CHEMWATCH

# Bulletin Board

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## ASIA PACIFIC

### Download the latest list of chemicals on the Inventory

*2025-01-31*

We took a snapshot of all the chemicals on the Australian Inventory of Industrial Chemicals on 3 January 2025. To view it as an Excel spreadsheet, go to our 'Search the industrial chemicals inventory' page and click the 'Download the Inventory' button.

Read More

AICIS, 31-01-25

https://services.industrialchemicals.gov.au/search-inventory/

### Microplastics in blood linked to impaired blood clotting, study finds

*2025-01-14*

South Korean study assesses link between microplastics in blood and plastic container use as well as blood coagulation disruptions; finds mostly polystyrene, polypropylene, and polyethylene microplastics in blood; links higher microplastic levels to use of plastic containers, impaired blood clotting and increased inflammation, suggesting potential cardiovascular risks

Micro- and nanoplastics (MNPs) are increasingly linked to human health outcomes such as to potential impacts on cardiovascular health (FPF reported). However, the mechanisms through which MNPs interfere with cardiovascular health have remained elusive. In an article published on December 6, 2024, in the journal Nature Scientific Reports, Dong-Wok Lee from Inha University, Incheon, South Korea, and co-authors analyzed MNPs in human blood and their association with the donors' lifestyles and disruptions in blood coagulation.]

The researchers analyzed blood samples from 36 healthy adults living in South Korea for the presence of MNPs and key blood coagulation markers. Participants also completed detailed questionnaires assessing lifestyle and demographics, including the use of ready-made meals and the percentage of plastic containers in their refrigerators. The team used Fourier-transform infrared (μ-FTIR) spectroscopy to quantify and identify plastic particles larger than 5 μm in the blood samples. When μ-FTIR failed to detect MNPs,



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they subjected the respective samples to μ-Raman spectroscopy, which is a more sensitive but also more time-consuming analysis method.

Read More

FPF, 14-01-25

https://foodpackagingforum.org/news/microplastics-in-blood-linked-to-impaired-blood-clotting-study-finds

## AMERICA

### Minister Guilbeault's statement on the conclusion of the Fifth Intergovernmental Negotiating Committee on Plastic Pollution (INC-5)

*2024-12-02*

The Honourable Steven Guilbeault, Minister of Environment and Climate Change, issued the following statement at the conclusion of the Fifth Intergovernmental Negotiating Committee on Plastic Pollution (INC-5) in Busan, Republic of Korea, which took place from November 25 to December 1, 2024.

"Two years ago, the United Nations Environment Assembly unanimously adopted a historic resolution to develop a new, legally binding agreement on plastic pollution by the end of 2024. Canada came to the Republic of Korea determined to conclude an ambitious and historic agreement on plastic pollution. While we were not able to reach a deal this time, Canada's commitment to an ambitious deal has not wavered. The fight against plastic pollution internationally is not over, and we will keep pushing toward the goal of an ambitious and inclusive treaty.

"This is a crisis that affects our environment, our economies, and our communities. To effectively address this global challenge, we need a legally binding agreement that spans the entire life cycle of plastics—from sustainable production and consumption, restricting problematic plastic products and chemicals of concern, to waste management and addressing plastic pollution in the environment. Only through this comprehensive approach can we achieve the system-wide change necessary to combat plastic pollution and protect future generations.

"Canada's delegation included the voices of provincial and territorial partners and representatives from National Indigenous Organizations, who provided valuable feedback throughout the process.

"Canadians want their government to tackle pollution. That's why Canada is taking action to reduce plastic waste and pollution. It is also an inaugural member of the High Ambition Coalition to End Plastic Pollution and a founding member of the INC Host Country Alliance.

"Canada plays a leadership role on the global stage and at home in the fight against plastic pollution, stemming from the launch of the Ocean Plastics Charter during our 2018 G7 Presidency. We will continue to lead the way domestically on plastic pollution, taking the concrete action that Canadians want to see. We remain steadfast in implementing our comprehensive plan to reduce plastic waste and pollution and move toward a circular economy for plastics. Our plan includes new rules that require more transparency from producers and other companies on the plastics they place on the Canadian market and how they are managed at end of life; banning harmful single-use plastics; and investing and advancing in science and targeted solutions and innovations. This means improving how plastics are made, used, and managed; cutting plastic waste; building green economic opportunities; and sending a clear signal to governments and businesses so they can spur innovation, drive policy, and signal areas of investment.

"We will continue to collaborate with all Canadians, including Indigenous partners, civil society, workers, industry, and subnational governments, to drive innovation and action on plastic pollution.

Read More

Government of Canada, 02-12-24

https://www.canada.ca/en/environment-climate-change/news/2024/12/minister-guilbeaults-statement-on-the-conclusion-of-the-fifth-intergovernmental-negotiating-committee-on-plastic-pollution-inc-5.html

## 'Forever pollution': The map of Europe's PFAS contamination

*2025-01-07*

PFAS (per- and polyfluoroalkyl substances), commonly known as "forever chemicals," are a persistent environmental concern in both Europe and America. Widely used in industrial applications, consumer products, and firefighting foams, these chemicals resist natural degradation due to their strong carbon-fluorine bonds. As a result, PFAS have contaminated soils, particularly in agricultural areas, posing serious risks to farmland, ecosystems, and public health. In Europe, PFAS contamination is most prevalent near industrial zones, military sites, and areas where biosolids containing PFAS have been applied as fertilizers. Countries such as Germany, Belgium, and the Netherlands have documented significant levels of PFAS in farmland soils, leading to concerns about the chemicals entering the food chain. Regulatory bodies like the European Environment Agency have flagged these hotspots as critical for intervention to safeguard agricultural productivity and food safety. In the United States, PFAS contamination is similarly alarming. States like Maine, Michigan, and Wisconsin have reported widespread contamination in agricultural soils, often linked to the use of tainted wastewater, biosolids, or proximity to industrial facilities. For example, dairy farms in Maine have been severely impacted, with PFAS detected in both the soil and milk. This has leds led to economic hardship for farmers and raised public health concerns raised.

Read More

Research Gate, 07-01-25

https://www.researchgate.net/publication/387722464_%27Forever_pollution%27_The_map_of_Europe%27s_PFAS_contamination

## EPA determines formaldehyde poses an 'unreasonable risk' to humans and must be regulated

*2025-01-31*

The Biden administration has officially determined the chemical formaldehyde poses an "unreasonable" risk to human health and should be regulated.

The Environmental Protection Agency (EPA) said this week that "formaldehyde presents an unreasonable risk of injury to human health, specifically to workers and consumers."

The agency noted that the chemical "is found nearly everywhere" and so "people are routinely exposed to formaldehyde in indoor and outdoor environments, often from more than one source at a time."

It also said that long-term exposure to the substance can cause cancer, as well as reduced lung function and worsened asthma.

As a result, it said it would try to address the "unreasonable risk" by proposing a rule to protect workers and consumers.

"Having made that unreasonable risk determination, [the Toxic Substances Control Act] requires EPA to issue a rule that fully eliminates formaldehyde's unreasonable risks," Jonathan Kalmuss-Katz, a senior attorney at environmental group Earthjustice, told The Hill.

Read More

The Hill, 03-01-25

https://thehill.com/policy/energy-environment/5066408-epa-formaldehyde-unreasonable-risk/

## 'Forever chemicals' in wastewater far more widespread than previously known, study reveals

*2025-01-07*

The "forever chemicals" flowing from U.S. wastewater treatment plants are not only more abundant than previously thought, but also largely consist of pharmaceuticals that have received little scientific or regulatory attention, a new multi-university study reveals.

The research, published in Proceedings of the National Academy of Sciences, found that common prescription drugs make up about 75% of the organic fluorine in wastewater entering treatment plants, and 62% in treated water released to the environment.

These findings suggest millions of Americans could be exposed to these persistent chemicals through their drinking water.

Read More

PHYS.org, 07-01-25

~https://phys.org/news/2025-01-chemicals-wastewater-widespread-previously-reveals.htmls

## EPA Releases Draft Human Health Criteria for PFAS in Waterbodies

*2025-01-07*

On December 19, 2024, the United States Environmental Protection Agency (EPA) released draft health-based recommendations for levels of per- and polyfluoroalkyl substances (PFAS) in water bodies. These



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draft recommendations target three PFAS chemicals – perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), and perfluorobutane sulfonic acid (PFBS). These draft human health criteria recommendations are not legally binding requirements and they do not substitute for the Clean Water Act (CWA) or other approved regulations.

It is important to note that these recommendations are currently in draft form and subject to change based on feedback received during the 60-day public comment period, ending on February 24, 2025. Stakeholders, including industry representatives, public entities and scientific experts, have the opportunity to provide input during this period. Following the comment phase, the EPA will review the feedback, revise the draft recommendations as necessary, and determine a timeline for finalization. Given the extensive rulemaking process1 under the CWA2 and the Administrative Procedure Act,3 it is unlikely that these draft recommendations will become finalized and approved within 2025, offering time for continued discussion and scientific review.

Read More

JD Supra, 07-01-25

https://www.jdsupra.com/legalnews/epa-releases-draft-human-health-6008660/

## EPA adds 9 PFAS to Toxics Release Inventory list

*2025-01-06*

Nine per- and polyfluoroalkyl substances have been added to the list of chemicals covered by the Toxics Release Inventory.

The U.S. Environmental Protection Agency (EPA) has added nine per- and polyfluoroalkyl substances to the list of chemicals covered by its Toxics Release Inventory.

These nine PFAS were added to the inventory list pursuant to the 2020 National Defense Authorization Act, which provides the framework for the automatic addition of PFAS to the inventory each year in response to specified EPA activities involving such PFAS.

The act includes a provision that automatically adds PFAS to the list upon the agency's finalization of a toxicity value. These nine PFAS were automatically added for reporting year 2025 due to EPA having finalized a toxicity value during 2024:

- Ammonium perfluorodecanoate (PFDA NH4)
- Sodium perfluorodecanoate (PFDA-Na)
- Perfluoro-3-methoxypropanoic acid
- 6:2 Fluorotelomer sulfonate acid
- 6:2 Fluorotelomer sulfonate anion
- 6:2 Fluorotelomer sulfonate potassium salt
- 6:2 Fluorotelomer sulfonate ammonium salt
- 6:2 Fluorotelomer sulfonate sodium salt
- Acetic acid, [(γ-ω-perfluoro-C8-10-alkyl)thio] derivs., Bu esters

Read More

Waste Today, 06-01-25

https://www.wastetodaymagazine.com/news/epa-adds-9-pfas-to-toxics-release-inventory-list/

## EPA Finalizes Protections for Workers and Communities from Cancer-Causing Ethylene Oxide Pollution

*2024-01-14*

**WASHINGTON** – Today, Jan. 14, the U.S. Environmental Protection Agency released the Interim Decision for Ethylene Oxide (EtO) – a pesticide used on 50 percent of all sterilized medical devices in the United States and on approximately 30 percent of dried herbs and spices. EtO is known to cause cancer, including lymphocytic leukemia, breast cancer, non-Hodgkin lymphoma and myeloma in people.  Workers who use EtO and people who work, live, or go to school or daycare near facilities that use EtO may breathe in emissions at levels that can increase cancer risk. The greatest risk is for people who work for their entire careers at facilities directly handling EtO with insufficient worker protections in place.

The Interim Decision includes mitigation measures that, in addition to the measures included in the 2024 EtO National Emissions Standards for Hazardous Air Pollutants(NESHAP), will reduce exposure to workers and nearby communities. Together, these two EPA actions provide a comprehensive approach to addressing EtO pollution concerns, including cancer risk, that will increase safety in communities and for workers while supporting ongoing supply chain needs for sterilized medical equipment. This decision advances President Biden's commitment to ending cancer as we know it as part of the Cancer Moonshot, as well as the Administration's commitment to securing environmental justice and protecting public



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health, including for communities that are most exposed to toxic chemicals.

"EPA continues to make important strides to protect people from dangerous chemicals like ethylene oxide," said Assistant Administrator for the Office of Chemical Safety and Pollution Prevention Michal Freedhoff. "These protections will reduce EtO exposures to workers and communities, while also ensuring that the chemical remains available to provide sterile life-saving medical supplies."

**Ethylene Oxide**

EPA regulates EtO's use as a pesticide under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). EtO has both antimicrobial uses, such as sterilization of medical devices, and conventional uses, such as fumigation of dried herbs and spices. In some instances, such as with sterilization of medical devices like surgical kits, EtO is the only available option, making it essential for protecting human health. Every 15 years, EPA evaluates potential human health and environmental effects associated with the use of a pesticide through the registration review process. As part of EtO's registration review, the agency assessed cancer risk from working in sterilization and health care facilities that use EtO, living in communities near EtO facilities, and consuming dried herbs and spices treated with EtO.

After a 75-day public comment period with over 60 stakeholder meetings with industry, other federal agencies, unions, and nonprofit organizations, EPA identified a broad set of protections under FIFRA that aim to reduce exposure to all EtO sterilization facility workers and to others who work, live, or go to school near sterilization facilities. Specifically, the Decision includes a reduced EtO concentration rate limit for new medical device sterilization cycles to reduce levels of exposure for workers; a lowered worker exposure limit of 0.5 ppm after three years, 0.25 ppm after five years, and 0.1 ppm after 10 years (compared to the current Occupational Safety and Health Administration standard of 1 ppm);  phased cancellation of the use of EtO on specific dried herbs and spices; and cancellation of the use of EtO when safer and effective alternatives are available.

**Interim Decision**

Some of the highlights of the Interim Decision include:

Commercial Sterilizers

- Lowered worker exposure limit of 0.5 ppm by 2028, 0.25 ppm by 2030, and 0.1 ppm by 2035, as compared to the 1984 OSHA limit of 1 ppm. Any workers who could be exposed to concentrations of EtO above these limits would need to wear additional respiratory protection.
- Finalizing the ban of use for museum, library and archival materials; cosmetics; musical instruments; and beekeeping equipment.
- Immediate cancellation of the use of EtO for specific dried herbs and spices for which its use is not considered critical for food safety, and phased cancellation for specific dried herbs and spices for which EtO use is considered critical for food safety but have potential alternatives to EtO.
- Establishing a concentration limit of 600 mg/L for new medical device sterilization cycles within 10 years. If a device requires a concentration of EtO greater than 600 mg/L due to the device design, the facility must maintain records to justify the increased application rate.
- Separation of HVAC systems for areas where EtO is used and areas where EtO is not used, to reduce EtO exposure in areas such as offices.
- Requiring respirators to protect workers involved in certain high EtO exposure tasks, such as connecting and disconnecting EtO containers from sterilization process equipment.
- Continuous EtO concentration monitoring throughout sterilization facilities, including on-site storage facilities.
- Data requirements to monitor breathing zone worker exposure to EtO within commercial sterilization facilities and warehouses that store sterilized materials, both on and off-site.
- Healthcare Facilities
- Require abatement devices for healthcare facilities that use more than 10 lbs. of EtO/year by comparison – c commercial sterilizers typically release tons of EtO annually.
- Ventilation of EtO through exterior ventilation stacks to reduce exposure to healthcare facility workers. Exposure to communities from EtO used in healthcare facilities is expected to be minimal because the amount of EtO used at healthcare facilities is orders of magnitude lower than at commercial sterilization facilities.

**Next Steps**

EPA expects that registrants will submit label amendments that include the changes outlined in the Interim Decision within 60 days after publication. The agency plans to quickly review the label amendments so that products sold and distributed by registrants will include the



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changes outlined in the Interim Decision. The timing for implementation for individual mitigation measures ranges from two years to 10 years, taking into consideration the costs, technology availability, potential impacts to the medical device supply chain and other logistical elements. Additionally, EPA will issue a Data Call-In (DCI) to gather information on worker exposure. Specifically, the DCI will require submission of worker exposure data for commercial sterilizers and warehouses in order to understand the worker exposure impacts of complying with EPA's Clean Air Act EtO commercial sterilization NESHAP and implementing the mitigation measures identified in this Interim Decision. EPA will reevaluate this Interim Decision within eight years, earlier than the typical 15-year cycle, based on the submitted worker exposure data, in order to identify further opportunities to reduce EtO exposures.

To view all documents related to EtO's registration review, visit docket EPA-HQ-OPP-2013-0244.

Read More

US EPA, 14-01-24

https://www.epa.gov/pesticides/pesticide-news-stories

## EUROPE

### Unpacking EU packaging rules: The good, the bad, and the single use

*2025-01-22*

The EU Packaging and Packaging Waste Regulation (PPWR) provides a foundation for more sustainable packaging but leaves too much room for voluntary adoption. For a stronger commitment to reducing packaging waste, we need Member States to go beyond the minimum requirements of the regulation. It will be crucial to adopt ambitious secondary legislation and standards that will address sustainable waste management, helping the much-needed shift towards more sustainable packaging.

The new EU Packaging and Packaging Waste Regulation (PPWR) has an important goal to reduce the rising amount of packaging waste that overwhelms our planet. It sets a clear pathway for waste reduction, as Member States are expected to reduce packaging waste per capita – compared to the levels recorded in 2018.

**Implementation timeline: Packaging and Packaging Waste Prevention**

**Packaging waste prevention targets for Member States**

- 5% – 2030
- 10% – 2035
- 15% – 2040

**Reusable targets are promising but with too many exceptions**

The new rules require some packaging to be reusable, but this important target does not broadly apply. In some cases, the obligation to use reusable packaging is optional depending on the sector, the product, or the size of the business.

The transport sector, for example, can use single-use packaging when using cardboard boxes or when shipping dangerous goods. There are also numerous exemptions for bottled drinks. Packaging for certain products, such as wine and milk, is exempt from reuse targets (a real missed opportunity!) and small businesses are allowed to sell products in single-use packaging.

Read More

ECOS, 22-01-25

https://ecostandard.org/news_events/ppwr-plastic-packaging-regulations

## The time for delay is over: EU must phase out pesticides and build sustainable food systems

*2025-01-27*

85 organisations – including environmental, health, and human rights groups, as well as farm worker unions and farmer organisations – have created a Roadmap for Pesticide Phase-Out for EU policy-makers. This document outlines key demands and actionable steps to reduce pesticide use and risk across Europe, advocating for an agricultural future that prioritises human health, environmental protection and a fair, secured future for farmers. It is essential that the recommendations are represented in the upcoming EU Vision for Agriculture and Food.

The organisations remind the European Commission of Farm to Fork and post-2020 Global Biodiversity targets, and of the loud and repeated calls of civil society and scientists to ambitiously reduce pesticides [1].



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Enrico Somaglia, EFFAT General Secretary said: "Farm workers require a just transition away from pesticides, alongside targeted measures to ensure enhanced protection against pesticide exposure and handling. These measures must be grounded in real-world conditions, offering access to comprehensive training, clear and practical worker information, stricter enforcement of occupational health and safety standards, and proactive prevention initiatives to raise awareness among workers. Furthermore, occupational diseases resulting from pesticide exposure should be officially recognised by social security systems across Europe and compensated fairly and appropriately."

The Roadmap comes ahead of the publication of the EU Commission's upcoming Vision for Agriculture and Food, which is expected to be presented on the 17 FEBRUARY February. It urges the Commission to make pesticide reduction a reality. It is of the utmost importance for the EU to actually start implementing existing legislations, and take real steps to phase out toxic pesticides. Implementation of Integrated Pest Management, mandatory since 2014, has been largely absent. The organisations also point at the currently used Harmonised Risk Indicator I, which is unfit for purpose, misleading and should be urgently replaced. Also the need for the right supportive framework to transition away from toxic pesticides is among the key demands, including high-expert independent advisory systems.

Read More

EFFAT, 27-01-25

https://effat.org/in-the-spotlight/the-time-for-delay-is-over-eu-must-phase-out-pesticides-and-build-sustainable-food-systems/

## Joint statement on repair in the EU vehicle law

*2025-01-22*

Early obsolescence is threatening vehicle repair, with dire consequences for consumers, businesses and the environment. Alongside a coalition of European NGOs and industries, we call on the EU Parliament to improve vehicle repair and reuse through the upcoming regulation on vehicle design and end-of-life management.

The issue at hand: Vehicle repairability is on the decline, as the rise of non-dismantlable design, the unavailability of spare parts, and the increased complexity of electronic components are driving early obsolescence in newer vehicles.

This has profound social, economic, and environmental implications:

- With 88% of Europeans relying on cars, unrepairable vehicles increase repair costs, limit consumers' right to repair, and force premature replacements. In addition, insurers facing rising repair costs may also lead to higher premiums for consumers.
- Anti-repair strategies by non-European manufacturers jeopardise the automotive aftermarket ecosystem, threatening local jobs and businesses in repair and maintenance.
- Vehicles consume vast quantities of raw materials, including critical resources vital to EU strategic autonomy. Improving repairability and reuse, especially for electric vehicle batteries, is crucial to reducing resource use and environmental strain.

**The solution:** The new EU regulation on vehicles design and end-of-life management presents an opportunity to address these issues. The statement calls on the European Parliament to:

- Promote modular design strategies for vehicles.
- Ensure the availability of spare parts and software updates at fair, non-discriminatory prices.
- Address anti-repair practices and guarantee access to repair information.
- Ensure the repairability of electric vehicle batteries, given their significance in cost, material use, and vehicle functionality.

Read More

EEB, 22-01-24

https://eeb.org/library/joint-statement-on-repair-in-the-eu-vehicle-law/

## INTERNATIONAL

### Closing in on an end to plastic pollution

*2025-01-23*

After two years of talks, we are closer to securing a treaty for the ages. One that hits the problem of plastic pollution hard and protects human, planetary and economic health.

A high degree of convergence has been reached in 29 out of 32 articles that are proposed to make up the treaty text. However, three areas require significant further work. Products, including the issue of chemicals.



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Sustainable production and consumption. Financing, including a financial mechanism and aligning financial flows.

There is a strong determination across Member States, across communities, across science, across civil society and across industry to get the treaty done. But a big political and diplomatic push is needed in the coming months, with the engagement of all stakeholders and strong G20 leadership, to lay the ground for success at INC 5.2.

Businesses have been engaged from the start and have a continued critical role to play, as do non-governmental organizations and other groups. Businesses have been calling for global rules. On Extended Producer Responsibility, which will make it easier for them to do their jobs with efficiency. On chemical additives of concern in plastic products where there are exposure risks.

Read More

UNEP, 23-01-25

https://www.unep.org/news-and-stories/speech/closing-end-plastic-pollution

# REACH Update

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## Corrigendum: testing proposals

*2025-01-25*

We launched 25 new consultations on testing proposals last week.

The correct deadline for submitting comments is 10 March 2025 (instead of 7 March, as indicated in our last bulletin).

Read More

ECHA, 31-01-25

https://echa.europa.eu/news

## Assessment of regulatory needs reports published

*2025-01-31*

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

- Long chain aliphatic benzylic quaternary ammonium compounds; and
- Non-cyclic carboxylic acid anhydrides.

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

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ECHA, 31-01-25

https://echa.europa.eu/news



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# Janet's Corner

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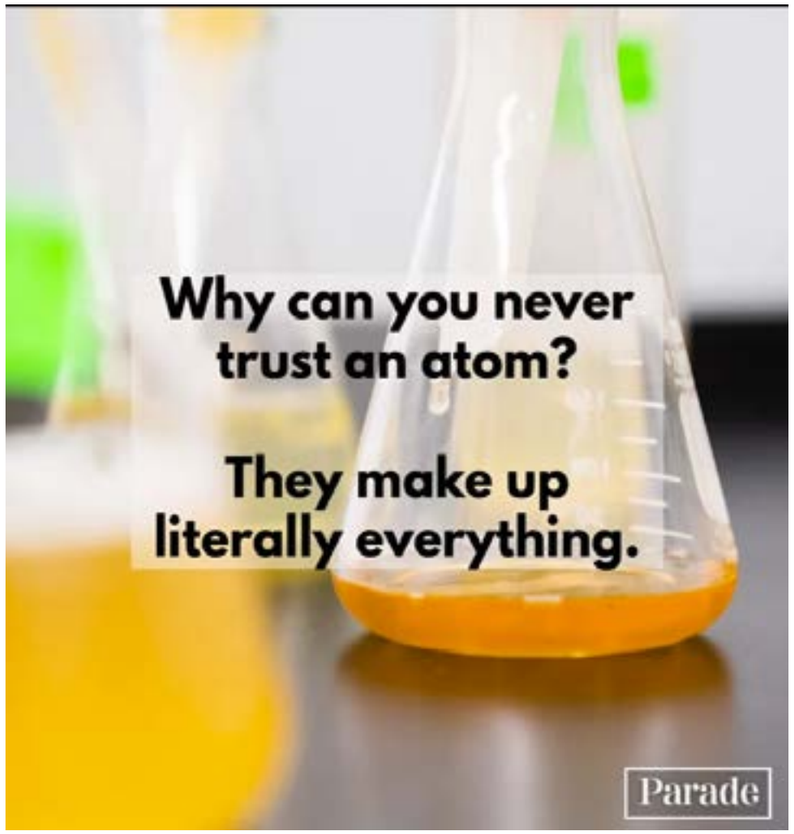
## Atoms

*2025-02-07*




https://parade.com/.image/c_limit%2Ccs_srgb%2Cq_auto:good%2Cw_700/MTkwNTgxMjQyMDMxNzc2ODkz/chemistry-jokes-atoms.webp

## Carbon Monoxide

*2025-02-07*

### USES [2,3]

Carbon monoxide is an industrial gas that has many applications in bulk chemicals manufacturing. Large quantities of aldehydes are produced by the hydroformylation reaction of alkenes, carbon monoxide, and H2. Hydroformylation is coupled to the Shell Higher Olefin Process to give precursors to detergents. Methanol is produced by the hydrogenation of carbon monoxide. In a related reaction, the hydrogenation of carbon monoxide is coupled to C-C bond formation, as in the Fischer-Tropsch process where carbon monoxide is hydrogenated to liquid hydrocarbon fuels. This technology allows coal or biomass to be converted to diesel. In the Monsanto process, carbon monoxide and methanol react in the presence of a homogeneous rhodium catalyst and hydroiodic acid to give acetic acid. This process is responsible for most of the industrial production of acetic acid. An industrial scale use for pure carbon monoxide is purifying nickel in the Mond process.

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

#### Exposure Sources

Some common products that can emit carbon monoxide when you use them are:

- barbeques that use wood, charcoal or gas
- fireplaces that use wood, charcoal or gas
- portable cookers that use gas or kerosene
- portable and/or outdoor heaters that use gas or kerosene
- flued gas heaters (under certain conditions)
- electrical generators that are diesel- or petrol-powered
- electrical equipment that is diesel- or petrol-powered (such as pumps, chainsaws, blowers and welders).

#### Routes of Exposure

Exposure to carbon monoxide can occur through inhalation of the gas and eye or skin contact with the liquid. [3] Carbon monoxide is then quickly absorbed into the bloodstream from the lungs.

**Carbon monoxide (CO), also called carbonous oxide, is a colourless, odourless, and tasteless gas that is slightly lighter than air. It can be toxic to humans and animals when encountered in higher concentrations, although it is also produced in normal animal metabolism in low quantities and is thought to have some normal biological functions. However, in the atmosphere it is short lived and spatially variable, since it combines with oxygen to form carbon dioxide and ozone. Carbon monoxide consists of one carbon atom and one oxygen atom, connected by a triple bond that consists of two covalent bonds as well as one dative**



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### HEALTH EFFECTS [4]

#### Acute Health Effects

Carbon monoxide is an asphyxiant in humans. Inhalation of carbon monoxide causes tissue hypoxia by preventing the blood from carrying sufficient oxygen. It combines reversibly with haemoglobin to form carboxyhemoglobin. The reduction in oxygen-carrying capacity of the blood is proportional to the amount of carboxyhemoglobin formed. All factors that speed respiration and circulation accelerate the rate of carboxyhemoglobin formation; thus exercise, increased temperature, high altitude, and anaemia increase the hazard associated with carbon monoxide exposure. Other conditions that increase risk are hyperthyroidism, obesity, bronchitis, asthma, pre-existing heart disease, and alcoholism. Carbon monoxide can be transported across the placental barrier, and exposure in utero constitutes a special risk to the foetus. Infants and young children are generally believed to be more susceptible to carbon monoxide than adults. The elderly are also believed to be more susceptible to carbon monoxide poisoning. A capacity to adapt to carbon monoxide exposure has been reported in several human studies.

The signs and symptoms of acute exposure to carbon monoxide may include headache, flushing, nausea, vertigo, weakness, irritability, unconsciousness, and in persons with pre-existing heart disease and atherosclerosis, chest pain and leg pain.

### SAFETY

#### First Aid Measures [5]

- Eye Contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.
- Skin Contact: After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.
- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

- Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.
- Ingestion: Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

**Workplace Controls & Practices [4]**

**What should I do if someone becomes ill from breathing carbon dioxide gas?** If symptoms are experienced, remove source of contamination or move to fresh air and obtain medical advice.

What do I do if someone gets carbon dioxide gas on their skin?

- **Gas:** Not applicable.
- **Liquefied gas:** Quickly remove victim from source of contamination and briefly flush with lukewarm, gently flowing water until the chemical is removed. Do not attempt to rewarm the affected area on site. Do not rub area or apply dry heat. Gently remove clothing or jewellery that may restrict circulation. Carefully cut around clothing that sticks to the skin and remove the rest of the garment. Loosely cover the affected area with a sterile dressing. Do not allow victim to drink alcohol or smoke. Quickly transport victim to an emergency care facility.

## REGULATION

**United States**

The following exposure limits are for Coal Tar Pitch Volatiles:

- **OSHA:** The United States Occupational Safety and Health Administration has set the following Permissible Exposure Limit (PEL) for carbon monoxide:
  General Industry: 29 CFR 1910.1000 Z-1 Table -- 50 ppm, 55 mg/m3 TWA
- Construction Industry: 29 CFR 1926.55 Appendix A -- 50 ppm, 55 mg/m3 TWA
- Maritime: 29 CFR 1915.1000 Table Z-Shipyards -- 50 ppm, 55 mg/m3 TWA



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- **ACGIH:** American Conference of Governmental Industrial Hygienists has set a Threshold Limit Value (TLV)for carbon monoxide of 25 ppm, 29 mg/m3 TWA
- **NIOSH:** National Institute for Occupational Safety and Health has set a Recommended Exposure Limit (REL) for carbon monoxide of 35 ppm, 40 mg/m3 TWA; 200 ppm, 229 mg/m3 Ceiling.

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Omega-3 Supplements Slow Biological Aging, Study Suggests

*2025-02-05*

Omega-3 supplements can slow down biological aging in older people, according to a new study.

This benefit may even be boosted by combining the supplements with vitamin D and exercise.

In a 3-year longitudinal trial involving participants aged 70 years or over, researchers found that consuming just 1 gram of omega-3 supplements per day slowed 3 out of 4 of the participants' epigenetic clocks.

On its own, vitamin D supplementation didn't appear to slow any of the studied clocks, but all four were slowed in the participants who consumed both supplement types and regularly exercised.

The findings were published in Nature Aging.

**Stop the clocks**

Omega-3 fatty acids – which can be found in oily fish and certain nuts and seeds – have been shown to reduce inflammation in the body and improve heart and brain health.

Other research has linked the fatty acids to changes in epigenetic markers, chemical tags on DNA that affect genes and, in some cases, biological aging.

To test this link, the researchers from the University of Zurich analyzed data taken from the DO-HEALTH cohort, a clinical trial project designed to support healthy aging in European seniors.

Out of the 2,157 participants in the study, 777 participants (aged between 70 and 91 years) were split into groups and asked to consume either an omega-3 supplement, a vitamin D supplement or both every day; some were also asked to combine this supplementation with a light exercise routine 3 times a week.

Blood samples were collected from the participants once a year.

After three years, the researchers found that the participants' omega-3 habit moderately slowed biological aging across three of the four studied epigenetic clocks by up to four months.



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The participants that only took daily vitamin D supplements didn't display any such slowed aging, but those who took both supplements and stuck to the exercise routine did – all four of their epigenetic clocks were slower.

The findings have been greeted with cautionary optimism by other researchers in the field of aging.

"It's exciting to see these results showing the benefits of omega-3, vitamin D and exercise on aging." Dr. Mary Ni Lochlann, a postdoctoral research fellow in geriatric medicine at King's College London, told the UK's Science Media Centre in a statement.

"While the study was focused on healthy and active older adults and led to a relatively small improvement in their ageing-biological-clocks, it adds to the growing evidence that these simple and fairly low-cost interventions are beneficial and, based on this and previous existing research, worth engaging in for adults as they get older."

Technology Networks, 5 February 2025

https://technologynetworks.com

## Value-added pancakes: Using science to improve nutrition of breakfast staple

*2025-02-05*

Typical breakfast pancakes are soft, fluffy and delicious but, sadly, not terribly healthy. Food scientists at Washington State University are working to change that by boosting the popular morning favorite's nutritional value while enhancing its taste and texture.

"Generally, pancakes are made with refined flours, contributing to empty calories," said Girish Ganjyal, a professor and food processing specialist in WSU's School of Food Science. "We wanted to see if it's possible to make tasty pancakes with whole grains that add some fiber and protein."

Ganjyal and his study co-authors replaced refined flour with whole-grain buckwheat, quinoa, millet, and whole-wheat flours in a variety of percentages ranging from 25% up to 100% apiece. The encouraging results were published in the journal Cereal Chemistry.

The team found that buckwheat, quinoa, and whole-wheat flours can be mixed into pancake recipes without significant changes to the taste or texture. The millet flour had to be slightly pre-cooked before it could be added seamlessly.

"We started with a small level of replacement flours, then kept increasing them until it wasn't practical," Ganjyal said. "With millet flour, for example, we found that it basically just crumbles; there was no binding."

The scientists used the same recipe for all the pancakes. The different flours were the only variable, and the recipe's leavening system and other ingredients like sugar, oil, flour, and salt remained constant. The recipes with the different flours and percentages were compared with the control pancakes, which were made with refined flour and all of the same other ingredients.

The study was part of WSU's Soil to Society project, which launched in 2021 with a grant from the USDA's National Institute of Food and Agriculture. The project takes a comprehensive approach to increasing foods' nutrient values and involves a multi-disciplinary team of plant breeders, nutrition experts, and food scientists. Ganjyal hopes flour manufacturers will use the research to produce healthier products for restaurants and consumers.

He is already continuing the research by trying to understand why various flours behave differently under cooking conditions. He and his team hope to modify the flours so their textures become indistinguishable from the refined version.

The original project required cooking many pancakes and then measuring them at various points throughout the process for different traits like viscosity, cook time, size, and texture. The paper's co-authors included a WSU graduate student, an undergraduate, and a high school intern with the Soil to Society project.

"She spent a lot of time over a griddle," Ganjyal said. "She also learned the fundamentals of how we do our work. One of the best parts of my job is training the next generation, and hands-on experience like this lets students see how we can help improve the food system for everyone. I have been lucky to have brilliant students in my research and Extension program."

Phys Org, 5 February 2025

https://phys.org



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## Sticky Sparks: How Everyday Tape is Powering the Future

*2025-02-04*

Scientists have found a way to turn static electricity into usable energy using a simple, cost-effective triboelectric nanogenerator.

By upgrading their previous design with heavy-duty tape, they improved efficiency and increased power output. The device can generate enough energy to light LEDs and function as a self-powered sensor, hinting at future applications in wearable tech and energy harvesting.

**Harnessing Static Electricity for Power**

Static electricity might be an everyday nuisance, especially in winter, but for some scientists, it holds untapped potential as an energy source. Using a device called a triboelectric nanogenerator (TENG), mechanical movement can be converted into electrical energy through the triboelectric effect.

While many TENGs rely on costly, specially manufactured materials, one research team has taken a different approach — using affordable, store-bought tape, plastic, and aluminum. Their latest advancements in this tape-based TENG were recently published in ACS Omega.

Led by Gang Wang and Moon-Hyung Jang, the team had previously developed a TENG by layering double-sided tape, plastic film, and aluminum. When the layers were pressed together and then pulled apart, they generated a small amount of electricity. However, the strong adhesion of the double-sided tape made separation difficult, requiring excessive force and limiting efficiency.

**An Improved Design for Greater Efficiency**

For the new and improved TENG, researchers replaced the double-sided tape with layers of thicker, heavy-duty single-sided tape. Unlike the old version, power is generated by the interaction between the polypropylene backing of the tape and the acrylic adhesive layer. The smooth surfaces can easily stick and unstick from one another, enabling the TENG to be rapidly connected and disconnected, thereby generating even more power in a shorter amount of time than before. Researchers accomplished this by placing the TENG atop a vibrational plate that bounced the tape layers apart, generating electricity as they came into contact and separated repeatedly.

**Promising Results and Potential Applications**

In tests, the new device produced a maximum power of 53 milliwatts. Additionally, it created enough power to light more than 350 LED lights as well as a laser pointer. The team also incorporated the tape TENG into two sensors: a self-powered, wearable biosensor for detecting arm movements and an acoustic sensor for sound waves.

This study demonstrates the utility of a low-cost TENG that performs well, and the researchers hope the device's applications can expand into power generation and self-powered sensors.

Sci Tech Daily, 04 February 2025

https://scitechdaily.com

## Silver Nanoparticles in Packaging Can Contaminate Dry Foods

*2025-02-28*

Incorporating silver nanoparticles (AgNPs) into plastic packaging has been proposed as a novel way to protect against foodborne disease and extend the shelf life of food.

Despite their demonstrated promise for this purpose, nanoparticle-infused polymers are not yet authorized in the United States or European Union for use as food packaging. This is largely due to the need for further studies proving that silver nanoparticles and ions will not migrate into the food they contact.

New research led by scientists at the US Food and Drug Administration (FDA) suggests that AgNPs can leach out of plastic packaging and into solid foods. The study, published in ACS Food Science & Technology, found evidence of nanoparticle migration into dry goods (flour and ground rice), moist solid foods (cheese slices) and leafy greens (spinach leaves).

**Understanding nanoparticle migration**

Studying the migration of nanoparticles out of these plastic matrices is not a new endeavor. Early assessments concluded that nanoparticles larger than a few nanometers in diameter would be too large to diffuse through and out of plastic packaging under commercially relevant timescales.

However, subsequent studies using beverages, gelatinous foods (such as yogurt) and liquid food simulants have shown that AgNP-containing



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plastics can release dissolved silver ions into the food they contain. In some cases, these ions were found to induce silver nanoparticle formation in foods during long-term storage.

One significant limitation of past studies is that they have mainly assessed liquids or liquid food simulants rather than packaged foods like dry goods (grains, cereals) or moist solids (cheese slices, deli meat).

This is an important distinction to make, as solid foods will have different interactions with their packaging than a beverage or liquid simulant. There is normally less contact between solid food and its packaging due to air bubbles, for example, which may make the direct migration of nanoparticles more difficult. Solid foods are also likely to have a harder time penetrating or degrading the polymer, which would otherwise increase the likelihood of nanoparticle migration or silver ion release.

In this latest study, the FDA researchers aimed to answer the question of whether AgNPs can transfer into solid foods from this kind of polymer nanocomposite (PNC) packaging.

**Silver nanoparticles can transfer without a liquid medium**

The researchers performed three different experiments to test whether AgNPs might migrate into solid foods.

"This study is the first to broadly consider the question of whether inorganic NPs, including AgNPs, can migrate out of PNC packaging and into either solid foods or abiotic surfaces under commercially relevant conditions (long-term room temperature or refrigerated storage)," the researchers wrote.

"To answer this fundamental question, we conceived of a simple model system to test whether NPs embedded in a polymer can migrate to a "non-fluid simulant" when the two materials are held in contact with each other for an extended time."

This first test took two discs of polymer — one plain and one embedded with luminescent nanocrystals — and pressed them together using a clamp. After being held together for some time, the two were separated and photographed under UV light. This revealed a luminescent glow on the plain polymer disc, proving that ultrasmall nanoparticles can pass from a "donor" polymer to an "acceptor" polymer through sustained contact under simulated long-term storage conditions.

The second test repeated this, but using AgNPs in place of the luminescent nanocrystals. As AgNPs do not react under UV light, any nanoparticle migration was assessed by testing the plain polymer disc using laser scanning confocal microscopy (LSCM) and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). This revealed traces of silver in the plain polymer disc, proving that AgNPs can transfer into other solid materials.

**Silver nanoparticles can migrate into cheese, flour, and leafy greens**

The third test involved placing real food samples — sliced cheese (to represent moist foods), all-purpose flour (to represent dry goods) and spinach leaves (to represent fresh produce) into sachets made from AgNP-infused polymer.

Analysis by ICP-MS revealed a "significant migration" of Ag into all three food samples.

The researchers also investigated whether there was any difference between samples of spinach that were washed in clean water after being removed from the sachet versus unwashed leaves. While the amount of Ag on the washed leaves was significantly lower, "significant Ag migration" was still found in both the washed and unwashed leaves.

"The fact that washing did not remove all the Ag may indicate some penetration of Ag into the leaves' interiors or that Ag may become trapped in pore spaces or other surface topological features that renders rinsing inefficient," the researchers wrote.

To probe whether food particle size might also affect Ag migration, a further two sachets were prepared containing either fine or coarse ground white rice. Significantly higher migration was observed in the case of the finely ground rice. The researchers believe this indicates the importance of polymer-food contact efficiency in controlling Ag migration in food.

"The observation of Ag migration to foods that vary considerably in terms of their moisture and fat content, and particularly that the amount of migration can depend on the food particle size, processing characteristics, and washing strategy, implies that more work is needed to understand the factors that may influence NP migration from PNCs intended for use in packaging of solid foods, including food chemistry/structure (polarity, moisture content, surface topology, particle size), NP characteristics (size,



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composition), and polymer type (composition, crystallinity, processing conditions)," the researchers concluded.

Technology network, 28 February 2025

https://technologynetworks.com

## Sustainable plant-based membrane works without fossil fuel materials and toxic solvents

*2025-02-04*

They are used in cleaning our drinking water, treating sewage, processing foods and keeping pharmaceuticals safe—membranes are a crucial part of everyday life.

Now, chemical engineers at the University of Bath have made an effective and more sustainable plant-based nanofiltration membrane, which—in a world first—does not use fossil fuel-derived materials or toxic solvents.

Made from two renewable and sustainable plant-derived materials—cellulose and lignin—the new polyelectrolyte membrane (PEM) design has been proven in testing to effectively filter water dyes of a range of different molecular weights, which are used to represent different pollutants' sizes.

The technology could be used in fields including water purification and wastewater treatment, replacing existing equivalents that use fossil fuels in their production.

The results are detailed in a new research paper, "Lignin- and Cellulose-Derived Sustainable Nanofiltration Polyelectrolyte Membranes," published in ACS Sustainable Chemistry & Engineering.

Dr. Olawumi Sadare, a Royal Society Newton Fellow in Bath's Department of Chemical Engineering, and co-author of the paper, said, "The potential of this technology to reduce environmental impacts is particularly crucial, especially in light of upcoming EU legislation to curb the use of toxic solvents, and the proposed bans on fluorinated polymers in membrane manufacturing.

"Another desirable aspect of the membrane we have created is that you can control its thickness as you wish to tune the permeance characteristics, or how selective it is."

The membrane also demonstrated excellent stability and performance after 30 days in water, proving its durability.

Professor Davide Mattia, from Bath's Center for Integrated Materials, Processes and Structures, co-authored the research paper. He said, "Chemical separations consume 10%–15% of the world's energy, and membranes are considered the most promising technology to dramatically reduce the carbon footprint of these vital processes.

"As such, the focus has always been on improving membrane performance, with little attention paid to the impact of their manufacturing. All commercial membranes manufactured today use toxic organic solvents and fossil-fuel derived materials, particularly polymers.

"These not only emit carbon to manufacture them but also cannot be recycled and end up in a landfill. The approach we developed focuses on making membrane manufacturing sustainable, while producing a membrane that has comparable performance to commercial ones."

The research team includes Dr. Olawumi Sadare, Dr. Liana Zoumpouli, Prof John Chew, Dr. Jannis Wenk, Dr. Bernardo Castro-Dominguez and Prof Davide Mattia.

The researchers have applied for patent protection for technology and are taking steps toward commercializing the membrane. Future research will focus on further testing the membrane's performance in water treatment, and in the removal of PFAS forever chemicals.

Phys Org, 4 February 2025

https://phys.org

## Cornell Researchers Create First-of-Its-Kind Durable and Recyclable Plastic

*2025-02-03*

Researchers have created a recyclable, bio-based alternative to thermoset plastics using dihydrofuran (DHF).

Cornell University researchers have developed a recyclable alternative to thermoset plastics, a durable class of materials commonly used in car tires, replacement hip joints, and bowling balls.

Thermosets are characterized by a crosslinked polymer structure that ensures exceptional strength and longevity. However, this same structure has made traditional, petrochemical-based thermosets— which account for 15% to 20% of all polymers produced—impossible to recycle.



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"Currently, zero percent of the world's thermoset materials are recycled – they're either incinerated or thrown in landfills," said Brett Fors, professor of chemistry and chemical biology at Cornell.

**A Bio-Based, Recyclable Solution**

The Fors lab has addressed that environmental challenge by creating an alternative made from a bio-sourced material that has crosslinked thermosets' durability and malleability but can be easily recycled and degraded.

"The whole process, from creating to reusing, is more environmentally friendly than current materials," said Reagan Dreiling, a doctoral student in the field of chemistry and first author of the paper, which published in Nature.

The Fors group studies dihydrofuran (DHF), a monomer – or chemical building block – that can be made from biological materials and has the potential to eventually compete with petroleum-based feedstocks.

**How the New Material Works**

Dreiling used DHF, a circular monomer with a double bond, as a building block for two successive polymerizations, the second of which results in a crosslinked polymer that can be recycled through heating and will degrade naturally in the environment.

DHF thermosets show comparable properties to commercial thermosets, including high-density polyurethane (used in electronics instruments, packaging, and footwear, for example) and ethylene propylene rubber (used in garden hoses and automotive weatherstripping).

In contrast to current petrochemical thermosets, the DHF-based materials offer a circular economy of use, Fors said. Chemically recyclable, the material can be made back into its building block monomer and used again from scratch. And when some of the material inevitably leaks into the environment, these materials will degrade over time into benign components.

The researchers are working toward applications, including making the DHF-based material useful for 3D printing. They are also experimenting to expand the properties with additional monomers.

"We've spent 100 years trying to make polymers that last forever, and we've realized that's not actually a good thing," Fors said. "Now we're

making polymers that don't last forever, that can environmentally degrade."

Sci Tech Daily, 2025-02-03

https://scitechdaily.com

## Researchers discover simple solution to break down forever chemicals

*2025-02-05*

A University of Missouri researcher has discovered a new method to remove so-called "forever chemicals" from our drinking water.

Per- and polyfluoroalkyls (PFAS) are industrial chemicals used to manufacture thousands of products, including cosmetics, carpeting, non-stick cookware, stain-resistant fabrics, firefighting foams, food packaging and waterproof clothing.

They're everywhere -- the environment, our food and even in our bodies. Peer-reviewed studies have shown that exposure to PFAS may lead to decreased fertility, developmental delays in children and increased risk of some cancers. And they take hundreds or even thousands of years to break down.

For roughly the past 10 years, researchers have been looking for ways to remove PFAS from the environment or at least degrade them into harmless, inorganic compounds.

Now, Feng "Frank" Xiao, an associate professor in Mizzou's College of Engineering, and team have found a simple solution using common tools and materials.

"You don't need organic solvent or really high temperatures," Xiao, an expert in degrading PFAS, said. "Just heat the PFAS with granular activated carbon, or GAC."

GAC is composed of granules of coal, wood or other carbon-rich materials that have been heated. It is already commonly used to filter a wide range of harmful chemicals from contaminated water or air. Consumers use it to clean household aquariums or filter drinking water, and it can be purchased online for just a few dollars per pound.

In a paper recently published in the journal Environmental Science and Technology, Xiao and his team describe how they heated PFAS with



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common GAC at 572 degrees Fahrenheit. As a result, the researchers achieved 90% mineralization of the PFAS, breaking the forever chemicals down into harmless, inorganic fluorine.

Before now, reaching this level of mineralization required temperatures in excess of 1292 degrees Fahrenheit, high pressure or solvents. Xiao's method is much more cost effective and sustainable, as GAC is inexpensive and can be reheated again and again.

**Potential applications**

The key to Xiao's innovation is the combination of GAC and heat.

"Once GAC is involved, the thermal degradation of PFAS occurs much faster, and the mineralization is more intense," Xiao said. "It's not an expensive process, compared to reverse osmosis, and it can be done at local scale with a regular furnace."

The discovery represents a significant breakthrough in managing PFAS-containing solid wastes, biosolids and spent adsorbent media that are major concerns to farmers and communities.

"In the Midwest, we use a lot of herbicides and give animals a lot of pharmaceuticals," Xiao said. "These substances can contain high amounts of PFAS. Through this new removal method, we can drastically reduce the compounds' presence in our lives."

Xiao chose Mizzou for the opportunities he has to collaborate with other leading researchers and for the quality of the scholarship of undergraduate and graduate students.

"I teach environmental courses, and the students really care about the environment. They care about the water quality, and they care about our ecosystem," Xiao said.

Xiao communicates to those students his passion for practical research and the opportunities they have to create a better world through engineering.

"The real-world application of this discovery is that we can effectively and efficiently remove forever chemicals and other contaminants from our water," he said. "This is the technology we need."

Science Daily, 5 February 2025

https://sciencedaily.com

## Biodegradable Nylon Precursor Developed Using Artificial Photosynthesis

*2025-01-24*

Nylon, the durable and elastic material, is like other plastics made from chemicals found in fossil fuels. Biodegradable plastics based on biomass-derived compounds are attracting attention as an alternative to conventional plastics, and Osaka Metropolitan University scientists have now synthesized biodegradable nylon precursors.

Professor Yutaka Amao's team at the Research Center for Artificial Photosynthesis previously reported on a method for producing raw materials for biodegradable plastics from biomass-derived compounds. A polyester-type biodegradable plastic could be formed by using L-lactic acid as the raw material for polylactic acid.

This time, by using L-alanine, an amino acid with a similar structure, the team created raw material for a nylon-type biodegradable plastic. Artificial photosynthesis technology was developed with the addition of the biocatalyst L-alanine dehydrogenase, which combines ammonia with pyruvate to produce L-alanine, to the photoredox system composed of a dye and a catalyst.

"We have also succeeded in synthesizing the precursor of biodegradable nylon poly-L-alanine using solar energy," Professor Amao declared. "In the future, we hope to achieve the synthesis of nylon precursors that have a low impact on the environment, with the aim of producing L-alanine through artificial photosynthesis using ammonia derived from biomass compounds."

Technology Networks, 24 January 2025

https://technologynetwork.com

## Most of Europe's surface water bodies polluted by chemicals, new report shows

*2025-02-04*

The majority of Europe's surface water bodies are contaminated with chemicals, according to a new report from the European Commission.

The findings paint a stark picture of the continent's struggling water resources, highlighting the urgent need for action.



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The Commission's assessment reveals that 39.5 per cent of surface waters, including lakes, rivers, and coastal areas, achieved "good" ecological status in 2021.

Even more alarming is the decline in chemical status, with only 26.8 per cent of these bodies meeting the required standards, a significant drop from 33.5 per cent in 2015.

This decline comes as the EU grapples with increasing water scarcity and droughts, exacerbated by climate change.

The report noted partial improvements - for example, in aquatic plants in lakes - but these did not rescue the overall health of water bodies.

The situation is better in Europe's groundwater bodies, 86 per cent of which had a good chemical status - although nitrates from farming were polluting groundwater supplies in most EU countries, the data showed.

"The situation for water in the EU is in bad shape," EU Environment Commissioner Jessika Roswall told Reuters in an interview last month. "We have taken water for granted for so long. And I think it's time now that we have this mindset change."

Addressing the issue will be a political challenge - not least because it would involve tackling the substantial impact farming has on water supplies, through irrigation and pollution like nitrates from fertilisers that leach off fields.

Farmers across Europe wielded their political influence last year, staging months of sometimes violent protests against EU rules that resulted in Brussels scaling back some environmental measures.

The Commission said more radical measures were needed to tackle nitrates pollution, but it acknowledged these "could be politically difficult to adopt".

With most countries expected to miss an EU target for all surface water to be in "good" status by 2027, failure to act could result in legal action. The Netherlands is already facing a court order to drastically cut nitrogen pollution, which damages water quality.

The EU could allocate more funds from its next budget to clean up water supplies - although those demands will compete with governments' requests for more EU spending on defence and industry.

The Independent, 4 February 2025

https://independent.co.uk

## Scientists develop groundbreaking biosensor for rare earth element detection

*2025-02-04*

QUT synthetic biologists have developed a prototype for an innovative biosensor that can detect rare earth elements and be modified for a range of other applications.

Lanthanides (Lns) are elements used in electronics, electric motors, and batteries.

The problem is that we can't extract enough of them to meet the growing demand and current extraction methods are expensive and environmentally damaging.

Professor Kirill Alexandrov and colleagues, from the QUT Centre of Agriculture and Bioeconomy and the ARC Centre of Excellence in Synthetic Biology, engineered proteins to create molecular nanomachines that generate easily detectable signals when they selectively bind to Lns.

Along with Professor Alexandrov, the international research team involved QUT researchers Dr Zhong Guo, Patricia Walden and Dr Zhenling Cui, in collaboration with researchers from CSIRO Advanced Engineering Biology Future Science Platform and Clarkson University (USA).

Publishing their findings in Angewandte Chemie International, the team describe engineering a hybrid protein, or "chimera," by combining a lanthanide-binding protein, LanM, with an antibiotic degrading enzyme called beta-lactamase.

This hybrid acts like a "switch" that becomes active only when lanthanides are present.

It can be used to detect and quantify Lns in liquids, producing a visible colour change or an electrical signal.



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Impressively, bacteria modified with these chimeras were able to survive in the presence of antibiotics that otherwise would kill them -- but only when lanthanides were present.

This highlights how precisely the proteins respond to these rare metals.

"This work opens up exciting possibilities for using biology to detect and recover rare earth metals," Professor Alexandrov said.

"The prototype can also be modified for various biotechnological applications, including construction of living organisms capable of detecting and extracting valuable metals."

The research team now plan to work on increasing the specificity of the molecular switch to better differentiate between closely related rare earth elements. It also explores the possibility of developing switches for other critical elements.

The team is in active discussions with potential industry partners who are interested in this technology.

"We also want to explore using the tool to engineer microbes that can directly extract rare earth minerals from ocean water," Professor Alexandrov said.

"This is probably one of the best performing switches made and has given us a lot of insight into the mechanics of protein switches."

Science Daily, 4 February 2025

https://sciencedaily.com

## Common supplement shows new signs of interrupting the aging process

*2025-02-04*

While the price of eggs in the US is unlikely to come down anytime soon, it might be time to find other sources of one of their key nutrients – omega-3. Because the latest research on polyunsaturated fatty acid (PUFA) has found some encouraging signs that it can slow the aging process.

An international team of researchers, including scientists from Australia's Monash University and Switzerland's University of Zurich, have reported that, for people aged 70 or over, omega-3 may press pause on cellular aging. In a three-year study of 777 individuals from five European countries, the team found that PUFA stalled the ticking of time, biologically speaking. While this translated to around 2.9-3.8 months over the three years, it's a promising result for maintaining healthy aging.

The comprehensive study tested eight treatments divided among the 777 adults, with different combinations of omega-3, vitamin D and exercise (three times a week for 30 minutes). The researchers found that blood samples upon completion of the study showed a significant difference in the samples of those who were prescribed the omega-3, vitamin D and exercise program, while there was improvement in the groups that had the PUFA included, as opposed to those with just vitamin D.

What's more, the participants who had all three interventions scored far better than other cohorts in terms of cancer risk and frailty.

The team used several epigenetic clocks – which measure biological age through blood and tissue biomarkers – and found that omega-3 looked to have been the factor in three out of four of these measures (PhenoAge, GrimAge2 and DunedinPACE).

"Our trial indicates a small protective effect of omega-3 treatment on slowing biological aging over three years across several clocks, with an additive protective effect of omega-3, vitamin D, and exercise based on PhenoAge," the researchers noted. "The observation that individuals with lower starting levels of omega-3 exhibited larger epigenetic shifts further strengthens the case for personalized approaches."

For many years, scientists have been putting omega-3 under the microscope, with research suggesting it can shield against many cancers and arterial plaques. It's even recently been associated with quelling aggression. That said, there are about as many papers that have found



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that its benefits might be overblown, even contradicting the heart health studies and cancer findings. Essentially all we know with any certainty is that we don't actually know a whole lot about this naturally occurring fatty acid.

The participants in this Swiss trial were only required to stick to a low daily dose of omega-3 – one gram a day. If eggs are off the table for now, flaxseed, salmon, walnuts and, of course, supplements are able to boost levels.

While there were limitations to the study – such as a lack of a standard measure to gauge biological aging and the Eurocentric trial participants – it's a promising sign for omega-3, following on from animal trials that had shown benefits to aging cell health. It also points to the importance of molecular biomarkers – not just a measure of years – to evaluate 'healthy aging.'

"Even small changes in biological aging, if sustained, may have relevant effects on population health," the researchers concluded.

The study was published in the journal Nature Aging.

**Source:** University of Zurich via Scimex

New Atlas, 04 February 2025

https://website

## Researchers Unveil New Metal Alloy That Does Not Expand

*2025-02-04*

Most metals expand when their temperature rises. The Eiffel Tower, for example, is around 10 to 15 centimetres taller in summer than in winter due to its thermal expansion. However, this effect is extremely undesirable for many technical applications. For this reason, the search has long been on for materials that always have the same length regardless of the temperature. Invar, for example, an alloy of iron and nickel, is known for its extremely low thermal expansion. How this property can be explained physically, however, was not entirely clear until now.

Now, a collaboration between theoretical researchers at TU Wien (Vienna) and experimentalists at University of Science and Technology Beijing has led to a decisive breakthrough: using complex computer simulations, it has been possible to understand the invar effect in detail and thus develop

a so-called pyrochlore magnet – an alloy that has even better thermal expansion properties than invar. Over an extremely wide temperature range of over 400 Kelvins, its length only changes by around one ten-thousandth of one per cent per Kelvin.

**Thermal expansion and its antagonist**

"The higher the temperature in a material, the more the atoms tend to move – and when the atoms move more, they need more space. The average distance between them increases," explains Dr Sergii Khmelevskyi from the Vienna Scientific Cluster (VSC) Research Centre at TU Wien. "This effect is the basis of thermal expansion and cannot be prevented. But it is possible to produce materials in which it is almost exactly balanced out by another, compensating effect."

Segii Khmelevskyi and his team developed complex computer simulations that can be used to analyse the behavior of the magnetic materials at finite temperature on the atomic level. "This enabled us to better understand the reason why invar hardly expands at all,' says Khmelevskyi. "The effect is due to certain electrons changing their state as the temperature rises. The magnetic order in the material decreases, causing the material to contract. This effect almost exactly cancels the usual thermal expansion."

It had already been known that the magnetic order in the material is responsible for the invar effect. But only with the computer simulations from Vienna, it became possible to understand the details of this process so precisely that predictions for other materials could be made. "For the first time, a theory is available that can make concrete predictions for the development of new materials with vanishing thermal expansion," says Sergii Khmelevskyi.

**The pyrochlore magnet with Kagome planes.**

In order to test these predictions in practice, Sergii Khmelevskyi worked together with the experimental team of Prof. Xianran Xing and Ass. Prof. Yili Cao from the Institute of the Solid State Chemistry of the University of Science and Technology Beijing. The result of this co-operation has now been presented: The so-called pyrochlore magnet.

In contrast to previous invar alloys, which only consist of two different metals, the pyrochlore magnet has four components: Zirconium, niobium, iron and cobalt. "It is a material with an extremely low coefficient of thermal expansion over an unprecedentedly wide temperature range," says Yili Cao.



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This remarkable temperature behaviour has to do with the fact that the pyrochlore magnet does not have a perfect lattice structure that always repeats itself in exactly the same way. The composition of the material is not the same at every point, it is heterogeneous. Some areas contain a little more cobalt, some a little less. Both subsystems react differently to temperature changes. This allows the details of the material composition to be balanced point by point in such a way that the overall temperature expansion is almost exactly zero.

The material could be of particular interest in applications with extreme temperature fluctuations or precise measuring techniques, such as in aviation, aerospace or high-precision electronic components.

Technology Networks, 07 February 2025

https://technologynetworks.com

## 10 Warning Signs of Mold Toxicity, According to an Air Quality Expert

*2025-01-09*

Signs of mold toxicity mirror symptoms of common health nuisances...but a nationally recognized mold remediator says exposure can lead to much greater health issues.

Sneezing, coughing, or feeling down and tired? While these symptoms might make you think you're coming down with a cold, you may want to keep an eye on how you feel over time. If these symptoms tend to linger or get worse whenever you're at home, they could be warning signs of mold toxicity.

The Healthy by Reader's Digest spoke with Michael Rubino, a mold and air quality authority, as well as the author of The Mold Medic: An Expert's Guide on Mold Removal, and Amy Myers, MD, a physician and leader in functional medicine and gut health who's personally struggled with mold toxicity.

Rubino points out that, in addition to respiratory issues, mold exposure has actually been linked to early-onset dementia and Alzheimer's. "We spend 90% of our time indoors," he says. "We're learning new things every day about all the effects our homes can have on our health, but all signs are kind of leading into the same place that if we want to improve our health, the air we breathe has a very profound effect on it."

**10 Warning Signs of Mold Toxicity**

"If you are regularly exposed to toxic mold, you may develop what's called mold toxicity," says Dr. Myers, who is also a two-time New York Times bestselling author. "This can be any illness brought on by exposure to toxic mold and mycotoxins."

Mycotoxins are naturally occurring toxins produced by certain molds and fungi that can cause harm throughout the body. And while they're responsible for many mold exposure symptoms, they can also have far-reaching implications on your health. "As mold exposure increases the toxic load on your system, the chances of developing an autoimmune disease begin to climb," Dr. Myers explains.

While routine cleaning is extremely important for controlling the mold in your home, also be aware of these 10 warning signs of mold toxicity before any illness gets worse.

1. **Trouble breathing**

"Mycotoxins are often airborne and enter your respiratory tract," Dr. Myers explains. "This triggers symptoms including asthma, allergies, and sinus infections."

According to the U.S. Centers for Disease Control and Prevention (CDC), mold can cause irritation in the nose, throat, and lungs, even in people who don't have asthma or aren't allergic to mold—and this irritation can lead to trouble breathing.

The CDC also cites evidence that chronic mold exposure can worsen pre-existing asthma and that there's an association between mold and new-onset asthma. In fact, past studies have estimated that mold in the home causes about 21% of new asthma cases in the United States.

2. **Sneezing and coughing**

While allergies are common, allergy-like symptoms—such as sneezing, coughing, itchy eyes and throat, and stuffy nose—are also early signs of mold exposure, or mold toxicity.

"Usually, it starts off with unusual allergies," says Rubino. "They notice they're getting sick more frequently; maybe their nose is stuffy [or] they're having allergic-type symptoms," explains Rubino.

He explains that these signs of mold toxicity can pop up with various timelines—sometimes immediately or sometimes with delayed reactions. If you're experiencing chronic allergy-like symptoms while you're at home, talk with your doctor.



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3. **You may feel fatigued**

Let's face it: Fatigue is a common symptom for lots of us. But Rubino points out that feeling fatigued is a common result of exposure to mold at home.

A 2013 study published in Toxins found exposure to different kinds of mold—especially mycotoxins, the kind of mold that can grow on food as well as under warm and humid conditions within the home—is linked to symptoms of chronic fatigue.

"Mycotoxins wreak havoc on your health by disrupting your mitochondria," Dr. Myers explains. "Mitochondria produce energy for nearly every bodily function. That's why mycotoxins can cause chronic fatigue or weakness."

4. **Brain fog**

Along with fatigue, exposure to mold can cause brain fog, resulting in people feeling sluggish and even forgetful.

Rubino notes that it is typically a result of inflammation the body is experiencing when exposed to mold: "You start to experience gut issues due to the inflammation that mold and toxins can cause. Gut inflammation can lead to brain inflammation, which then can cause a whole host of neuropsychiatric symptoms."

Per a 2023 review of research published in the Journal of Integrative Neuroscience, one study found that mold exposure can trigger a variety of cognitive impairments, including memory and learning problems, emotional functioning, and reaction time. Other studies cited that the neurological changes in people chronically exposed to mold are comparable to damage from chemical exposure or mild to moderate traumatic brain injury.

5. **Anxiety and depression**

"We are seeing a lot of studies that show that [mold is] impacting people's mental health [through] people's anxiety and depression," Rubino says.

According to an article published in Environmental Health Perspectives in 2007, those who are exposed to damp, moldy households have a 34-44% higher risk of depression. Further studies, such as one published in Brain, Behavior, and Immunity in 2019, have demonstrated that mold exposure can increase anxiety-like behavior.

**6. Headaches**

Headaches are a common symptom of mold exposure, according to Dr. Myers. The mycotoxins that can trigger cognitive issues can also cause

different types of headaches, ranging from dull pain to an "ice pick" sensation or even a migraine.

Other substances produced by some molds called microbial volatile organic compounds (mVOCs) may also cause headaches—even after short-term exposure, according to 2024 research published in Hygiene and Environmental Health Advances.

**7. Light sensitivity**

Dr. Myers says that chronic mold exposure can cause vision problems such as light sensitivity. According to the Journal of Integrative Neuroscience research, this is because mycotoxin inflammation can affect your optic nerve (a condition called optic neuritis)—and optic nerve inflammation can lead to blurred vision, reduced visual fields, and sensitivity to light.

Fortunately, these vision issues can be reversed with treatment.

**8. Eye irritation**

Exposure to mold and its mycotoxins can cause inflammation on the ocular surface as well, according to research published in the journal Toxins in 2017. Even at low levels, this mold-induced inflammation can cause eye irritation and sensitivity, prompting symptoms like dry, itchy, and red eyes.

**9. Frequent illness**

Exposure to mycotoxins may also show up as cold or flu-like symptoms, Dr. Myers says. And because of the way these toxins affect your body, it can feel like you're catching one cold after another.

"Compromised mitochondria release free radicals," Dr. Myers explains. "These unstable atoms create oxidative stress, causing cellular damage and inflammation."

Your body's immune system function is strongly regulated by oxidative stress and inflammation, per 2020 research published in Nutrients. So, as chronic exposure to toxic mold triggers more and more oxidative stress, it becomes harder for your immune system to respond to infections.

**10. Skin irritation**

If you have a mold allergy, it's common to get a skin rash from inhaling or touching mold, according to the CDC. But mold exposure can irritate your skin even if you're not allergic.



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This is because "mycotoxins may also pass through your intestinal wall," Dr. Myers says. "Once they get into your bloodstream, they can cross tissue barriers," affecting your brain and other organs, such as your skin.

**Other warning signs of mold toxicity**

Mold's effect on the body can be different from one person to the next. Beyond the 10 warning signs of mold toxicity noted above, Dr. Myers says that other common mold toxicity symptoms can include:

- Unexplained weight gain or weight loss
- Mood changes
- Numbness and tingling in the body
- Vertigo or dizziness
- Pain (abdominal pain or muscle pain similar to fibromyalgia)
- Tinnitus (ringing in the ears)
- Digestive issues (bloating, food intolerances)
- Metallic taste in the mouth
- Excessive thirst and dehydration, bed-wetting in children
- Symptoms similar to hormone imbalances (hair loss, rashes)

**How to know if there's mold in your home**

According to the U.S. Environmental Protection Agency (EPA), mold thrives in moist, damp, and poorly ventilated areas of the home. For instance, mold can start growing if you've had recent water damage from a roof leak or burst pipe—and the longer the mold grows, the more damage it causes.

But day-to-day, several areas of the home are particularly susceptible to mold growth due to low air circulation, high humidity, or regular moisture. These hotspots can include:

- Bathrooms and sinks
- HVAC (heating/ventilation/air conditioning) systems
- Air ducts
- Behind the fridge
- Basements

**How to test for mold**

To check for toxic mold in your home, Dr. Myers recommends two tests. "The EPA developed a research tool—the Environmental Relative

Moldiness Index (ERMI)—to test for mold and mycotoxins," she says. "Dust samples are collected in a home, and DNA from mold in the dust is analyzed." The sample is then compared to the ERMI index.

"You can hire a company to do this or use one of the many kits," she says. "Some of these include professional evaluation of the results, and some you compare to a chart."

Another testing option is to have a certified mold testing company run a spore capture test, a type of air quality test. "This mold toxicity test will see if you have high mold concentration levels in your home," Dr. Myers explains. "The problem with this test is it doesn't test specifically for mycotoxins. You may have a high mold concentration, yet it doesn't necessarily mean these are toxic molds."

For instance, she says mold caused by water damage should be fixed ASAP. "However, these molds are not necessarily creating mycotoxins." That's why if you're unsure, it's good to work with a professional who specializes in testing for toxic molds.

**How to prevent mold from growing in your home**

Controlling moisture in your home is the key to preventing mold growth, according to the EPA. The best way to do this is to keep indoor humidity levels below 60%—and ideally between 30-50%.

To do this, the agency advises that you:

- Fix leaks within 48 hours.
- Vent appliances that use moisture to the outside when possible, including dryers, stoves, and gas heaters.
- Run the bathroom fan or open a window when showering.
- Use exhaust fans or open a window when cooking or washing dishes.
- Use dehumidifiers where needed, such as in a basement.
- Note that if you see condensation collecting on windows, walls, or pipes, as this can be a sign of high humidity in the home.

The EPA also suggests covering cold surfaces like pipes with insulation (as this can limit condensation) and keeping air circulation flowing through your home.

**When to see a doctor**

"Anyone can be negatively affected by molds, from infants to the elderly," Dr. Myers says. "Everyone also processes mold exposure differently."



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But she says that certain factors can further influence the severity of mold and mycotoxin exposures, such as:

- **Home conditions:** If you live in very humid areas or have water damage in your home, you're more likely to encounter mold.
- **Inflammation:** "Chronic inflammation in the body makes you more susceptible to toxic mold," Dr. Myers says. "This is because the immune system is overworked and worn out."
- **Foods:** "Commercialized [processed] foods can develop mold during processing or storage," she says.

"If you are experiencing any symptoms and identify with the above factors, I recommend seeing a functional medicine doctor for testing," advises Dr. Myers.

She also says that some people are genetically predisposed to mold sensitivities. "For instance, I have the HLA-DR gene that prevents me from clearing both toxic mold and mycotoxins," she says. "Consider having genetic testing done to see if you're at risk."

To check if you currently have mycotoxins in your body, Dr. Myers says several diagnostic tests are available. "I like to start with a urine test from RealTime Labs. They test for several specific types of mycotoxins that may be in your body."

**What to do if you have mold toxicity**

If you do have mycotoxins in your body, the first step is to remove yourself from certain environments. "Determining the source of the mold problems can be difficult," Dr. Myers says. "This way, you can establish which [environments] trigger mycotoxin symptoms."

Still, whether your encounter was brief or chronic, you can recover from the harmful effects of mold and mycotoxins. Dr. Myers recommends a few strategies for combating mold symptoms:

- Clean your home of toxic mold.
- Eliminate inflammatory foods such as sugar, alcohol, caffeine, and artificial sweeteners.
- Manage your stress levels.
- Prioritize good nutrition and eat foods rich in antioxidants and amino acids.

- For her patients, Dr. Myers also recommends supplements such as glutathione, which promotes immune system function and tissue repair, and L-Tyrosine, which supports your central nervous system.

The Healthy, 09 January 2025

https://thehealthy.com

## Study explores compound's potential to enhance THC for pain treatment

*2025—02-05*

University of Mississippi researchers have discovered how a compound found in cannabis might be used to mitigate the negative effects of THC, a psychoactive compound in the plant.

This breakthrough sets the stage for new uses of the CBD, which could help people who experience anxiety, chronic pain and a number of other illnesses.

Amar Chittiboyina, principal scientist and associate director of the National Center for Natural Products Research, and a team of investigators recently published their research in ACS Chemical Neuroscience.

"This research will open a new avenue for anyone in the field of cannabis research," Chittiboyina said. "It actually opens up new prospects or a new horizon in modulating cannabinoid receptors and harnessing THC's beneficial effects for pain management."

CBD is one of more than 200 natural cannabinoids in the cannabis plant, but unlike some of its counterparts, CBD is not psychoactive. Its popularity in the United States has grown since 2018, when the Agricultural Improvement Act decriminalized hemp.

"The 2018 Farm Bill passage effectively opened a Pandora's box of research challenges," Chittiboyina said. "CBD's use proliferated across a wide spectrum from pain management, recreational purposes to seemingly endless other applications.

"However, the fundamental question lies in understanding how CBD works on various targets and exerts its perceived effects at the molecular level."

Cannabinoid receptor type 1 is a protein found throughout the body that regulates pain, mood, appetite, metabolism and memory. Both CBD and THC bind to this protein.



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When THC attaches to the receptor, the effect is like an off switch to a light bulb, effectively turning "off" the pain. But THC also has harmful side effects, including memory loss, nausea and addiction.

When CBD binds to the receptor, however, it acts more like a dimmer switch, turning up or down the function of the protein.

The researchers have discovered the locations on this protein molecule where CBD binds, meaning future research could "turn down" or minimize the side effects of THC use.

"Our primary objective is to harness the beneficial effects of THC while mitigating its undesirable side effects," said Pankaj Pandey, a research scientist in the center.

This research could help scientists develop a synthetic CBD that can alter receptor behavior more efficiently even than CBD, said Robert Laprairie, associate professor at the University of Saskatchewan and co-author of the study.

"When people talk about cannabis, they tend to focus on or think of it just as a drug, as the plant," Laprairie said. "But we have a treasure chest of drug possibilities here and what we're trying to do is pick out specific, very focused effects and refine those.

"We're trying to pull out the benefits and leave the harms behind."

One example of new research that is made possible by the recent findings is that of William Neal, a postdoctoral researcher at the Ole Miss center. Neal's upcoming research hopes to determine if CBD use would affect opioids like morphine in the body.

"In the event that CBD binds to an opioid receptor, you could have negative interplay with opiate drugs like morphine," Neal said. "If you're getting pain relief from opiates, and if CBD negatively interferes with the opioid receptor, it's going to frustrate people who are prescribed opiates.

"As a result, CBD will reduce efficacy of opiates and could enhance the drug abuse liabilities."

Neal's research into the interaction of CBD and opioids is only one of many avenues that are opened due to this research, Chittiboyina said.

"That's what I mean when I say this is a new horizon for cannabinoids research," Chittiboyina said. "Often, to mitigate pain, patients combine

opiates with cannabis, kratom and other substances. Is this approach beneficial or detrimental?"

More research is needed to confirm the team's findings before they finalize their results.

"But if we can pinpoint how CBD interacts with multiple targets on molecular level, we will be in a stronger scientific position to develop solutions that are relevant to public health," he said.

Phys Org, 5 February 2025

https://phys.org

## First Trimester Vitamin D Levels May Impact Pregnancy Outcomes

*2025-02-04*

Vitamin D plays an important role in our bodies, promoting bone and muscle health, among other functions.

In pregnancy, vitamin D is associated with the production of pro-angiogenic factors that support the development of the placenta. Maternal vitamin D status has also been linked to fetal development and birth weight.

What lacks in this research area, however, is an understanding of whether vitamin D levels across the gestational period are associated with specific fetal growth patterns and pregnancy outcomes. Most studies have analyzed data from women mid-gestation; very few studies have explored vitamin D levels between the first and second trimesters.

Consequently, there is an information gap. Researchers led by Dr. Alison Gernand, associate professor of nutritional sciences at Penn State University, sought to fill it using study data and samples from the Nulliparous Pregnancy Outcomes Study: Monitoring Mothers-to-Be (nuMoM2b).

**Vitamin D and pregnancy outcomes assessed**

Gernand and colleagues randomly selected a sample of 351 participants from the nuMoM2b cohort who were, on average, 27.9 years of age with a BMI of 26.6 kg/m2.



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Participants' blood samples were analyzed for serum 25-hydroxyvitamin – or 25(OH)D – concentrations at 6–13 and 16–21 weeks of gestation using liquid chromatography-mass spectrometry.

Gernand and team examined pregnancy outcomes across serum 25(OH)D concentrations using the Institute of Medicine cutoffs, which state that 25(OH)D concentrations of <30 nmol/L represent vitamin D deficiency, <50 nmol/L represent insufficiency and ≥50 nmol/L represent sufficiency, in addition to exploratory cutoffs.

Participants also underwent ultrasound scans at 16–21 weeks and 22–29 weeks of gestation, with neonatal anthropometric measures collected at birth.

Women with low vitamin D levels in first trimester more likely to experience pre-term birth

No statistical differences in pregnancy outcomes were identified between women with vitamin D insufficiency and vitamin D sufficiency.

When Gernand and team analyzed the data from a wider range of concentrations, though, the results changed.

**Women in their first trimester with 25(OH)D concentrations less than 40 nmol/L were 4.35 times more likely to have a preterm birth compared to women with 25(OH)D concentrations ≥80 nmol/L.**

As only 29 infants (8%) were born preterm in the study cohort, the researchers emphasize that additional studies in larger cohorts are warranted. It's also important to note that correlation or association does not necessarily mean causation.

A statistically significant association was also observed between 25(OH)D concentrations in the first trimester and fetal growth patterns. "When we examined first trimester 25(OH)D continuously in relation to longitudinal fetal growth patterns, we observed associations between 25(OH)D and linear growth, but not with weight or head circumference in adjusted models," Gernand and colleagues explained.

This association was not observed in data from the second trimester. However, 74% of participants showed an increase in 25(OH)D levels between their first and second trimesters, which may have impacted the researchers' ability to detect an association.

**Vitamin D important for pregnancy health**

These data emphasize the importance of early pregnancy and even pre-conception nutrition, according to Dr. Celeste Beck, the study's first author and a former doctoral student in nutritional sciences at Penn State: "Individual women may or may not need supplements depending on their diet and lifestyle. But healthy nutrition is critical for promoting the healthy development of a fetus. This research indicates that vitamin D levels – along with iron, folate and other essential nutrients in pregnancy – should be monitored and understood by obstetricians and women early on to promote healthy birth outcomes."

"We can't just assume that everybody is deficient, but proper nutrition is something that needs to be on your radar if you may become pregnant," Gernand added. "And this study provides evidence that vitamin D appears to be an important part of a pregnant woman's nutritional health."

Future research should aim to clarify the role that timing of vitamin D supplementation might have with regard to pregnancy outcomes.

This article is a rework of a press release issued by Penn State University. Material has been edited for length and content.

Technology networks, 04 February 2025

https://technologynetworks.com

## 'Chemistry will no longer be an exclusive club': how AI is changing Omar Yaghi's work

*2025-02-03*

Reticular chemistry pioneer Omar Yaghi has co-founded a new institute focused on using AI to tackle climate challenges. He spoke to Chemistry World about what the Bakar Institute of Digital Materials for the Planet at the University of California, Berkeley aims to achieve and how AI will change the way we do chemistry.

**Why is AI so attractive to reticular chemists?**

AI has a transformative role. In reticular chemistry, the synthesis of materials like metal–organic frameworks (MOFs) and covalent organic frameworks (COFs) relies on well-established chemical conditions. We use AI to rapidly optimise the reaction conditions for various building blocks, to create new frameworks with the desired properties.



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AI can help in predicting and mapping the vast space of potential structures that arise from different molecular geometries, significantly accelerating the identification of promising candidates and saving resources.

Reticular chemistry enables chemists to not only do the basic science but to engineer their product into a prototype to show the market how it will work for a specific application. AI is still in its infancy in terms of its application to science, but I feel we need to experiment with it. We need to engage with our computer science colleagues, to help them understand how we think and how discoveries are made in chemistry and to make sure that those models are improved to enhance chemistry.

**How has AI helped your work?**

MOFs have a metal ion and a charged linker, making a very strong bond. One linker we thought would be interesting is hydroxymate. Hydroxymate MOFs are difficult to crystallise and in five years we've made only one. By using a suite of large language models working together, we can mine texts and images in the literature to give us an idea about what direction we should go in to find conditions under which a specific set of building blocks are going to make a MOF or a COF. With these tools, one of my new students made 15 new compounds in just six months.

able to harvest water? We use chemical computation and quantum mechanical computation to try to understand the environment inside the pore. Alongside we've developed a machine learning algorithm that incorporates all the features we chemists think are important for the properties we're looking for. And bit by bit you develop a mathematical framework that enables the algorithm to make better predictions than you would at random. Using our models, which we call Foundational Gen AI models, we're doing 50% better than random.

**How can these models get better?**

This is systematic, rigorous work that documents the successes and failures, which is something that we chemists haven't been doing, thus far. Knowing what doesn't work improves the machine learning algorithms.

It's hard for scientists to tell the world what didn't work because it's a reflection of how smart their design was. But I think journals and publishers can drive this, so what didn't work becomes part of the literature.

**Can AI help save the planet?**

The discovery of new materials needed to address global challenges such as climate change is a slow process. It involves exploration of a huge chemical space and, without the aid of robotics and AI, our ability to find the We can use the models to look for green building units and find out what structures they can make and under what conditions they'll crystallise. Once we make them, we'll know exactly what to do to make, for example, a carbon capture material based on what we've already learnt. I think that ultimately is where chemistry is going.

By accelerating the discovery of sustainable materials, AI can drive innovations in clean energy, efficient storage and carbon capture technologies. These advances reduce greenhouse gas emissions, promote renewable energy adoption and minimise resource waste.

**What would your advice be to students on AI?**

AI is absolutely essential for the future of chemistry. I have been telling incoming students that every student in my lab will have to learn how to use AI to facilitate and speed up chemical research. We would be doing them a disservice to allow them to continue in the old-fashioned way. To prepare the next generation to think outside the box, to compete with other fields and solve the difficult problems in society, they're going to have to be well versed not just in chemistry, but in engineering, and in using AI and computation.

**What have you learnt from computer scientists?**

That if it doesn't scale it's not worth looking at. Everybody needs to take advantage of your discovery and that's ultimately how the world gets better. Part of scaling up is enabling everyone to access a platform for, say, making MOFs and COFs. You go to this platform, plug in questions and the platform comes back with potential MOFs and COFs that you could use. It guides you step by step to make and test them and potentially tells you who to partner with to scale up production. What that means is that chemistry will no longer be an exclusive club, but open to all.

This interview has been edited for clarity and brevity.

Chemistry World, 3 February 2025

https://chemistryworld.com



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## Scientists make progress in producing $H_2$-rich syngas from biomass gasification

*2025-02-05*

The production of hydrogen from biomass has garnered increasing attention, with thermochemical methods emerging as the most widely adopted approach. Among these, steam gasification stands out as a particularly promising technique for producing H2-rich syngas.

However, a major challenge associated with the gasification process is the formation of tar, which can cause equipment corrosion and pipeline blockages, significantly compromising the overall efficiency of the process.

The addition of catalysts during gasification has proven effective in cracking tar and enhancing hydrogen production. Moreover, inorganic minerals found in biomass, such as alkali and alkaline earth metals (AAEMs), have been observed to promote the production of H2-rich syngas. However, further research is required to clarify how AAEMs impact gas production and the mechanisms behind the interactions among different metals.

To tackle these challenges, a research team led by Prof. Yin Jiao from the Xinjiang Technical Institute of Physics and Chemistry of the Chinese Academy of Sciences has developed a series of Ni/CaO-Ca12Al14O33 catalysts. The team has made significant progress in improving the stability of these catalysts.

**The research is published in the journal Energy.**

Experimental results indicated that the Ni/Ca3AlO catalyst demonstrated excellent catalytic performance and cyclic stability. The yield and concentration of hydrogen in the syngas were measured at 30.08 mmol/gbiomass and 60.61 vol% during the initial reaction. Notably, minimal carbon deposition and slight sintering were observed on the catalyst surface after ten cycles.

The catalyst's remarkable anti-sintering performance was mainly attributed to its unique blade-like morphology, which effectively enhanced metal-carrier interactions, thereby preventing Ostwald ripening.

The research provides a theoretical foundation for the design of novel nickel-based catalysts and their application in hydrogen production from biomass catalytic gasification.

Furthermore, the inhibition of filamentary carbon formation by Ca12Al14O33 in the carriers and the suppression of encapsulated carbon precursors through calcium doping contributed to the catalyst's resistance to carbon accumulation.

Phys Org, 5 February 2025

https://phys.org

## CBD May Reduce Cravings for People Suffering With Alcoholism

*2025-01-30*

Cannabidiol (CBD) is a natural component of the cannabis plant and has no intoxicating effects. With their ICONIC study, the scientists at the Central Institute of Mental Health (CIMH) provide the first evidence that this cannabis active ingredient could help with alcohol problems. The team recently published the results of their study in the journal Molecular Psychiatry.

**First clinical study with CBD**

Alcohol-related diseases are associated with a high level of suffering and are among the most common and devastating diseases worldwide. Despite this, only a few drugs have been approved for their treatment. Currently, the majority of patients relapse even when treated with relapse prevention medications, highlighting the need for the development of new pharmacological treatments. Preclinical studies have shown that CBD could be promising, as it was able to significantly reduce alcohol consumption in laboratory animals. However, there has been a lack of clinical trials in humans. The ICONIC study (Investigation of the effects of Cannabidiol ON cue-InduCed alcohol craving and nucleus accumbens activation) fills this gap.

The scientists investigated how CBD influences the craving for alcohol triggered by alcohol stimuli and brain activity in the nucleus accumbens (NAc) – the NAc is a brain region associated with reward and addiction.

**Tests also in a bar-like environment**

The double-blind, randomised and controlled study comprised 28 people aged between 18 and 60 with mild to severe alcohol-related illness and was conducted at the CIMH in Mannheim. The researchers divided the participants into two groups. One group was given a single dose of 800 mg CBD, while the other received a placebo. The test subjects then took



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part in various tests in which they were exposed to alcohol stimuli or stress, for example. They were shown alcohol-related images or asked to enter an environment that resembled a bar. They assessed their craving for alcohol using questionnaires. Their brain activity was measured using a magnetic resonance tomograph.

**CBD influences reward centre in the brain**

The study shows that those who received CBD reported a significantly lower craving for alcohol compared to the placebo group. The authors also found that the NAc, i.e. the "reward centre of the brain", was significantly less activated in people who took CBD. Lower activity in the NAc is associated with a lower craving for alcohol and a lower likelihood of relapse. The authors were also able to show that higher CBD levels in the blood were associated with a lower alcohol craving and less activation in the NAc.

"Our study provides initial and clear evidence that cannabidiol can help to reduce the craving for alcohol and change the brain activity associated with addiction," says Prof. Dr. Dr. Patrick Bach, research group leader at the Addictive Behaviour and Addiction Medicine at the CIMH, summarising the results. Scientist Sina Vetter adds: "However, further research activities are needed to answer important questions – which were not the subject of the study – such as whether the results are generally applicable and whether the effect of CBD remains stable over time."

The research team is currently preparing a study that will also build on the findings of the ICONIC study. In the ICONICplus study, it will investigate the added value of treatment with CBD and naltrexone compared to established standard treatments for alcohol addiction.

Technology Networks, 30 January 2025

https://technologynetworks.com

## Using sugars from peas speeds up sour beer brewing

*2025-02-05*

Sour beers have become a fixture on microbrewery menus and store shelves. They're enjoyed for their tart, complex flavors, but some can require long and complicated brewing processes. Researchers reporting in ACS' Journal of Agricultural and Food Chemistry brewed new sours in less time using a seemingly strange ingredient: field peas. The experimental beers had fruity -- not "beany" -- flavors and other attributes comparable to a commercial Belgian-style sour, but with shorter, simpler brewing steps.

"Sour beer is the beer enthusiast's alternative to Champagne. By using sugars derived from peas that yeast cannot metabolize, we promote the growth of bacteria essential for producing sour beer," says Bjørge Westereng, one of the study's authors.

The characteristic mouth-puckering taste of a sour beer comes from acids made by lactic acid-producing bacteria (LAB) or Brettanomyces yeast, which are added by brewers or introduced naturally from the environment.

However, these microbes often require months or even years to ferment the original sugary, steeped-grain liquid (wort) into a desirable drink.

So, Westereng, Philipp Garbers, Catrin Tyl and colleagues have been searching for sugars beyond those found in traditional grain for the LAB to nosh on that might speed up the fermentation process.

Previously, they tried molecules derived from wood. But this time, they turned to a group of plants called pulses, which includes beans, lentils and peas.

Pulses have historically been underutilized largely because of their tendency to impart beany flavors to foods.

But they're considered sustainable and easy to grow, and contain sugars called raffinose-family oligosaccharides (RFOs), which LAB can easily use as a food source.

In the new research, the team brewed sour beers with RFOs extracted from field peas and compared the final product to a commercially available Belgian sour.

Using three different LAB, the researchers brewed four experimental sour beers: two with the field pea RFOs and two without.

All four were fermented for 19 days with Brettanomyces clausennii yeast together with combinations of LAB.

After chemical analysis and evaluation by a trained sensory panel, the team discovered that the beers brewed using the RFO extract had:

- More lactic acid, ethanol and fruity flavor-imparting compounds than the beers brewed without RFOs.
- Fruitier flavors, more acidic tastes and higher total taste intensity than the beers made without RFOs, but total taste intensity comparable to the commercial beer.



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- No trace of unwanted beany flavors.

Despite the short fermentation time, the LAB gobbled up all the RFOs, leaving no detectable traces in any of the experimental beers. This is important because RFOs can cause gastrointestinal problems for some people. The researchers hope that this work shows how pulses and RFOs could be incorporated into beer brewing and that pea-based ingredients can be associated with products that taste good.

Sciene Daily, 5 February 2025

https://sciencedaily.com

## Electrically Controlled Nanogate Revolutionizes Molecular Movement

*2025-02-05*

Scientists at Osaka University have designed a nanogate that opens and closes using electrical signals, offering precise control over ions and molecules.

This tiny innovation has the potential to transform sensing technology, chemical reactions, and even computing. By adjusting voltage, researchers can manipulate the gate's behavior, making it a versatile tool for cutting-edge applications.

**Nanogates: Control at the Macro and Nanoscale**

Gates are used to control movement, whether it's livestock passing through a farm gate or molecules moving at the nanoscale. Just as a physical gate can open or close to regulate larger entities, nanogates can control the passage of single molecules.

Researchers at Osaka University have developed a nanogate that opens and closes in response to electrical signals. Its behavior depends on both the voltage applied and the materials present in the surrounding solutions. This makes it a promising tool for applications such as molecular sensing and precisely controlled chemical reactions.

**How the Nanogate Works: A Tiny Pore with Big Potential**

The nanogate is a tiny pore embedded in a silicon nitride membrane. This membrane is housed in a flow cell on a chip, with solutions introduced on both sides. By applying voltage through electrodes on the chip, researchers measured the resulting ionic current, which indicates ion movement through the pore. Since this current is highly sensitive to

the composition of the surrounding solutions, researchers can precisely control the flow of ions and trigger the formation or dissolution of metal compounds within the pore.

The change of pore diameter resulting from precipitation (which closed the nanogate) or dissolution (which opened the nanogate) led to distinct types of ion transport. "Precipitates grew and closed the pore under negative voltage, decreasing ionic current," says lead author of the study, Makusu Tsutsui. "Inverting the voltage polarity caused the precipitates to dissolve, reopening the pore."

**Memristive Behavior and One-Way Ion Transport**

Under certain conditions, the formation of a precipitate that blocked the pore resulted in the highest rectification ratio, which is a measure of the propensity of ions to travel only in one direction, achieved to date for a nanofluidic device. As well as acting as a rectifier, the system could also behave as a memristor; that is, a memory effect was observed in its relationship between current and voltage. The sequential precipitation and dissolution of materials in the pore led to this memristive behavior.

**Biomolecule Detection: DNA Sensing in Action**

Additionally, in-pore reactions could be regulated to allow biomolecule detection. This was demonstrated using DNA. The system exhibited distinct output signals as individual DNA molecules moved through the pore.

"The ability to finely control pore size using applied voltage should allow pores to be tailored for specific analytes immediately before conducting measurements," explains senior author Tomoji Kawai. "We also anticipate that our approach can be used to develop reaction systems to access new chemical compounds."

**Future Applications: Sensing, Chemistry, and Computing**

Using a membrane with a single controlled pore in nanofluidic electrochemical devices is a versatile approach that can be tailored for specific applications including sensing, chemical reactions, and neuromorphic computing.

Sci Tech Daily, 5 February 2025

https://scitechdaily.com





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