025/03/18/epr-is-not-enough/>

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REACH Update

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Assessment of regulatory needs reports

2025-04-11

Reports for the following substance groups are now available on our website:

- Cyanide salts with counterions of low hazard;
- Tall oils;
- Fluorinated aliphatic hydrocarbons; and
- Esters from 2,2,4-trimethylpentane-1,3-diol.

If you have questions or feedback related to the assessment work, you can send them to us using this webform

[Read More](#)

ECHA, 11-04-25

<https://echa.europa.eu/assessment-regulatory-needs>

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Janet's Corner

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Decomposers

2025-05-25



https://www.reddit.com/r/RedditDayOf/comments/235znb/decomposers_by_beatrice_the_biologist/

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Hazard Alert

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Hexachlorobenzene

2025-04-25

USES [2,3]

There are currently no commercial uses of hexachlorobenzene. It was previously used as a pesticide but is no longer registered for this use. In addition, HCB was used in the production of fireworks, ammunition, rubber, aluminium, and dyes, and in wood preservation. Hexachlorobenzene was widely used as a pesticide to protect the seeds of onions and sorghum, wheat, and other grains against fungus. It is formed as a by-product during the manufacture of chemicals used as solvents (to dissolve other substances), other chlorine-containing compounds, and pesticides. Furthermore, it is formed as a by-product in the waste streams of chloralkali and wood-preserving plants, and when burning municipal waste.

EXPOSURE SOURCES & ROUTES OF EXPOSURE [3]

Exposure Sources

- Inhalation exposure to hexachlorobenzene may occur through proximity to industrial sites where it is formed as a by-product or to waste facilities where it is disposed.
- Occupational exposure, via inhalation and dermally, can occur at industries where hexachlorobenzene is produced as a by-product.
- Exposure to hexachlorobenzene can also occur through consuming foods tainted with hexachlorobenzene including fish and dairy products or meat from cattle grazing on contaminated pastures.
- Drinking small amounts in contaminated water.
- Eating or touching contaminated soil.
- For babies, drinking contaminated breast milk from exposed mothers.
- Hexachlorobenzene has been listed as a pollutant of concern to EPA's Great Waters Program due to its persistence in the environment, potential to bioaccumulate, and toxicity to humans and the environment.

Routes of Exposure

- **Inhalation** – A minor route of exposure for the general population.

Hexachlorobenzene (HCB), is a chloro-carbon with the molecular formula C₆Cl₆. [1] It is a fully chlorinated industrial hydrocarbon chemical, which is insoluble in water, but is very soluble in fat, oils, and organic solvents. Hexachlorobenzene is one of the most persistent environmental pollutants, and bioaccumulates in the environment, in animals, and in humans. It is not currently manufactured as a commercial product in the United States, and virtually all commercial production ended in the late 1970s.

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Hazard Alert

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- **Oral** – The predominant route of exposure for the general population through ingestion of contaminated food.
- **Dermal** – Skin contact with contaminated soil may be an important route of exposure, for those living near waste sites, especially children.

HEALTH EFFECTS [4]

Acute Health Effects

- No information is available on the acute (short-term) effects of hexachlorobenzene in humans.
- Acute animal tests in rats and mice have shown hexachlorobenzene to have low-to-moderate acute toxicity from oral exposure.

Carcinogenicity

- Human data regarding the carcinogenic effects of hexachlorobenzene are inadequate.
- Hexachlorobenzene, when administered orally, has been shown to induce tumours of the liver, thyroid, and kidney in several animal species.
- EPA has classified hexachlorobenzene as a Group B2, probable human carcinogen.
- EPA calculated an inhalation unit risk estimate of $4.6 \times 10^{-4} (\mu\text{g}/\text{m}^3)^{-1}$.

Other Effects

- One human study reported abnormal physical development in young children who ingested contaminated bread during a 4-year poisoning incident.
- Hexachlorobenzene has been found to decrease the survival rates of newborn animals and to cross the placenta and accumulate in foetal tissue in several animal species.
- Neurological, teratogenic, liver, and immune system effects have been reported in the offspring of animals orally exposed to hexachlorobenzene while they were pregnant.

SAFETY

First Aid Measures [5]

- **Eyes:** Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

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Hazard Alert

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- **Skin:** Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Get medical aid.
- **Ingestion:** If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid.
- **Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Workplace Controls & Practices [4]

Personal Protective Equipment

- **Eyes:** Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
- **Skin:** Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Get medical aid.
- **Ingestion:** If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid.
- **Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

REGULATION

United States

- The EPA has recommended that drinking water should not contain more than 0.05 milligrams of hexachlorobenzene per litre of water (0.05 mg/L) in water that children drink, and should not contain more than 0.2 mg/L in water that adults drink for longer periods (about 7 years). The EPA has set a maximum contaminant level of 0.001 mg/L in drinking water.
- The EPA requires that spills or accidental releases into the environment of 10 pounds or more of hexachlorobenzene be reported to the EPA.
- **ACGIH:** The American Conference of Governmental Industrial Hygienists has set a time weighted average threshold limit value (TLV) of 0.002 mg/m³; Skin; Appendix A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans.

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Hazard Alert

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Arsenic Levels on the Rise in Paddy Rice Fields Due to Climate Change

2025-04-17

A new study from Columbia University Mailman School of Public Health reveals that climate change may significantly impact arsenic levels in paddy rice, a staple food for millions across Asia. The research shows that increased temperatures above 2°C, coupled with rising carbon dioxide (CO₂) levels, lead to higher concentrations of inorganic arsenic in rice, potentially raising lifetime health risks for populations in Asia by 2050. Until now, the combined effects of rising CO₂ and temperatures on arsenic accumulation in rice have not been studied in detail. The research done in conjunction with colleagues at John Hopkins Bloomberg School of Public Health and the Chinese Academy of Sciences is published in The Lancet Planetary Health.

“Our results suggest that this increase in arsenic levels could significantly elevate the incidence of heart disease, diabetes, and other non-cancer health effects,” said Lewis Ziska, PhD, Columbia Mailman School associate professor of Environmental Health Sciences. “As rice is a dietary staple in many parts of the world, these changes could lead to a substantial rise in the global burden of cancer, cardiovascular diseases, and other arsenic-related health issues.”

Ziska explained that the higher arsenic levels are likely due to climate-related changes in soil chemistry that favor arsenic that can more easily be absorbed into rice grain.

“From a health perspective, the toxicological effects of chronic iAs exposure are well established; and include cancers of the lung, bladder, and skin, as well as ischemic heart disease. Emerging evidence also suggests that arsenic exposure may be linked to diabetes, adverse pregnancy outcomes, neurodevelopmental issues, and immune system effects. In fact, ‘ingesting rice in regions like southern China and Southeast and South Asia is already a significant source of dietary arsenic and cancer risk,’ said Ziska.

By measuring the effects of rising temperatures and CO₂ on 28 rice strains over ten years in the field using FACE (Free-Air CO₂ Enrichment) methodology, and combining advanced modeling techniques, the team estimated inorganic arsenic doses and health risks for seven Asian countries: Bangladesh, China, India, Indonesia, Myanmar, the Philippines, and Vietnam.

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Health risks were calculated for cancer and non-cancer outcomes. Estimates of rice availability in 2021 by country, as reported in Food and Agriculture Organization of the United Nations (FAO) food balance sheets, were used as the starting point for estimating rice ingestion. The standard deviation of rice ingestion per kg bodyweight from the US Environmental Protection Agency data was used to create a normal distribution for each country.

The study’s projections for 2050 suggest a sharp rise in lifetime cancer cases, particularly lung and bladder cancers. China is projected to see the highest number of cases, with an estimated 13.4 million cancers linked to rice-based arsenic exposure.

“Based on our findings, we believe there are several actions that could help reduce arsenic exposure in the future,” Ziska noted. “These include efforts in plant breeding to minimize arsenic uptake, improved soil management in rice paddies, and better processing practices. Such measures, along with public health initiatives focused on consumer education and exposure monitoring, could play a critical role in mitigating the health impacts of climate change on rice consumption.”

“Our study underscores the urgent need for action to reduce arsenic exposure in rice, especially as climate change continues to affect global food security,” says Ziska.

Technology Networks, 17 April 2025

<https://technologynetworks.com>

Explainer: what is ricin?

2025-10-03

A UK doctor has gone on trial for the attempted murder of his mother’s partner using a poisonous substance. The court heard that Thomas Kwan had a ‘deeply disturbing, long-term interest bordering on obsession’ with poisons. Kwan had researched and obtained the raw materials to produce ricin, which investigators initially thought he had used in the attempted murder. It has since been suggested that the poison used was actually iodomethane.

Ricin is one of the world’s most famous poisons, having featured in Agatha Christie novels, TV shows like Breaking Bad and real-life cold war assassination attempts. The compound is listed as a controlled substance under both the Biological Weapons Convention and the Chemical

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Weapons Convention. But what is it that makes ricin such a dangerous poison?

What is ricin?

Ricin is a protein produced in the seeds of the castor oil plant. It is a type of carbohydrate-binding protein known as a lectin. Lectins are found throughout nature and are produced by plants, animals, bacteria and viruses. Ricin was actually the first compound in this class ever to be discovered when it was isolated in 1888 by the Baltic-German microbiologist Peter Hermann Stillmark.

Lectins are found in various beans and grains, many of which must be cooked prior to eating to reduce their lectin content. While not all lectins are toxic, ricin is particularly potent and can be fatal in very small doses. A lethal oral dose of ricin can be as low as 1 milligram per kilogram of body weight, while just five to 10 micrograms can be fatal if the substance is inhaled.

Ricin is sensitive to heat and exposing the compound to temperatures upwards of 80°C is enough to denature it.

How is it made?

Ricin is generally extracted from castor seeds. Around 1–2 million tonnes of castor seeds are grown every year for the production of castor oil. Castor oil contains very little ricin as the toxin is insoluble in it and manufacturers ensure no residual toxin remains by heating it to denature any that may be present. However, the solid waste that is left over after the seeds are crushed can contain up to 5% ricin by weight. This material can be autoclaved to denature the ricin before then being used as fertiliser or animal feed.

Eating just two unprocessed castor seeds can be toxic. However, deaths are rare as the seeds have to be thoroughly chewed to release the ricin. In 2013, a US resident survived eating 30 castor beans.

How does it kill?

Ricin is a complex protein composed of two polypeptide chains – the A and B chains – that are linked by a disulfide bond. The B chain enables ricin to enter cells by binding to carbohydrates attached to certain proteins and lipids on the cell surface. The ricin is then internalised by the cell via endocytosis. Inside the cell, ricin's disulfide bond can be reductively cleaved, causing a separation of the A and B chains. Once freed, the A

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chain inactivates ribosomes – the cellular machinery responsible for the production of proteins. It does this by cleaving a specific bond to remove one of the ribosome's key adenine nucleotides. Each ricin molecule can disable 2000 ribosomes in a minute and it has been estimated that one molecule of ricin is enough to kill a cell. By disrupting protein production in this way, ricin can induce cell death within a few hours.

The compound is highly toxic whether inhaled, ingested or injected and can even be absorbed through cracks in the skin. Symptoms will vary depending on how ricin is administered – for example ingestion will likely first bring about gastrointestinal symptoms such as vomiting and nausea, whereas early symptoms of inhalation could be a cough, sore throat or fever. Injection is likely to bring about inflammation of the tissue around the injection site. Within two to three days, all forms of administration are likely to lead to severe symptoms including seizures, organ failure and, ultimately, death.

What's the history here?

During the first world war, the US military began investigating ricin as a weapon, either as a coating for bullets and shrapnel or in munitions that would create clouds of the substance to be inhaled. Due to ricin's sensitivity to heat, the idea of coating bullets with the substance was discarded, while the cloud idea was delayed until an antidote could be created.

During the second world war, France, the UK, Canada, Japan and Russia investigated the use of ricin as a weapon. However, more focus was placed on developing weapons based on other cheaper and more potent toxins.

Since then, ricin has been used in various assassination attempts. Letters and packages dusted with ricin have been intercepted before reaching various US politicians, including former presidents Barack Obama and Donald Trump.

One of the most famous attacks alleged to have involved ricin was on the Bulgarian dissident Georgi Markov. In 1978, Markov was killed after being shot with a tiny metal pellet believed to contain ricin that was supposedly fired from the tip of a modified umbrella. Ten days before Markov was shot in central London, a similar attack was carried out in Paris on another Bulgarian defector, Vladimir Kostov. While Kostov was hospitalised, he did eventually recover. No-one was ever held responsible for these attacks, although it has been widely suggested that they were carried out on behalf of the Bulgarian Secret Service with support from the KGB.

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Can ricin poisoning be treated?

There is no antidote for ricin. As a result the best way to treat someone who has been poisoned with ricin is to try and get it out of their body as quickly as possible. The exact type of treatment will depend on how they were exposed. For example, if the ricin was ingested, treatment could involve giving them intravenous fluids or feeding them activated charcoal to absorb the protein. If the ricin was inhaled, measures would be taken to clear a patient's airways and they would likely be treated with oxygen and mechanical ventilation. Medication can also be given to try to treat the symptoms brought on by ricin exposure, for example drugs that prevent seizures and low blood pressure.

Efforts are also underway to develop vaccines to protect against ricin exposure. In 2020, the US Food and Drug Agency granted a fast-track designation to Soligenix for its RiVax vaccine candidate. RiVax contains a genetically altered version of ricin's A chain and so primes an antibody response to ricin exposure. The vaccine appears to have provided a high level of protection against ricin exposure in animal studies.

Correction: The article was updated on 3 October 2024 as evidence was presented in court that iodomethane, not ricin as previously reported, was the likely poison used by Thomas Kwan.

Chemistry World, 3 October 2025

<https://chemistryworld.com>

Iron and blue light enable rapid, low-toxicity creation of carbohydrates for new antibiotics

2025-04-22

Researchers at the University of Oklahoma have made a discovery that could potentially revolutionize treatments for antibiotic-resistant infections, cancer and other challenging gram-negative pathogens without relying on precious metals.

Currently, precious metals like platinum and rhodium are used to create synthetic carbohydrates, which are vital components of many approved antibiotics used to combat gram-negative pathogens, including *Pseudomonas aeruginosa*, a notorious hospital-acquired infection responsible for the deaths of immunocompromised patients. However, these elements require harsh reaction conditions, are expensive to use and are harmful to the environment when mined.

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In an innovative study published in the journal Nature Communications, an OU team led by Professor Indrajeet Sharma has replaced these precious metals with either blue light or iron, achieving similar results with significantly lower toxicity, reduced costs, and greater appeal for researchers and drug manufacturers.

By using abundant, inexpensive, iron or metal-free non-toxic blue light, the team can more easily and rapidly synthesize these important carbohydrates. Since most antibiotics rely on a carbohydrate molecule to penetrate the thin, external layer of the gram-negative bacteria, this discovery could transform the way doctors treat multi-drug-resistant pathogens.

"Drug-resistant infections are a major problem and are expected to rise unless something is done," Sharma said. "By using our methods to make late-stage drug modifications, synthetic carbohydrate-based antibiotics could help treat these infections. Furthermore, since carbohydrates can also increase a drug's solubility, they can be easily deployed as a pro-drug that a patient can simply take with water."

A pro-drug is a medication that is less active when administered and metabolized into its active form. To help drug molecules last longer in the body and work more effectively, Sharma's team is exploring ways to attach specially designed sugars or unnatural sugars to them. They are using a unique blue light-based method—developed by Surya Pratap Singh, a lead researcher and doctoral student in Dr. Sharma's lab—that does not require metals.

"If a drug molecule is broken down too quickly, it loses its potency. By replacing an oxygen atom in the carbohydrate molecule with a sulfur one, enzymes in the human body won't recognize the molecule as a carbohydrate and won't break it down as quickly," Sharma said. "These modified compounds, commonly called thiosugars, could be used to more effectively treat infections and diseases like cancer."

Working with OU professor Helen Zgurskaya, the team is also exploring whether their process can help her research on *Pseudomonas aeruginosa*, a widespread, hospital-acquired drug-resistant pathogen commonly found in immunocompromised patients.

"*Pseudomonas* is a very persistent infection that is responsible for a large number of deaths in cancer patients," Sharma said. "Currently, compounds identified in the Zgurskaya lab for *Pseudomonas* are inactive. We believe this is because they cannot cross the thin outer lipid layer of the gram-

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negative pathogen. By attaching our synthesized carbohydrate molecule to the lab's lead compounds, we hope to achieve potency against pathogens like *Pseudomonas aeruginosa*. Time will tell."

Phys Org, 22 April 2025

<https://phys.org>

Scientists Turn Discarded Wood Waste Into Valuable Chemicals

2025-04-14

A new enzyme can turn lignin waste into valuable chemicals using green, hydrogen peroxide-based processing, offering a cleaner, sustainable alternative to petroleum-based methods.

Approximately 98% of lignin, a by-product of forestry derived from plants, is currently discarded. However, a newly discovered enzyme may enable the efficient extraction of valuable molecules from this waste using environmentally friendly, green chemistry methods.

These extracted molecules serve as the building blocks for products such as fragrances, flavorings, fuels, and pharmaceuticals, transforming a largely unused waste stream into a valuable resource.

"Traditional chemical processes for the synthesis of these types of chemicals rely on petroleum-based starting compounds and heavy metal catalysts, making them non-renewable and inherently toxic processes," says Dr Fiona Whelan, a Cryo-electron Microscopist from Adelaide Microscopy at the University of Adelaide, whose study was published in Nature Communications.

"This new catalytic processing method will support the development of other new green chemistry 'enzyme factories' or biorefineries to turn the lignin and other biological waste streams into a valuable repository of fine chemicals."

Understanding Lignin and Its Potential

Lignin is the name given to the hard polymers that act as mechanical support in hard- and softwoods and is one of the most abundant polymers on Earth.

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Agriculture and forestry amass around 100 million tonnes of waste lignin per year, but this could be diverted to become a promising renewable and sustainable feedstock for chemicals currently obtained from fossil fuels.

"Strategies for using lignin involve a combination of chemical and biological processes," says Associate Professor Stephen Bell, from the University's School of Physics, Chemistry and Earth Sciences.

"High temperatures, high pressure, strong acids, and poisonous solvents are used to break up the polymers in the waste stream.

"The valuable compounds trapped in the waste are then extracted and undergo further chemical processing at temperatures higher than 400°C to 'valorize' the lignin. These processes are expensive and bad for the environment."

A Biological Breakthrough

Hardwood lignin has two key chemical components that require processing to make useful compounds.

Researchers had previously discovered an enzyme that could be used to break down one of these compounds, which is also found in softwood, but no biological breakdown process had been identified that could use the second more complex hardwood compound, comprising about 50 percent of the waste.

"Biological breakdown of lignin occurs in a complex microbial quorum, with fungal enzymes likely breaking up hard polymers, and bacteria taking the unreactive smaller compounds and processing them to get metabolic energy," said Dr Whelan.

"Looking to the microbial kingdom, we identified that a soil bacterium, *Amycolatopsis thermoflava*, contains enzymes that could process molecules from lignin cheaply, using hydrogen peroxide to drive the reaction – making valorization much less harmful to the environment."

The research team has used this new enzyme as a model for retrofitting the hydrogen peroxide driven activity into other enzymes to generate green chemistry approaches of the future for the generation of high-value chemicals of use in the flavor, fragrance, and medicinal chemistry industries.

Sci Tech Daily, 14 April 2025

<https://scitechdaily.com>

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Novel electrochemical technique measures degradation rate of polymer coatings on iron

2025-04-22

Think of a metal with paint on it, like an automobile or a pipeline carrying natural gas. The paint or polymer coating protects the metal underneath from degrading.

Although the coating should ideally protect the metal for a long time, a scratch or a defect in the coating can lead to early onset of metal degradation. This happens by a well-established mechanism known as cathodic disbondment, where quick diffusion of oxygen and water from the ambient atmosphere allows for the oxygen reduction reaction (ORR) to accelerate the degradation of the coating by virtue of the generated free radicals.

Of crucial significance is the rate of this ORR as it determines the lifetime of the metal underneath. Measuring this rate of corrosion of a painted metal is challenging as the interface between the coating and metal is buried or inaccessible.

Conventional techniques to measure this rate, such as potentiodynamic polarization, rely on polarizing this interface by means of using an auxiliary electrode, i.e., a counter electrode. The idea behind this approach is to enable an ionic current to flow in the electrolyte between the coated metal and the counter electrode so that an electronic current can be measured in the external circuit.

Knowing this current can give the rate of degradation of the coated metal. But here comes the challenge—an organic coating being ionically impermeable does not allow the coated metal to be polarized.

Whatever current is still being measured through this technique is only a result of pinholes, which are pores or defects introduced during the coating application process, and not the true corrosion rate. Therefore, new electrochemical techniques are needed to quantify the degradation rate of such coated metals.

Recently, we introduced a novel approach using hydrogen permeation-based potentiometry (HPP) and electrochemical impedance spectroscopy (EIS) to measure this rate. The research is published in the journal Corrosion Science.

Firstly, the principle behind HPP is to make use of the electrochemically reducing nature of atomic hydrogen as a means to polarize the coated

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metal interface from the back side of a double electrochemical cell. Typically, the atomic hydrogen acts in the same way as the auxiliary electrode in conventional polarization, i.e., it polarizes the coated metal, but without the limitation of needing ion transport.

Hence, we first generated defined amounts of hydrogen on one side of the double electrochemical cell using a model electrocatalytic palladium (Pd) membrane. This hydrogen permeates through the Pd membrane and reaches the other cell, where it reacts with the already present oxygen and establishes an electrochemical equilibrium potential.

We then increased the amount of hydrogen generated in one cell in a stepwise fashion, which resulted in more hydrogen to permeate and, correspondingly, more oxygen to be reduced in the other cell, which was reflected as a decrease in the electrochemical potential.

By knowing how much hydrogen was generated in one cell and proving that almost all of that hydrogen could quantitatively be made to react with the oxygen in the other cell, the rate of ORR could first be measured on Pd.

We then used this method to measure ORR on a Pd membrane coated on one side with an acrylate polymer. We found that this approach could elegantly measure the kinetics of ORR underneath this coating, which vastly differed from the little or zero current that could be measured with conventional polarization. But there was still the question of whether this measured ORR rate is indeed the true kinetics of coating degradation.

That's when the idea of using a complementary technique such as classical EIS struck us. The principle behind using EIS was to primarily measure the charge transfer resistance for ORR and the barrier properties; i.e., pore resistance of the polymer coating.

If the HPP approach could indeed measure the true rate of coating degradation, then this must be associated with both a decreasing charge transfer resistance and coating pore resistance with progress of ORR.

This was exactly what we measured! Further, we could successfully extend this combined approach of using HPP-EIS to measure the rate of degradation of a polymer coating on a thin layer of industrial metal such as iron deposited on the Pd membrane.

This technique will be useful in determining the rate at which a polymer coating de-adheres from a pipeline carrying hydrogen blended with natural gas. But the implications of this novel HPP-EIS technique, in our opinion, extend beyond corrosion underneath coatings to the field of

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sensors, fuel cells and fundamental investigations relying on exploiting interfacial electrochemical phenomena.

This story is part of Science X Dialog, where researchers can report findings from their published research articles. Visit this page for information about Science X Dialog and how to participate.

Phys Org, 22 April 2025

<https://phys.org>

Colloidal crystal model reveals new factors in controlling polymorph formation

2025-04-22

Polymorphs are not mythical, chimeric beasts—they are substances with identical chemical compositions but differing crystal structures that also exhibit different physical and chemical properties. What this means for practical use, is that companies often want to create a certain polymorph—but not the others.

Researchers at Tohoku University took a deep dive into using colloidal crystallization as a model system to figure out how to achieve that fine control over specific polymorph formation. The research is published in the journal Communications Physics.

Zoom in on a crystal at a microscopic level, and you'll find that what makes it unique is its highly ordered structure. A colloidal crystal has a similar ordered structure, but with the addition of suspended, submicron-sized particles.

These special crystals are regarded as a good model of phase transition, and versatile materials for a wide range of scientific and industrial applications. However, the mechanisms behind polymorph selection during the crystallization process are not fully understood. One of the goals of this study was to reveal novel insights about these mechanisms.

"The ability to control the growth of specific crystal polymorphs is essential in fields like materials science and pharmaceuticals," says Jun Nozawa (Tohoku University). "Any change to the polymorphs results in changes to product performance and functionality, so being able to confidently select for a specific polymorph is crucial."

The study used colloidal crystallization as a model system and conducted in situ observations with single-particle resolution to investigate

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polymorph selection mechanisms. The study employed a method called heteroepitaxial growth using polystyrene colloidal particles. The crystallization process involved nucleation, growth, and dissolution—each influenced by polymorphic transitions.

The final products were found to be governed by polymorph transitions. They found that the probability of a certain polymorph occurring was driven by size and cluster stability. Particle additives were able to effectively control polymorph formation as well.

"These factors we analyzed can be used in principle to help create the desired polymorph, depending on the situation. This opens new pathways for polymorph regulation technologies," remarks Nozawa.

This research has advanced the understanding of polymorph control, providing insights applicable to material fabrication and drug development. These findings emphasize the significance of cluster dynamics and growth rates beyond thermodynamic stability for polymorphic crystal selection.

Phys Org, 22 April 2025

<https://phys.org>

'Forever chemicals' are everywhere: Most of their health effects are unknown

2025-04-09

In miniature test tubes in biologist Ryan Baugh's lab at Duke, thousands of tiny wriggling worms -- each one a fraction the size of an eyelash -- munch on their dinner of bacteria broth.

The worms' soupy meal is laced with a hidden ingredient, invisible so-called "forever chemicals" found in America's drinking water, our food and farmlands, even lurking in our bodies.

It's a chemical safety test, said Duke postdoctoral fellow Tess Leuthner. The worms are *C. elegans*, a garden- and compost-dwelling nematode that is helping researchers such as Baugh and Leuthner uncover new insights into the health effects of human-made chemicals used in everyday products ranging from cookware to candy wrappers.

The work revolves around per- and polyfluoroalkyl substances, or PFAS, a group of long-lasting compounds that have been used in industry and

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consumer goods since the 1940s because of their ability to resist grease, oil, water and heat.

Virtually Everywhere

PFAS are almost impossible to avoid. The chemicals are used to keep food from sticking to our pots and pans; make outdoor gear water-resistant; protect our furniture and textiles from stains, among many other uses. They're in our takeout containers, rain gear, carpets, paint, even dental floss and makeup.

The substances are called "forever chemicals" because of their longevity. PFAS consist of chains of carbon and fluorine atoms linked together. It's one of the strongest chemical bonds known.

"It's these strong carbon-fluorine bonds that make PFAS so durable but also make them impossible to degrade," Leuthner said.

That's why, once they're produced they tend to stick around. They build up and essentially never break down.

"Any PFAS that's already in the environment is there to stay," Leuthner said.

That's what happened in North Carolina's Cape Fear River, where chemicals discharged into the waterway by a chemical manufacturing plant have left downstream communities struggling with tainted drinking water for decades.

That's also what befell service members and residents living near North Carolina's Fort Bragg and hundreds of other military sites across the country, where PFAS from firefighting foam has made its way into the groundwater, contaminating private wells used by nearby residents.

Today, nearly all people in the U.S. have PFAS in their blood. Their use is so widespread that PFAS have even turned up in polar bears and the middle of the open ocean.

These chemicals exist in more than 14,000 forms. While several have been linked to health problems, such as cancer, lower birthweight and liver damage, the vast majority have never been tested. The potential health effects from exposure are unknown.

And while some PFAS are no longer manufactured in the U.S., they are still found in older or imported goods, and newer replacement chemicals continue to take their place.

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So what do we do? Duke researchers say there may be a way to help close the knowledge gap -- using tiny transparent worms.

Toxicity Isn't One-Size-Fits-All

In a recent study, a Duke team led by Leuthner, Baugh and Heather Stapleton of Duke's Nicholas School of the Environment exposed *C. elegans* worms to different doses of 13 PFAS chemicals -- some old, some newer -- and then measured the effects of the chemicals on their growth.

When they compared the PFAS-treated worms to worms that were not exposed, they found that all of the chemicals they tested stunted the worms' growth. But some PFAS took a toll at much lower doses than others, the researchers found.

The most toxic chemical, PFOSA, was a thousand times more toxic than the least toxic chemical, PFBA.

What's more, not every worm strain responded in the same way. Some strains suffered adverse effects at lower doses of certain chemicals than others, suggesting differences in sensitivity that are rooted in their genes.

"This is the first evidence that genetic variation contributes to susceptibility to PFAS toxicity," Leuthner said.

The health risks to worms might seem like a trivial concern.

But many disease-causing genes in humans have counterparts in *C. elegans*. And while humans and worms appear very different, they share many of the same metabolic and developmental pathways, Leuthner said.

High-Throughput Testing

What's more, the worms' small size and fast development means researchers can study the effects of diverse chemicals on large numbers of them in a relatively short amount of time.

Traditional toxicity testing in animals such as mice and rabbits can take over a year to complete; whereas similar experiments in *C. elegans* take less than a week.

The work is part of a larger NIH-funded study aimed at using worm genetics to better predict which chemical exposures are most likely to hurt people's health.

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The idea is to pinpoint gene variants that, if counterparts exist in humans, could help identify people who may be more sensitive to some environmental pollutants than others due to their genetic makeup.

“This is really critical, because humans are genetically diverse,” Leuthner said.

As a next step, the researchers are working to pin down which genes are responsible for the differences they found.

The work could help identify people or populations who might be particularly susceptible, or help pinpoint untested PFAS with the most potential for harm and flag them for future study.

“This could really speed up testing and regulation,” Leuthner said.

This research was funded by the National Institutes of Health (R01ES029930, P42 ES010356 and F32-ES034954) and the Duke Department of Biology.

Science Daily, 9 April 2025

<https://sciencedaily.com>

Scientists Uncover Game-Changing Fix That Could Extend Battery Life by Over 19 Times

2025-04-18

Researchers at POSTECH identified a new battery degradation mechanism triggered by deep discharging. Avoiding full discharge significantly extends the life of high-nickel lithium-ion batteries.

A research team led by Professor Jihyun Hong from the Department of Battery Engineering at POSTECH (Pohang University of Science and Technology), in collaboration with Professor Jongsoon Kim's group at Sungkyunkwan University, has uncovered a previously unidentified degradation mechanism in lithium-ion batteries. The team includes researchers Seungyun Jeon and Dr. Gukhyun Lim. Their groundbreaking work has been featured as the cover article in *Advanced Energy Materials*.

Lithium-ion batteries, widely used in electric vehicles, commonly employ nickel-manganese-cobalt (NMC) ternary cathodes. To lower production costs, the industry has increasingly shifted toward using cathodes with higher nickel content while reducing the proportion of costly cobalt.

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However, this approach often comes at the expense of battery longevity, as elevated nickel levels are known to reduce the overall cycle life.

A Focus on the Discharging Process

Until now, battery performance degradation was primarily attributed to overcharging. However, this explanation failed to account for degradation occurring under seemingly stable voltage conditions. The research team focused on the discharging process—the actual operation of the battery—to solve this mystery.

They discovered that when a battery is used for extended periods without recharging, a phenomenon known as the “quasi-conversion reaction” occurs on the cathode surface. During this reaction, oxygen escapes from the surface and combines with lithium to form lithium oxide (Li_2O) during discharge, particularly around 3.0V. This compound further reacts with the electrolyte, generating gas and accelerating battery degradation.

The quasi-conversion reaction was found to be more severe in high nickel cathodes. The research team confirmed that when batteries are used until most of their capacity is depleted, the effects of the degradation process including battery swelling, become increasingly pronounced.

A Simple Strategy to Prolong Battery Life

Importantly, the study also revealed a simple yet effective solution. The research team significantly extended cycle life by optimizing battery usage and avoiding full discharge. In experiments with high-nickel batteries (containing over 90% nickel), those discharged deep enough to trigger the quasi-conversion reaction retained only 3.8% of their capacity after 250 cycles, whereas batteries with controlled usage maintained 73.4% of their capacity even after 300 cycles.

Prof. Jihyun Hong, who led the research, stated, “The impact of discharge—the actual process of using a battery—has been largely overlooked until now,” and added, “This research presents an important direction for the developing longer-lasting batteries.”

Reference: “Reduction-Induced Oxygen Loss: the Hidden Surface Reconstruction Mechanism of Layered Oxide Cathodes in Lithium-Ion Batteries” by Seungyun Jeon, Gukhyun Lim, Hoseok Lee, Hyunyoung Park, Min Kyung Cho, Chan Kim, YeEun Lee, Jaehoon Kim, Minhyung Kwon, Jung-Keun Yoo, Hyangsoo Jeong, Jinwoo Kim, Seung-Ho Yu, Minah Lee, Jongsoon Kim and Jihyun Hong, 16 January 2025, *Advanced Energy Materials*.

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Sci Tech Daily, 18 April 2025

<https://scitechdaily.com>

Dedicated beamline will support SLAC's growing catalysis research community

2025-04-22

Catalysts make our modern lives possible. By reducing the start-up energy needed for chemical reactions, they facilitate the production of fuels, plastics and textiles as well as vital water treatment processes.

As a result, researchers are always looking to design new and improved catalysts—and for guidance, they often turn to X-ray facilities like the Stanford Synchrotron Radiation Lightsource (SSRL) at the Department of Energy's SLAC National Accelerator Laboratory, where they can get a better handle on catalysts' molecular structures.

Now, in response to a boom in catalysis users, researchers have transformed Beam Line 10-2 into the first dedicated space for catalysis studies at SSRL.

"We need world-class capabilities to stay at the forefront of synchrotron science in catalysis," said Simon Bare, SLAC distinguished staff scientist and co-director of the SSRL Chemistry & Catalysis Division. "The new Beam Line 10-2 provides just that."

Co-ACCESS supports a growing user community

In 2019, Bare and colleagues at the SUNCAT Center for Interface Science and Catalysis—a partnership between SLAC and Stanford's School of Engineering—established Co-ACCESS, the Consortium for Operando and Advanced Catalyst Characterization via Electronic Spectroscopy and Structure.

The program is a collaborative framework designed to assist SSRL users throughout their catalysis research, from initial idea to data publication. The initiative spurred significant growth in SSRL's catalysis user

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community, expanding from six principal investigators to more than 70 in just six years.

"This growth is the outcome of our supportive approach," said Adam Hoffman, SLAC staff scientist and lead scientist on Beam Line 10-2. "We don't just provide world-class facilities; we help researchers in all stages of their work, from writing competitive proposals for beamtime and guiding them through the experimental process to helping them process their results."

The Co-ACCESS team also shares their expertise in operando catalysis studies—research that examines catalysts in action under real-world conditions.

"In operando studies, we create different environmental conditions to observe their effect on the catalyst," Hoffman said. "If I change the composition of the gas in the atmosphere, like adding more oxygen, will that cause oxidation within the sample? If I increase the pressure, does that change how the system behaves? How about the temperature? Does the material change in reaction to these environmental changes?"

These studies offer insights into catalyst structure and behavior, helping researchers to refine and optimize their designs. However, manipulating parameters such as atmosphere, pressure and temperature within the experimental chamber requires a lot of equipment. Previously, the Co-ACCESS team relied on a portable lab setup, which involved repeatedly setting up and dismantling equipment as they moved between available SSRL beamlines. With their growing user base, Co-ACCESS demonstrated the need for a fully dedicated beamline for operando catalysis studies.

Introducing the Beam Line 10-2 for catalysis

The state-of-the-art Beam Line 10-2 features two specialized experimental stations: one for scattering experiments, which reveal catalyst structure, and another for spectroscopy, enabling real-time monitoring of catalytic reactions.

A standout feature of the beamline is its cutting-edge quick-scanning monochromator, developed and engineered by Oliver Mueller, senior engineer in SSRL's Chemistry & Catalysis Division. "Monochromators are at the heart of every beamline," Mueller explained.

"Using a pair of crystals, a monochromator diffracts the X-ray beam to select specific energies or wavelengths for an experiment. By adjusting the

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orientation of the crystals, researchers can sweep through a given energy range and compile a full spectrum of data.”

Because stability and accuracy are crucial, this process is typically slow—traditional monochromators take around 90 seconds to collect each spectrum, yielding about 40 spectra per hour. But researchers wanted a tool that could capture changes on a per-second timescale, the timescale on which catalytic reactions occur.

“Our challenge was to maintain the system’s stability while sweeping quickly through a given energy range,” Mueller said. “Our design relies on vibration-free mechanics that are precise to a thousandth of a degree.”

The beamline’s new quick-scanning monochromator employs an additional motor that rapidly rocks through various energy levels.

“With this capability, we can generate a spectrum every 50 milliseconds, translating to 72,000 spectra per hour, a huge level-up for time-resolved catalysis experiments,” said Hoffman. Now, scientists can get a precise play by play of the catalytic interactions they are studying.

“As the only facility that pairs a quick scanning instrument with a high-flux beamline, we can produce world-leading data and maintain a leadership position in catalysis research,” Bare said.

Engineering behind the beamline

Constructed on an existing beamline, Beam Line 10-2 required merging new technology with systems dating back decades. “The biggest challenge was the integration of new technologies with older systems,” said Ann McGuire, a mechanical engineer with the SSRL Beamline Design Group. “We wanted to modernize this beamline while retaining as much of the existing infrastructure as possible.”

The engineering team spent five years designing and installing state-of-the-art equipment to direct and control the beam, reaching a significant milestone when the first SSRL X-rays were delivered to the experimental stations in February 2025.

Though primarily focused on catalysis, Beam Line 10-2 also holds promise for fast-charging battery research. During the charging and discharging processes, metals in batteries undergo chemical processes that degrade the batteries in our phones, computers and vehicles. The beamline’s fast-scanning capabilities will help scientists observe these transformations in real time and design more efficient and resilient batteries.

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“By combining X-ray diffraction and fast-scanning spectroscopy, we hope to gain insights into both structural and chemical processes as we charge and discharge batteries,” said Molleigh Preefer, a SLAC staff scientist interested in finding new materials for high-performing battery materials. “This beamline will allow us to keep pace with the rapid interactions inside fast-charging batteries that we otherwise could not resolve.”

When beamline testing is complete, Co-ACCESS will accept beamtime proposals for its inaugural user run. “Catalysis is fundamental to many aspects of daily life, and a better understanding of these materials will continue to improve our lives,” Hoffman said. “This facility will provide unique insights unavailable through other means.”

Phys Org, 22 April 2025

<https://phys.org>

Plastics in birds’ stomachs release toxic chemicals, study suggests

2024-05-23

Plastic can release toxics in a bird’s stomach, according to a new study.

Material left to float in seawater may turn it cloudy potentially releasing toxic chemicals into the water, and could do the same in birds’ stomachs.

When left in the water for six months, the pristine plastic also appeared to cause a kind of scum to form on the surface, turning the mix into a “soup”.

Based at the Natural History Museum, Dr Joby Razzell Hollis, whose work focuses on the impact of plastic pollution on seabirds, said it was “shocking” to see the impact the plastic pellets had on the water in the ongoing study.

He told the PA news agency: “We’re really interested in seeing how the plastic is changing but also what the plastic is releasing into the water.

“And it definitely is, because not only have we seen that some of this plastic has visibly discoloured over time – it has turned yellow as it’s been exposed to sunshine.

“But also some of the plastic that’s been floating in water, after six months that water has become kind of cloudy, and you can see there is a kind of scum on the surface.

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"So these plastics are releasing something into the water as they degrade, and that's kind of similar to what you would expect to see happening in the ocean.

"But also if you imagine when you put those plastics into a seabird's stomach, and you expose them to acids that could potentially be different kinds of chemicals that they're releasing as well.

"So it's clear that these plastics are not inert, they are changing over time, they are interacting with their environment and they're releasing something.

"We are really curious to find out exactly what that is and then compare it to the list of known chemicals of emerging concern, or things that are potentially toxic."

Some 44% of seabird species are known to eat plastic, and some species are particularly badly affected, causing malnutrition and new diseases like plasticosis, experts say.

Dr Hollis said: "The plastic they have in their stomach is almost certainly too large to pass and won't break down easily.

"But the problem is that from a chemical perspective, the stomach acid may be enough to release chemicals, small amounts of chemicals, but even a small amount can be potentially quite toxic. So we really want to try and figure out how that process is occurring."

Dr Hollis hopes that by measuring the different types of plastic they eat, as well as the size, shape and colour, he will be able to understand why seabirds mistake plastic pollution for food, and what it is about plastic that causes the most harm when ingested.

The researchers have found that flesh-footed shearwater is almost exclusively eating low-density plastics like polyethylene, and this is likely because this species only forages near the ocean surface where such plastics float.

The researchers are just finishing the six-month study of deliberately degrading plastic in artificial seawater to see how it breaks down and releases potentially harmful chemicals over time in the ocean.

Speaking on what they have found so far, Dr Hollis said: "I sort of jokingly referred to it as plastic soup. It doesn't really look like clean water any more."

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He added: "To see the fact that the water is visibly changing was quite shocking."

Dr Hollis was speaking ahead of the launch of the Birds Brilliant And Bizarre exhibition on Friday at the Natural History Museum.

The exhibition tells the story of birds as the ultimate survivors who as descendants of the dinosaurs have conquered every continent on Earth thanks to their ingenious behaviour and adaptations.

The Independent, 23 May 2024

<https://independent.co.uk>

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Nearly Half of Americans Would Consider a Plant-Based Diet to Reduce Carbon Emissions

2025-04-17

The poll included 2,203 US adults.

As Earth Day approaches on April 22, a new Physicians Committee for Responsible Medicine/Morning Consult survey shows that 46% of Americans would consider eating a plant-based diet to help reduce greenhouse gas emissions from food production.

The poll included 2,203 US adults surveyed March 24-26, 2025. When asked, "How strongly would you consider eating a plant-based diet to help reduce greenhouse gas emissions?" 16% said they would "strongly consider" it, while another 30% said they would "somewhat consider" it.

Shifting diets from meat and other animal products to plant-based diets has a high potential for reducing carbon footprints and mitigating climate change, as well as improving human health, according to Climate Change 2022: Mitigation of Climate Change, a report from the United Nations' Intergovernmental Panel on Climate Change

"This Earth Day—and every day—people should eat a plant-based diet to keep themselves and the planet healthy," says Roxanne Becker, MBChB, DipIBLM, a doctor with the Physicians Committee who recommends a plant-based diet to patients for their health. "From cutting greenhouse gas emissions to cutting the risk of diet-related chronic diseases like heart disease and type 2 diabetes, a plant-based diet is a win-win."

More than half of those surveyed, 54%, did not know what foods contribute to greenhouse gas emissions.

According to research compiled by the United Nations that looked at the greenhouse gas emissions of several foods, beef ranks highest in kilograms of greenhouse gas emissions (70.6 kg) per kilogram of food, followed by cheese (23.9 kg), tofu (3.2 kg), vegetables (0.7 kg), and nuts (0.4 kg).

When asked to rank these foods based on the amount of greenhouse gases emitted, most respondents, 54%, correctly ranked beef as contributing the most greenhouse gas emissions.

Cattle produce methane as part of their digestive process, called enteric fermentation. When cows burp, the methane is released into the atmosphere. Methane is also produced when animal manure is stored or

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managed in lagoons or holding tanks, according to the Environmental Protection Agency.

Experts say that cutting emissions from methane, which is relatively short-lived but has around 80 times more warming potential than carbon dioxide, is critical in preventing catastrophic climate change.

Forty percent of survey respondents said they "strongly agree" or "somewhat agree" that "the meat and dairy industry should be taxed on greenhouse gas emissions to help offset climate change," which Denmark will begin doing in 2030.

Fifty-nine percent of respondents said they "strongly agree" or "somewhat agree" that "the government should offer incentives to farmers to convert from animal agriculture to growing crops and orchards to help benefit the environment."

When asked, "How strongly do you agree that federal food policy, such as the Dietary Guidelines for Americans, should discuss the impact that food choices have on climate change, ecosystems, and the environment?" a combined 60% said they "strongly agree" or "somewhat agree."

Although the impact of diet on the environment is not mentioned in the Dietary Guidelines, research shows that the Dietary Guidelines' Healthy Vegetarian Dietary Pattern has half the carbon footprint of the Guidelines' main recommendations. The Healthy Vegetarian Dietary Pattern's protein group replaces meat, poultry, and seafood with plant-based items including legumes, soy, nuts, and seeds.

Technology Networks, 17 April 2025

<https://technologynetworks.com>

Scientists finally confirm vitamin B1 hypothesis from 1958

2025-04-21

Chemists have confirmed a 67-year-old theory about vitamin B1 by stabilizing a reactive molecule in water—a feat long thought impossible. The discovery not only solves a biochemical mystery, but also opens the door to greener, more efficient ways of making pharmaceuticals.

The molecule in question is a carbene, a type of carbon atom with only six valence electrons. Generally, carbon is stable with eight electrons around it. With only six electrons, it is chemically unstable and highly reactive. In

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water, it usually decomposes instantly. But for decades, scientists have suspected that vitamin B1, also known as thiamine, may form a carbene-like structure in our cells to carry out vital reactions in the body.

Now, for the first time, researchers have not only generated a stable carbene in water, they've also isolated it, sealed it in a tube, and watched it stay intact for months. This discovery is documented in a paper published last week in *Science Advances*.

"This is the first time anyone has been able to observe a stable carbene in water," said Vincent Lavallo, a professor of chemistry at UC Riverside and corresponding author of the paper. "People thought this was a crazy idea. But it turns out, Breslow was right."

The reference is to Ronald Breslow, a Columbia University chemist who proposed in 1958 that vitamin B1 could convert into a carbene to drive biochemical transformations in the body. Breslow's idea was compelling, but carbenes were so unstable—especially in water—that no one could prove they actually existed in a biological setting.

Lavallo's team succeeded by wrapping the carbene in what he calls "a suit of armor," a molecule they synthesized in the laboratory that shields the reactive center from water and other molecules. The resulting structure is stable enough to be studied with nuclear magnetic resonance spectroscopy and X-ray crystallography—providing conclusive evidence that carbenes like this can exist in water.

"We were making these reactive molecules to explore their chemistry, not chasing a historical theory," said first author Varun Raviprolu, who completed the research as a graduate student at UCR and is now a postdoctoral researcher at UCLA. "But it turns out our work ended up confirming exactly what Breslow proposed all those years ago."

Beyond confirming a biochemical hypothesis, the discovery has practical implications. Carbenes are often used as "ligands," or support structures, in metal-based catalysts—the chemical workhorses used to produce pharmaceuticals, fuels, and other materials. Most of these processes rely on toxic organic solvents. The researchers' method of stabilizing carbenes in water could help make those reactions cleaner, less expensive, and safer.

"Water is the ideal solvent—it's abundant, non-toxic, and environmentally friendly," Raviprolu said. "If we can get these powerful catalysts to work in water, that's a big step toward greener chemistry."

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Knowing that such reactive intermediate molecules can be generated and survive in water also brings scientists one step closer to mimicking the kind of chemistry that happens naturally in cells—which are mostly made of water.

"There are other reactive intermediates we've never been able to isolate, just like this one," Lavallo said. "Using protective strategies like ours, we may finally be able to see them, and learn from them."

For Lavallo, who has spent two decades designing carbenes, the moment is both professional and personal.

"Just 30 years ago, people thought these molecules couldn't even be made," he said. "Now we can bottle them in water. What Breslow said all those years ago—he was right."

For Raviprolu, the discovery serves as a reminder to persevere in scientific research and discovery.

"Something that seems impossible today might be possible tomorrow, if we continue to invest in science," he said.

Phys Org, 21 April 2025

<https://phys.org>

Starch-Based Microplastics May Pose Health Risks, Mouse Study Finds

2025-04-09

Wear and tear on plastic products releases small to nearly invisible plastic particles, which could impact people's health when consumed or inhaled. To make these particles biodegradable, researchers created plastics from plant starch instead of petroleum.

An initial study published in *ACS' Journal of Agricultural and Food Chemistry* shows how animals consuming particles from this alternative material developed health problems such as liver damage and gut microbiome imbalances.

"Biodegradable starch-based plastics may not be as safe and health-promoting as originally assumed," says Yongfeng Deng, the corresponding author of the study.

Microplastics (plastic pieces less than 5 millimeters wide) are entering human bodies through contaminated water supplies, foods and drinks —

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and even IV infusions. Scientists have linked plastic particles in the bloodstream and tissues to various health risks. For example, a study found that people with inflammatory bowel disease have more microplastics in their feces.

Biodegradable plastics have been presented as a safer, more environmentally friendly alternative to traditional petroleum-based plastics. One of the most common types comes from starch, a carbohydrate found in potatoes, rice and wheat. However, there is a lack of information on how starch-based biodegradable plastics affect the body. A team of researchers led by Deng tackled this issue by exploring these effects in animal trials.

The researchers compared three groups of five mice: one group consuming normal chow and two groups consuming food infused with starch-based microplastics. The doses (low and high) were calculated and scaled from what an average human is expected to consume daily. They fed the mice for 3 months and then assessed the animals' organ tissues, metabolic functions and gut microbiota diversity. Mice exposed to the starch-based plastic particles had:

- Multiple damaged organs, including the liver and ovaries, with more pronounced damage in the high-dose group. However, mice eating normal chow showed normal organ tissue biopsies.
- Altered glucose management, including significant abnormality in triglycerides (a type of fat) and disruption in molecular biomarkers associated with glucose and lipid metabolism, compared to mice fed normal chow.
- Dysregulated genetic pathways and specific gut microbiota imbalances, which the researchers suggest could alter microplastic-consuming animals' circadian rhythms.

"Prolonged low-dose exposure to starch-based microplastics can lead to a broad spectrum of health impacts, particularly perturbing circadian rhythms and disrupting glucose and lipid metabolism," says Deng. However, the researchers acknowledge that because this is one of the first studies examining the impacts of consuming starch-based microplastics, further research is needed to understand how these biodegradable particles break down in the body.

Technology Networks, 9 April 2025

<https://technologynetworks.com>

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Engineering a hydrogen-bonding microenvironment to boost CO₂ electroreduction

2025-04-21

Catalytic conversion of waste CO₂ into value-added fuels and chemicals offers unprecedented opportunities for both environmental protection and economic development. Electrocatalytic CO₂ reduction reaction (CO₂RR) has garnered significant attention for its ability to efficiently convert CO₂ into clean chemical energy under mild conditions. However, the relatively high energy barrier for *COOH intermediate formation often becomes the determining step in CO₂RR, significantly limiting reaction efficiency.

Inspired by enzyme catalysis, a team led by Prof. Jiang Hai-Long and Prof. Jiao Long from the University of Science and Technology of China (USTC) of the Chinese Academy of Sciences (CAS) developed a novel strategy to stabilize *COOH intermediate and enhance electrochemical CO₂ reduction by constructing and modulating the hydrogen-bonding microenvironment around catalytic sites. Their work is published in the Proceedings of the National Academy of Sciences.

In this work, the team co-grafted catalytically active Co(salen) units and proximal pyridyl-substituted alkyl carboxylic acids (X-PyCn) onto Hf-based MOF nanosheets (MOFNs) via a post decoration route, affording Co&X-PyCn/MOFNs (X = o, m or p representing the ortho-, meta-, or para-position of pyridine N relative to alkyl chain; n = 1 or 3 representing the carbon atom number of alkyl chains) materials.

The Co&X-PyCn/MOFNs achieve precise control over the spatial positioning of the N atoms in pyridine groups relative to the Co(salen), which provides a novel and facile approach to microenvironment modulation around catalytic sites at atomic scale.

Among the catalysts, the optimized Co&p-PyC3/MOFNs exhibits significantly enhanced catalytic activity and selectivity in electrochemical CO₂ reduction, superior to Co/MOFNs without pyridine unit and other Co&X-PyCn/MOFNs counterparts.

Furthermore, the in situ reduction of pyridine to pyridinyl radical (PyrH•) is observed during electrochemical CO₂ reduction and the in situ formed PyrH• species are confirmed to be the real microenvironment around Co(salen) for enhanced performance.

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Mechanism investigations reveal that PyrH• can collaborate with trifluoroethanol (TFE) molecules in electrolyte to stabilize the *COOH intermediate by generating *COOH...TFE...PyrH• triad intermediate via hydrogen-bonding interaction, greatly minimizing reaction energy barrier. This provides a clear picture on the working mode of microenvironment for performance optimization during the catalysis.

This work unambiguously demonstrates the significance of microenvironment modulation around catalytic sites for enhancing catalysis, paving a new way for understanding the mechanism in future catalysis studies.

Phys Org, 21 April 2025

<https://phys.org>

Harmful microplastics infiltrating drinking water

2025-04-21

Despite advances in wastewater treatment, tiny plastic particles called microplastics are still slipping through, posing potential health and environmental hazards, according to new research from The University of Texas at Arlington.

Because plastic is inexpensive to produce yet lightweight and sturdy, manufacturers have found it ideal for use in nearly every consumer good, from food and beverage packaging to clothing and beauty products. The downside is that when a plastic item reaches the end of its useful life, it never truly disappears. Instead, it breaks down into smaller and smaller pieces called microplastics -- particles five millimeters or less, about the width of a pencil eraser -- that end up in our soil and water.

"What our systematic literature review found is that while most wastewater treatment facilities significantly reduce microplastics loads, complete removal remains unattainable with current technologies," said Un-Jung Kim, assistant professor of earth and environmental sciences at UT Arlington and senior author of the study published in Science of the Total Environment.

"As a result, many microplastics are being reintroduced into the environment, likely transporting other residual harmful pollutants in wastewater, such the chemicals Bisphenols, PFAS and antibiotics," Dr. Kim added. "These microplastics and organic pollutants would exist in trace level, but we can get exposure through simple actions like drinking water,

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doing laundry or watering plants, leading to potential long-term serious human health impacts such as cardiovascular disease and cancer."

According to the study, one of the main challenges in detecting and mitigating microplastics is the lack of standardized testing methods. The researchers also call for a unified approach to define what size particle qualifies as a microplastic.

"We found that the effectiveness of treatments varies depending on the technology communities use and how microplastics are measured to calculate the removal rates," said the study's lead author, Jenny Kim Nguyen. "One way to better address the growing microplastics issue is to develop standardized testing methods that provide a clearer understanding of the issue."

Nguyen began this research as an undergraduate student in Kim's Environmental Chemistry Lab. She is now pursuing a master's degree in earth and environmental sciences at UTA, where she is working to develop standardized experimental protocols for studying microplastics in air and water.

"This work helps us understand the current microplastics problem, so we can address its long-term health impacts and establish better mitigation efforts," said Karthikraj Rajendiran, a co-author of the study and assistant professor of research from UTA's Bone Muscle Research Center within the College of Nursing and Health Innovations.

The team also emphasizes the need for greater public awareness of microplastics to help consumers make more eco-friendly choices.

"While communities must take steps to improve microplastic detection and screening at the wastewater and water quality monitoring, consumers can already make a difference by choosing to buy clothing and textiles with less plastics whenever feasible, knowing that microfibers are the most common microplastic continually released through wastewater," Kim added.

Funding for the project was provided by UTA's Research Enhancement Program, which supports multidisciplinary researchers in launching new projects.

Science Daily, 21 April 2025

<https://sciencedaily.com>

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Fears grow over the future of mRNA vaccine research in the US

2025-04-16

Researchers are increasingly concerned about the future of messenger RNA (mRNA) vaccine research in the US. Initial worries were sparked by a US National Institutes of Health (NIH) review of the studies it funds in this area, while staff cuts at agencies that support this type of research have added to scientists' fears.

'Despite the promise of this technology ... we are risking squandering our leadership in the mRNA space in the 21st century,' Jeff Collier, an expert on RNA biology from Johns Hopkins University (JHU) in Maryland, warned at a media briefing about the potential of mRNA medicines on 10 April.

'NIH [funded] researchers across the US are being targeted for projects involving mRNA vaccines,' he stated. 'Based on what we have seen in other research areas, the next steps could be for the administration to halt funding for projects that are developing these breakthrough mRNA therapeutics.'

Collier also highlighted 'the huge cuts in experienced staff' at the US Food and Drug Administration, and in particular the resignation of Peter Marks, the long-time director of the agency's unit that regulates vaccines and other biological products. Such departures raise significant questions about whether the US will maintain its leadership within this sector, he suggested.

mRNA projects lose budgets, partnerships and jobs

According to Collier, there are currently over 700 potential medicines based on mRNA at the preclinical development stage across academia and industry, and 267 in clinical development. Most of this activity is housed at companies located within the US, with around 65% of the 150,000 people working globally on mRNA research based in the country.

But Collier warned that 'skittishness' across the industry could see projects moved overseas, due to companies' concerns about the situation in the US.

Surveys of 100 senior life science professionals in the field, conducted in late March by the Alliance for mRNA Medicines that Collier helped found, indicated that about 30% would consider relocating their operations overseas if the US pulled away from investment in mRNA technology.

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According to Collier, almost half of those surveyed reported already experiencing negative effects from policies enacted under President Donald Trump's second administration. These impacts include the reduction in the scope of projects, budget reductions, delayed capital investments, partnership terminations, job losses and hiring freezes, and relocation of projects or divisions at their companies to other shores, Collier said.

'Indeed, in conversations with our members, strategic partnerships have been lost because NIH funding has been cut, and companies are already looking overseas to turn their manufacturing operations into other countries,' he stated.

Amid 'the threat of indiscriminate cuts' to mRNA programmes in the US, Collier noted that governments in China, the EU, Australia and Brazil appear to be doubling down on their investments in this technology.

Meanwhile the deputy director of JHU's comprehensive cancer centre Elizabeth Jaffee, an oncologist focused on immune-based therapies for pancreatic and breast cancers, is worried that her NIH grant that funds research on an mRNA-based pancreatic cancer vaccine could be stopped, along with the ongoing associated clinical trial.

'We are very concerned, and our patients are concerned,' Jaffee stated at the JHU briefing. 'We don't have a lot of funding for doing these trials beyond the NIH, and the way things are going ... you are told a day in advance that your grant is cut.'

In the meantime, Collier said that Republican lawmakers in at least seven states have introduced state measures to ban or restrict the usage of mRNA in treating various health disorders.

In response to questions Chemistry World raised about researchers' concerns over grant terminations and delays, and the threat of mRNA medical research projects moving overseas, an NIH spokesperson said: 'NIH is taking action to terminate research funding that is not aligned with NIH and HHS priorities. We remain dedicated to restoring our agency to its tradition of upholding gold-standard, evidence-based science.'

'As we begin to make America healthy again, it's important to prioritise research that directly affects the health of Americans. We will leave no stone unturned in identifying the root causes of the chronic disease

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epidemic as part of our mission to make America healthy again,' they added.

Chemistry World, 16 April 2025

<https://chemistryworld.com>

Corn Protein Boosts Lithium-Sulfur Battery Lifespan

2025-04-16

Researchers at Washington State University have demonstrated a way to use corn protein to improve the performance of lithium-sulfur batteries, a finding that holds promise for expanding the use of the high-energy, lighter-weight batteries in electric vehicles, renewable energy storage and other applications.

Lithium-sulfur batteries are lighter for the same amount of energy and more environmentally friendly than commonly used lithium-ion batteries, but their commercial adoption has been limited by technological hurdles that shorten their lifespan.

The WSU team's research, published in the *Journal of Power Sources*, showed that a protective barrier made of corn protein, in combination with a commonly used plastic, significantly improved the performance of a button-sized lithium-sulfur battery. The researchers found that the battery could hold its charge over 500 cycles, a significant improvement over batteries without the protective corn barrier, known as a separator.

"This work demonstrated a simple and efficient approach to preparing a functional separator for enhancing the battery's performance," said Katie Zhong, professor in the School of Mechanical and Materials Engineering and a corresponding author on the paper. "The results are excellent."

Lithium-sulfur batteries are considered a possible alternative to lithium-ion batteries for many applications. They theoretically contain a lot more energy, so using them in cars or airplanes would require much smaller and lighter batteries than current batteries. Furthermore, the lithium-sulfur battery uses sulfur for its cathode, which is abundantly available, cheap, and non-toxic, making it more environmentally friendly than current batteries. The cathode of a lithium-ion battery is made of metal oxides and include toxic heavy metals like cobalt or nickel.

However, lithium-sulfur batteries suffer from two major problems. Called the shuttle effect, the sulfur portion of the battery tends to leak into the liquid part of the battery and migrate to the lithium side, causing the

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battery to stop working very quickly. The lithium side of the battery also often grows spikes of lithium metal, called dendrites, which can cause an electric short circuit.

In their proof-of-concept work, the researchers used corn protein as a cover for a separator in the middle of the battery to prevent both problems.

"Corn protein would make for a good battery material because it's abundant, natural, and sustainable," said Jin Liu, professor in the School of Mechanical and Materials Engineering and a corresponding author on the paper.

Graduate students Ying Guo, Pedaballi Sireesha and Chenxu Wang led the work.

The building blocks of the protein are amino acids, which reacted with the battery materials to improve the movement of lithium ions and inhibit the shuttle effect. Because protein is naturally folded on top of itself, the researchers added a small amount of flexible plastic to flatten it and improve its performance.

"The first thing we need to think about is how to open the protein, so we can use those interactions and manipulate the protein," said Liu.

The researchers conducted both numerical studies and experiments to prove the battery's success. They are conducting further studies on how the process worked, which amino acid interactions might be responsible, and how the protein structure might be optimized.

"A protein is a very complicated structure," said Zhong. "We need to do further simulation studies to identify which amino acids in the protein structure can work best for solving the critical shuttle effect and dendrite problems."

The researchers would like to collaborate with industry partners to study larger experimental batteries and to scale up the process. The work was funded by the U.S. Department of Agriculture.

Technology Networks, 16 April 2025

<https://technologynetworks.com>

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Precision-shaped Cu₂O crystals unlock new potential for clean energy catalysts

2025-04-18

Can the shape of a crystal really change how well it performs in clean energy technology? A new study says yes—decisively.

Researchers from National Taiwan University, National Tsing Hua University, and National Yang Ming Chiao Tung University have discovered that the performance of a widely studied catalyst, cuprous oxide (Cu₂O), in oxygen reduction reactions (ORR) depends heavily on which crystal face is exposed.

The paper is published in the Journal of Materials Chemistry A.

Oxygen reduction is a central reaction in fuel cells, which are devices that convert chemical energy into electricity. Platinum is commonly used in this role but is expensive and limited in supply. Cu₂O, a more affordable alternative, has now shown surprising potential—if used with the right shape.

The team synthesized Cu₂O crystals into three distinct shapes: cubes, octahedra, and rhombic dodecahedra. These shapes expose different crystal facets—{100}, {111}, and {110}, respectively—and were each blended with carbon nanotubes to enhance conductivity.

The researchers found that the rhombic dodecahedron version, exposing the {110} surface, delivered the strongest catalytic activity for ORR, while the cube was most stable over time.

By combining advanced quantum simulations with lab experiments, the team found that oxygen molecules behave differently depending on which crystal surface they land on.

The {110} surface showed the weakest grip on oxygen, which helps the reaction proceed more smoothly. This matched their density functional theory (DFT) predictions and was clearly shown in free energy diagrams and 2D volcano plots that link binding strength to catalytic performance.

However, better performance sometimes comes at a cost. The rhombic dodecahedron crystals were found to degrade faster during operation, possibly due to self-oxidation. In contrast, the cube-shaped crystals—though less reactive—were more robust over time.

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This research not only helps explain why different facets perform differently but also opens doors to designing next-generation, low-cost catalysts by simply controlling crystal shapes.

“By fine-tuning the geometry of crystal surfaces, we can tailor their reactivity and stability, which is crucial for advancing sustainable energy technologies,” said Prof. Jyh-Pin Chou of National Taiwan University.

Phys Org, 18 April 2025

<https://phys.org>

Drugged-up salmon are acting weird and we don't know how to fix it

2025-04-20

A benzodiazepine seeping into waterways is causing young Atlantic salmon to behave strangely, with fish in the wild migrating more rapidly and taking more risks on their journey from river to ocean. It even seems to be messing with their social dynamics.

An international team of researchers from institutions including Australia's Griffith University, led by the Swedish University of Agricultural Sciences, has found that the “benzo” clobazam – often prescribed for anxiety and sleep disorders, as well as for controlling seizures – in particular is affecting the salmon. It's the largest study of its kind, and sheds new light on the impact of pharmaceutical contamination on marine life.

“This study is unique because it investigates the effects of these contaminants on wildlife directly in the field, allowing us to better understand how exposure impacts wildlife behavior and migration in a natural context,” said Dr Marcus Michelangeli from Griffith University's Australian Rivers Institute. “While the increased migration success in salmon exposed to clobazam might seem like a beneficial effect, it is important to realize that any change to the natural behavior and ecology of a species is expected to have broader negative consequences both for that species and the surrounding wildlife community.”

The team used slow-release drug implants and tracking transmitters to see how clobazam and another common pharmaceutical pollutant – the opioid tramadol – affected juvenile Atlantic salmon (*Salmo salar*) in the crucial stage of their life cycle, navigating waterways to make it to the Baltic Sea.

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Homing in on clobazam as a result of observations in the wild, the researchers then conducted an additional lab study and could see how the drug appeared to impact the species' shoaling behavior. Shoaling, as opposed to schooling, is a social behavior that could affect breeding and cohesion among groups of fish. While this maybe doesn't sound like a big deal, the species as a whole has gone from Least Concern on the IUCN Red List – the "bible" for tracking wildlife numbers – to Near Threatened. In some areas they're endangered, and populations of these freshwater fish in areas like Maine and in the UK have rapidly declined over the last decade.

And their populations have become increasingly fragmented, which means changes in social behavior and making more risky moves are big red flags for a dwindling species.

While benzos are generally seen as sedatives in humans, clobazam-drugged salmon actually navigated their migration route much more rapidly, speeding through two hydropower dams that regularly pose challenges on the important journey. There can be a number of ways this impacts a species – prematurely reaching open waters, fish being less careful about being picked off by predators en route to the sea – that are not fully known.

"Pharmaceutical pollutants are an emerging global issue, with over 900 different substances having now been detected in waterways around the world," Michelangeli said. "Of particular concern are psychoactive substances like antidepressants and pain medications, which can significantly interfere with wildlife brain function and behavior.

"When you consider realistic exposure scenarios where entire ecosystems are exposed – encompassing multiple species and a diversity of contaminants – the potential consequences become even more complex," he added.

And, yes, there is evidence that these pharmaceutical contaminants can affect humans who eat drug-affected fish, however, long-term health impacts are not yet fully understood. Generally speaking, low levels of pollutants aren't going to have any immediate, obvious effect, but there remains a lack of research in the area.

The scientists call for pharmaceutical companies to improve medicine biodegradability, as well as better wastewater treatment to limit what we're pumping back into the wild.

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"Advanced wastewater treatment methods are becoming more effective at reducing pharmaceutical contamination, and there is promising potential in green chemistry approaches," Michelangeli said. "By designing drugs that break down more rapidly or become less harmful after use, we can significantly mitigate the environmental impact of pharmaceutical pollution in the future."

The study was published in the journal Science.

New Atlas, 20 April 2025

<https://newatlas.com>

Scientists create a 'brilliantly luminous' nanoscale chemical tool

2025-04-16

Imagine tiny building toy pieces that automatically snap together to form a strong, flat sheet. Then, scientists add special chemical "hooks" to these sheets to attach glowing molecules called fluorophores.

Associate Professor Gary Baker, Piyuni Ishtaweera, PhD '24, and their team have created these tiny, clay-based materials -- called fluorescent polyionic nanoclays. They can be customized for many uses, including advancing energy and sensor technology, improving medical treatments and protecting the environment.

Thousands of commercially available fluorophores are used today for medical imaging, disease detection and biomarker tagging, as well as in sensors for chemical analysis, forensic investigations and biosensing. They can also play a key role in industrial applications such as water quality monitoring.

Mizzou's discovery, which is patent pending, stands out due to the remarkable adaptability of these nanoclays.

"They possess a high degree of functionality, meaning we can control how many and what kinds of fluorescent molecules are attached to the surfaces of these nanoclays," Baker, whose appointment is in the Department of Chemistry, said. "This provides a versatile platform where the optical and physicochemical properties can be precisely tuned by selecting and attaching appropriate molecules. This ready-for-use customization is the hallmark of these materials, enabling a wide array of applications across different fields."

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Medical uses

Early tests suggest these materials are safe for medical use and can help doctors see inside the body more clearly. Scientists already use fluorophores to highlight cells and tissues under special microscopes, making tiny details visible. They also use these glowing molecules to track diseases, study how cells work and help diagnose health conditions.

“Normalized for volume, our fluorescently tagged clays exhibit 7,000 brightness units, matching the highest levels ever reported for a fluorescent material,” Baker said. “The increased brightness makes these materials highly useful for sensitive optical detection methods. This translates to enhanced analytical signals and improved detection, unlocking new possibilities for advanced sensors and contrast agents in medical imaging.”

While fluorescence is a key focus of the current research, Baker said the team wants to explore other ways of customizing the nanoclays with other molecules, such as amino acids, antibodies, DNA aptamers and ligands for selective metal binding. This means these materials can be used for more than just glowing sensors and imaging. They could also help in capturing solar energy, delivering medicine, improving light-based technology and medical tests, tracking diseases and treating cancer.

“Programmable fluorescent polyionic nanoclays as sensory materials,” was published in Chemistry of Materials. Other co-authors are Luis Polo-Parada, an associate professor of medical pharmacology and physiology at Mizzou, and Nathaniel Larm at the United States Naval Academy. Ishtaweera is now at the U.S. Food and Drug Administration.

Science Daily, 16 April 2025

<https://sciencedaily.com>

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Technical Notes

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[Application of Silica Nanoparticles Induces Different Effects on Inorganic and Methylated Arsenic Accumulation in Rice Grains: Insights from Arsenic Transformation in Soil](#)

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ENVIRONMENTAL RESEARCH

[Sunscreens and Their Impact on Human Health and the Environment: A Review](#)

PHARMACEUTICAL/TOXICOLOGY

[Endocrine disruption potential of dust in children's indoor environments: Associations with multiple chemicals from various compound classes across exposure matrices used for health risk assessment](#)

[Association between humidifier disinfectant use and development of lung cancer: A nested case-cohort study](#)

[Associations of exposure to arsenic species and endogenous sex hormones with oral cancer: a hospital-based study in Southeastern China](#)

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