CHEMWATCH

Bulletin Board

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AUG. 11, 2023

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ASIA PACIFIC

PFAS in groundwater report released

2023-08-02

We have released a report with findings from the first large-scale survey of per- and polyfluoroalkyl substances (PFAS) in New Zealand groundwater wells.

We commissioned the tests for PFAS in 2022, as part of the Institute of Environmental Science and Research four-yearly survey of pesticides in groundwater.

Our aim was to find out whether there is PFAS contamination in New Zealand groundwater, and to better understand the background levels of these chemicals in our environment.

The results show there is very little PFAS contamination of groundwater in the areas tested, and a low level of potential risk from these chemicals.

This survey is part of our ongoing response to potential risks from these substances.

Read More

EPA NZ, 02-08-23

https://www.epa.govt.nz/assets/Uploads/Documents/Hazardous-Substances/National-survey-of-PFAS-in-groundwater-report-May-2023.pdf

Application to reassess the insecticide Actara

2023-07-23

Decision Dat: 03 July 2023

We have approved changes to some controls for the insecticide Actara.

- Formal receipt
- Public consultation
- Evaluation
- Hearing or consideration
- Decision

The Ministry for Primary Industries (MPI) applied to modify some rules (known as controls) so Actara could be used if the brown marmorated stink bug (BMSB) invades New Zealand.

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A Decision-making Committee considered the risks, impact upon Māori and taonga, costs, and benefits from using Actara in a biosecurity response to an incursion of BMSB.

The Committee considered that the benefits from eradicating BMSB would outweigh the risks and costs from using Actara. The Committee has approved this reassessment application, putting in place additional controls to minimise risks to the environment.

Actara decision document (PDF, 2.8MB)

Actara reassessment documents

Controls

These are the rules for using Actara for an active biosecurity response to a BMSB incursion:

- Actara must only be used by authorised staff with direct MPI oversight.
- Actara may be applied up to eight times per year, but must be alternated with an insecticide with a different mode of action.
- Actara may only be applied through spot spraying and may be applied to flowering plants if necessary.
- Beehives in and within 7km of the spray area should be removed for at least three weeks.
- A pre-application assessment must be carried out to identify and map sensitive organisms and areas that should be protected.
- Actara may not be applied during unfavourable weather conditions.
- Prior to spraying, owners and occupiers in or adjacent to spray sites must be notified, as well as relevant local iwi.

Background to the application

Actara contains the active ingredient thiamethoxam, a neonicotinoid insecticide, and is currently approved in New Zealand with controls.

The brown marmorated stink bug is one of the highest-risk biosecurity threats currently facing New Zealand, as it can cause significant damage to many important horticultural crops. It is also a significant social nuisance pest that can adversely impact personal wellbeing.

The application sought to change two controls currently in place for Actara:

1. An increase in the maximum number of applications of Actara (within any one target area) from four to 19 applications per year.
2. An exemption from a control prohibiting application of an agrichemical where bees are foraging or on plants that are in flower or likely to flower.

Read More

EPA NZ, 02-07-23

https://www.epa.govt.nz/public-consultations/decided/reassessment-of-actara/

Updates to the Cosmetic Products Group Standard

2023-08-02

We asked for feedback on proposed updates to the Cosmetic Products Group Standard, which contains rules for cosmetics in Aotearoa New Zealand. The submission period ended on 31 May 2023.

- Develop proposals
- Public consultation
- Evaluation
- Hearing or consideration
- Decision

Cosmetics are hugely popular, and many products sold in Aotearoa New Zealand are regulated as cosmetics. They include things you may not think of as cosmetics, such as soap, shampoo, and sunscreen. The group standard contains rules for these products, including how they must be labelled and what ingredients are banned or restricted.

The updates we propose

Here's a summary of the main proposed updates.

Aligning our rules for ingredients with the European Union

Schedules 4 to 8 of the group standard are lists of ingredients that are banned, restricted, or subject to other rules. The main aim of the updates is to align these lists with the requirements of the European Union – seen as a global high standard.

Phasing out PFAS ingredients

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Sometimes called forever chemicals, perfluoroalkyl and polyfluoroalkyl substances (PFAS) are used as ingredients in some cosmetics. We're proposing to ban these ingredients from cosmetics, phasing them out by the end of 2025.

Extending the group standard to cover more products

Some cosmetic products currently contain hazardous substances in concentrations too small to classify the overall product as hazardous. We're proposing to require these products to comply with the group standard. This change aims to protect consumers, give the industry clearer rules to follow, and support enforcement.

We also propose several other updates, including:

- requiring clear recordkeeping for nanomaterials
- updating requirements for fragrances
- consolidating the main text and Schedules 4 to 8 into one document
- improving the presentation and useability of the group standard.

Read the proposed updates (PDF, 372KB)

Read the Cosmetic Products Group Standard with tracked changes (PDF, 5.4MB)

Read the proposed group standard with changes hidden (PDF, 4.9MB)

View the proposal documents in the HSNO application register

Read More

EPA NZ, 02-08-23

https://www.epa.govt.nz/public-consultations/in-progress/updates-to-the-cosmetic-products-group-standard/

Proposed infringement scheme for hazardous substances

2023-08-02

We welcome your feedback on this proposed infringement offence scheme for hazardous substances under the Hazardous Substances and New Organisms Act 1996 (HSNO Act).

- Submissions open
- Analyse submissions

- Decision
- Publish regulations

You have until 5.00 pm on 28 August 2023.

The Ministry for the Environment (MfE) and the Environmental Protection Authority (EPA) have been working together to propose an infringement offence scheme for hazardous substances.

What are infringement offences?

Infringement offences:

- are for straightforward issues of fact easily identified by an enforcement officer
- deter conduct that is less serious and that does not justify prosecution
- result in an infringement notice (an "on-the-spot fine")
- don't result in a criminal conviction.

Why set up an infringement scheme

The current range of enforcement tools for hazardous substances is limited to warning letters, compliance orders, or prosecution. An infringement scheme will provide an intermediate enforcement tool.

This will let enforcement officers respond to lower-level offences in a way that is more efficient and proportional to the offending. Access to appropriate enforcement tools in a timely and efficient manner will support improved compliance and provide deterrence for future non-compliance. Improved compliance will reduce the risk of harm to people and the environment.

What feedback we would like

The consultation document proposes a list of infringement offences and the fees that go with them. We would like to hear your views on these and have asked 10 specific questions for you to consider. We are also happy to receive any general feedback on the proposed scheme.

Read the consultation document (PDF, 848KB)

How to make a submission

Anyone can make a submission on the consultation document. The document explains when and how we might make your submission public and what your privacy rights are. You can answer some or all of the questions.

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Submit online

We encourage you to use the secure online submission form. When you submit the form you will get an email with your response and a reference number.

Complete the online submission form

You can also submit by email or post

Alternatively, you can download the Word form, and email or post your response to us.

Download the Word submission form (DOCX, 121KB)

Email to: hsinfringements@epa.govt.nz

Post to: Environmental Protection Authority, Private Bag 63002, Waterloo Quay, Wellington 6140

Read More

EPA NZ, 02-08-23

https://www.epa.govt.nz/public-consultations/open-consultations/infringement-scheme-for-hazardous-substances/

AMERICA

US FDA stands by decision on phthalates in food contact

2023-07-25

On July 21, 2023, the US Food and Drug Administration (FDA) for the second time denied a citizen petition to ban eight ortho-phthalates in food contact. In its announcement, the FDA states "[w]e evaluated the reconsideration petition and concluded that it does not provide a basis for modifying the FDA's response to the original citizen petition."

Earthjustice asked for a reconsideration of the petition with new evidence after FDA denied the original petition in May 2022 (FPF reported).

The petition has gone through years of back-and-forth between civil society organizations and the FDA, with the US Congress stepping in as well. Civil society organizations had put forward the petition in 2016 based on concerns about the human health effects of phthalates that migrate

into food from packaging and processing equipment (FPF reported). The FDA is legally supposed to respond to a petition within 180 days. The organizations called for a response from FDA in 2019 (FPF reported) and finally sued the agency in 2021 (FPF reported). After the legal suit, members of Congress also demanded that the FDA formally respond (FPF reported).

Read More

FPF, 25-07-23

https://www.foodpackagingforum.org/news/us-fda-stands-by-decision-on-phthalates-in-food-contact

CA PROPOSITION 65: SETTLEMENTS/JUDGEMENTS SUMMARY FOR Q2 2023

2023-07-27

Enforcement Trends

- Product categories with the most settlements/judgments:
- Food and dietary supplements: 26%
- Bags/kits/cases/totes/backpacks/pouches: 15%
- Metals were the chemicals named in the most settlements and judgements, and accounted for 43% of settlements/judgements 105 for lead, 2 for cadmium, 2 for arsenic and 13 for two or more metals.
- Phthalates accounted for 38% of settlements/judgements, with 86 settlements/judgements were for DEHP, 11 for DINP, 5 for DIDP, 2 for DBP, and 1 for two or more phthalates.
- Additional note: there were 2 settlements for PFOA: both for paper straws.

Download Bulletin PDF file for summary charts for the top targeted Product Categories and Chemicals.

Recent CA Prop 65 Regulatory Updates

- CA Prop 65 Settlements (June 2023)
- CA Proposition 65: Exposures to Acrylamide in Cooked or Heat Processed Foods (January 2023)
- CA Proposition 65 Warning for Acrylamide in Food (January 2023)

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Read More

Bureau Veritas, 27-07-23

https://www.cps.bureauveritas.com/newsroom/ca-proposition-65-settlementsjudgements-summary-q2-2023

US, MEXICO ANNOUNCE ENFORCEMENT OF WORKER PROTECTION AGREEMENT

2023-07-08

WASHINGTON, DC – On Thursday, July 8, the U.S. and Mexico announced a comprehensive plan to ensure that international labor standards are being enforced at the General Motors' facility in Silao, Mexico. This effort represents the first step of remediation under the United States-Mexico-Canada Agreement. Through this type of enforcement, American workers are protected from unfair trade practices and are able to compete and succeed in the manufacturing sector.

U.S. Secretary of Labor Marty Walsh reacted to this historic plan:

"If we are to succeed in protecting workers' rights at home, we must ensure that those rights will not be undermined by exploitative labor practices and violations of collective bargaining rights around the world," he said. "This agreement shows the commitment of the Biden-Harris administration to centering workers in our trade policy and – if executed faithfully – it promises to result in meaningful gains for workers on both sides of our border."

The plan reflects the strong partnership between the department and the Mexican Secretariat of Labor and Social Welfare here working closely with the Office of U.S. Trade Representative and the Office and the Mexican Secretariat of the Economy. While focused on providing remedy to the more than 6,000 unionized workers of the GM facility in Silao, the plan also includes measures to strengthen policies that will improve bargaining rights and freedom of association more broadly to workers in Mexico.

Read More

US Department of Labor, 08-07-23

https://www.dol.gov/newsroom/releases/ilab/ilab20210709

Safe + Sound Week Places Spotlight on Workplace Health and Safety

2023-08-02

This August, the American Chemistry Council (ACC) continues its dedication to safety by promoting the Occupational Safety and Health Administration's (OSHA) Safe + Sound Week. This nationwide event is held every August to emphasize the importance of safety in the workplace by recognizing the successes of workplace health and safety programs and offering information and ideas on how to keep workers safe. We are thrilled to continue the tradition of highlighting the significance of workplace safety programs with OSHA during this event, as workplace health and safety is a year-round priority for ACC!

OHSA's official Safe + Sound Week website has information, guidance, and resources on workplace safety for both employers and employees. Its website features state-by-state lists of Safe + Sound Week participants and workplace safety events, along with resources for developing a workplace health and safety program. Three core elements of a workplace health and safety program encouraged by OSHA are leadership from management, worker participation, and finding & fixing hazards.

If you would like to register your Safe + Sound Week event, you can visit OSHA's website and Take the Pledge!

ACC's Year-Round Commitment to Workplace Health and Safety

ACC is dedicated to promoting workplace health and safety all year round. OSHA's Safe + Sound Week provides an excellent opportunity to showcase our commitment to supporting a safe workplace for those in the polyurethanes value chain.

ACC's Center for the Polyurethanes Industry (CPI) and the Diisocyanates (DII) and Aliphatic Diisocyanates (ADI) panels formed a voluntary alliance with OSHA aimed at providing members, occupational physicians, stakeholders, and others within the polyurethanes value chain with information, guidance, and access to training resources that promote the health and safety of workers. Originally signed in 2017 for a two-year commitment, we renewed the alliance in September 2020 for an additional five years.

Outside of the OSHA Alliance, ACC has developed numerous health and safety resources for the polyurethane value chain. These include:

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ACC Resources and Documents Libraries: ACC's CPI, ADI, and DII groups all have substantial resource libraries with important information on product stewardship and health and safety. These materials include information on polyurethane safety, industrial hygiene, worker protection, waste disposal, transportation requirements, and regulatory compliance.

Read More

American Chemistry Council, 02-08-23

https://www.americanchemistry.com/chemistry-in-america/news-trends/blog-post/2023/safe-sound-week-places-spotlight-on-workplace-health-and-safety

EUROPE

Commission seeks views to make retail and wholesale sectors more resilient, digital and green

2023-07-28

Today, the Commission is inviting interested parties to express their views on how the retail industrial ecosystem can accomplish a digital, green and skills transformation, increase its resilience and competitiveness, while doing so in a just and fair way.

As a basis for this consultation, the Commission published a documentEN• analysing the main challenges and opportunities of this transition.

Companies and business associations across the ecosystem as well as public authorities, social partners, consumers, research organisations, academia and other relevant parties can respond to the EU Survey questionnaire until 26 September 2023.

In addition to the consultation, the Commission is organising stakeholder workshops to deepen the understanding of the ecosystem. The outcome of the survey and workshops will feed into the co-creation of a transition pathway with concrete actions and commitments to drive the greening and digitalisation of the retail ecosystem, to be finalised in early 2024.

With 30 million people employed in 5.5 million companies and almost €1.5 trillion value added, the retail ecosystem, comprising retail and wholesale, is the largest of all EU industrial ecosystems. Due to its interlinkages with most of the industrial ecosystems, its competitiveness can have a

positive spill-over effect on the whole EU economy, serving 450 million EU consumers.

Read More

European Commission, 28-07-23

https://single-market-economy.ec.europa.eu/news/commission-seeks-views-make-retail-and-wholesale-sectors-more-resilient-digital-and-green-2023-07-28_en

UK: THE PRODUCT SAFETY REVIEW

2023-08-04

In 2021 a consultation conducted by the Office for Product Safety and Standards (OPSS) on product safety in the UK was carried out and they have published their proposal for the UK product safety framework.

The Product Safety Review is intended to reform the framework in the UK so that it is more accountable and proportionate.

The main areas that the product safety review will cover include:

- Ensuring business obligations are proportionate to the hazard presented by their products, looking at how to reduce compliance costs for lower risk products and where possible make the conformity assessment process easier.
- Shift the balance between regulations and industry led standards to allow for a more agile and responsive regulatory framework which should allow businesses greater scope to innovate when producing safe products
- Use digital solutions for example voluntary e-labelling
- Address concerns regarding the ease with which unsafe products can be sold online
- Enhance the leadership and co-ordination role of OPSS, and address enforcement gaps

The consultation (link below) on these proposals is now open and will close on the 24th October 2023.

Read More

Bureau Veritas, 04-08-23

https://www.cps.bureauveritas.com/newsroom/uk-product-safety-review

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Using the UKCA marking

2023-08-01

Find out if you need to use the UKCA (UK Conformity Assessed) marking on products you manufacture or handle.

The government intends to extend recognition of the CE marking for placing most goods on the market in Great Britain, indefinitely, beyond December 2024. These updates apply to the 18 regulations that fall under the Department for Business and Trade (DBT). These are:

- Toys
- Pyrotechnics
- recreational craft and personal watercraft
- simple pressure vessels
- electromagnetic compatibility
- non-automatic weighing instruments
- measuring instruments
- measuring container bottles
- lifts
- equipment for potentially explosive atmospheres (ATEX)
- radio equipment
- pressure equipment
- personal protective equipment (PPE)
- gas appliances
- machinery
- equipment for use outdoors
- aerosols
- low voltage electrical equipment

There are different rules for medical devices, construction products, cableways, transportable pressure equipment, unmanned aircraft systems, rail products, marine equipment and ecodesign. The relevant departments covering these sectors either have communicated, or will communicate, plans in due course.

This page will be updated to reflect the changes in due course.

This guidance explains how to use the UKCA marking. For information on placing products on the market, see the guidance on placing manufactured products on the market in Great Britain.

Product areas covered by the UKCA marking

You will need to use the UKCA marking if you manufacture or handle products in the following areas:

- toys
- pyrotechnics
- recreational craft and personal watercraft
- simple pressure vessels
- electromagnetic compatibility
- non-automatic weighing instruments
- measuring instruments
- measuring container bottles
- lifts

Read More

Gov.UK, 01-08-23

https://www.gov.uk/guidance/using-the-ukca-marking

INTERNATIONAL

Canada and Germany propose plans to reduce plastic, support reusable packaging

2023-08-03

The Canadian government published a pollution prevention planning notice for plastic food packaging as part of ongoing efforts to address plastic waste and pollution (FPF reported). The proposed notice would require large Canadian grocery retailers (defined in the document as retailers that generate grocery retail sales in Canada over $4 billion annually) to formulate and apply a pollution prevention plan to meet reuse and recycle targets by eliminating unnecessary packaging, displacing single-use packaging with reuse-refill systems, and providing food-safe plastics designed to be reused, recycled, and composted in Canadian facilities.

The Government of Canada's proposed objectives for the pollution prevention plan:

- "Reduce the environmental impact of primary food plastic packaging along the value chain to the greatest extent practicable through the

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elimination of unnecessary or problematic packaging and design for circularity" by 2035.
- 75% of "[f]resh fruits and vegetables are distributed and sold in bulk and/or plastic-free packaging" by 2026, and 95% by 2028.
- "All primary food plastic packaging is reusable, recyclable, or compostable" by 2028.
- "Develop strategies, outside of fresh produce, to increase, by a certain percentage, the sale of products within a reuse-refill system, products free of plastic packaging, and/or concentrated products", 20% by 2026, 50% by 2030, and 60% by 2035.
- "Non-reusable plastic food packaging contains post-consumer recycled content", 10% by 2028, 20% by 2030, and 30% by 2035.

The government is currently seeking feedback on the proposal and would like to engage with operators of supermarkets, grocery stores, processing industries, sectoral associations, non-governmental organizations, and local governments. Key inputs that they are looking for are additional objectives and factors to consider, supply chain considerations, reporting and measuring success, and data on plastic footprint.

Read More

FPF, 03-08-23

https://www.foodpackagingforum.org/news/canada-and-germany-propose-plans-to-reduce-plastic-support-reusable-packaging

EU Restricts Formaldehyde Releases From Articles under REACH

2023-07-25

Starting from August 6, 2026, formaldehyde releases from articles will be subject to more stringent rules under REACH.

On July 17, 2023, the European Union issued Regulation (EU) 2023/1464 to set the emission limits for formaldehyde and formaldehyde-releasing substances from articles. It shall enter into force 20 days following its publication in the Official Journal of the EU.

Read More

Chemlinked, 25-07-23

https://chemical.chemlinked.com/news/chemical-news/eu-restricts-formaldehyde-releases-from-articles-under-reach

Slovakia now accepts poison centre notifications through ECHA's submission portal

2023-08-03

ECHA now welcomes Slovakia as the latest Member State to accept poison centre notifications through ECHA's submission portal. For companies that have already made submissions to Slovakia via the Portal, you will now start seeing the "received" message in the Submission report.

According to our updated Overview of Member States Decisions document, the accepted language for notifications is Slovak, and no fees are expected. In addition, Slovakia is accepting consumer, professional and industrial use mixtures through to the Portal to help notifiers of industrial use only mixtures prepare for the second compliance date of 1 January 2024.

See also:

- National support page
- Overview of Member States decisions

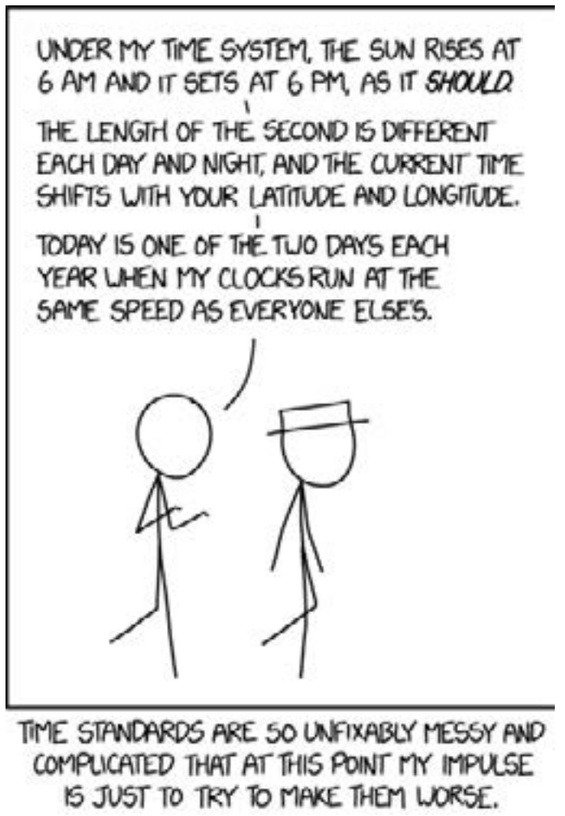
Read More

ECHA, 03-08-23

https://poisoncentres.echa.europa.eu/-/slovakia-now-accepts-poison-centre-notifications-through-echas-submission-portal

Time

2023-08-11



https://xkcd.com/2050/

Hexafluoroacetone

2023-08-11

USES [1,2]

Hexafluoroacetone is mostly employed in organic synthesis, but it is also the main chemical intermediate used in the production of hexafluoroisopropanol, as well as polymethyl methacrylates and polyesters for textile coating. It is also found in liquid form and is used in making solvents, adhesives, pharmaceutical products, other chemicals, and as a herbicide.

ROUTES OF EXPOSURE [3]

The main routes of exposure to hexafluoroacetone are:

- Inhalation;
- Contact with the skin and eyes;
- Skin absorption

HEALTH EFFECTS [2,4]

Acute Health Effects

- Hexafluoroacetone is toxic; may be fatal if inhaled, ingested or absorbed through skin.
- Vapours are extremely irritating and corrosive. Contact can severely irritate and burn the skin and eyes.
- Breathing hexafluoroacetone can irritate the nose and throat causing coughing and wheezing.
- Breathing hexafluoroacetone can irritate the lungs causing coughing and/or shortness of breath. Higher exposures can cause a build-up of fluid in the lungs (pulmonary oedema), a medical emergency, with severe shortness of breath.
- Exposure can cause headache, nausea, vomiting, dizziness and light-headedness.

Carcinogenicity

- Hexafluoroacetone has not been tested for its ability to cause cancer in animals.

Hexafluoroacetone is an organic compound with the formula CF3-CO-CF3. It comes in the form of a co-lourless, hygroscopic, non-flammable, highly reactive gas characterised by a musty odour. The most common form of this substance is hexafluoroacetone sesquihydrate (1.5 H2O). Hexafluoroace-tone is a very reactive substance: it will react vigorously with water, forming corrosive acids. In the presence of humidity, reaction of hexafluoroacetone with most metals will generate white fumes of hydrogen gas. Hexafluoroacetone will also undergo vio-lent reactions in the presence of alkali. [1]

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Chronic Effects

- Hexafluoroacetone may damage the liver and kidneys.
- Prolonged exposure may affect the blood cells.
- Hexafluoroacetone can irritate the lungs. Repeated exposure may cause bronchitis to develop with cough, phlegm, and/or shortness of breath.

Fire Hazard

- Some hexafluoroacetone may burn but none ignite readily.
- Vapours from liquefied gas are initially heavier than air and spread along ground.
- Some of these materials may react violently with water.
- Cylinders exposed to fire may vent and release toxic and/or corrosive gas through pressure relief devices.
- Containers may explode when heated.
- Ruptured cylinders may rocket.

SAFETY [2,5,6]

First Aid Measures

- If inhaled: Move to fresh air. If the person is not breathing, give artificial respiration. Avoid mouth-to-mouth contact. Seek immediate medical attention.
- In case of skin contact: Remove all contaminated clothing. Immediately (within seconds) flush affected area for FIFTEEN (15) minutes. Seek immediate medical attention.
- In case of eye contact: Remove any contact lenses. Use nearest emergency eyewash immediately for at least FIFTEEN (15) minutes. Seek immediate medical attention and continue eye rinse during transport to hospital.
- If swallowed: DO NOT INDUCE VOMITING. Never give anything by mouth to an unconscious person. Rinse mouth with water. Seek immediate medical attention.

Workplace Controls & Personal Practices

Engineering Controls

- Engineering controls are the most effective way of reducing exposure.

- The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure.
- Where possible, automatically transfer hexafluoroacetone from cylinders or other storage containers to process containers.

The following work practices are also recommended:

- Workers whose clothing has been contaminated by Hexafluoroacetone should change into clean clothing promptly.
- Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to hexafluoroacetone.
- Eye wash fountains should be provided in the immediate work area for emergency use.
- If there is the possibility of skin exposure, emergency shower facilities should be provided.

Personal Protective Equipment [5]

Gloves and Clothing

Avoid skin contact with hexafluoroacetone. Wear solvent-resistant gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation. All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

Wear non-vented, impact resistant goggles when working with fumes, gases, or vapours. Wear indirect-vent, impact and splash resistant goggles when working with liquids. Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

Where the potential exists for exposure over 0.1 ppm, use a MSHA/NIOSH approved supplied-air respirator with a full-face piece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive pressure mode.

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REGULATION

United States

ACIGH: American Conference of Governmental Industrial Hygienists has set a Threshold Limit Value (TLV) for hexafluoroacetone of 0.1 ppm, 0.68 mg/m3 TWA (Skin)

NIOSH: National Institute for Occupational Safety and Health has established a Recommended Exposure Limit (REL) for hexafluoroacetone of 0.1 ppm TWA (Skin)

Australia

Safe Work Australia: Safe Work Australia has set a 8 hour Time Weighted Average concentration for hexafluoroacetone of 0.1 ppm, 0.68 mg/m3

REFERENCES

1. http://en.wikipedia.org/wiki/Hexafluoroacetone
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7. https://www.osha.gov/dts/chemicalsampling/data/CH_245100.html
8. http://www.safeworkaustralia.gov.au/sites/swa/about/Publications/Documents/772/Workplace-exposure-standards-for-airborne-contaminants.docx

Breakthrough injectable hydrogel drug delivery system for advanced medical treatment applications

2023-08-09

The research team was led by Professor Anderson Ho Cheung Shum of the Department of Mechanical Engineering at The University of Hong Kong (HKU) and their collaborators, Professor Michael To's team from The University of Hong Kong-Shenzhen Hospital, and the group of Professor Howard Stone and Dr. Janine Nunes from the Department of Mechanical and Aerospace Engineering at Princeton University.

The latest discovery has been published in Advanced Materials.

Injectable hydrogels are valuable in wound healing due to their injectability, minimal invasiveness, and adaptability to irregular sites. However, challenges include scalable manufacturing, matching properties, and on-demand drug release, limiting control over biophysical cues for endogenous cell direction.

The research team designed and fabricated an oil-free, reaction-free, biomimetic, injectable, and fully scalable Fibro-Gel for wound healing applications. For the first time, Ph.D. student Yanting Shen and postdoctoral fellow DrYuan Liu of the Department of Mechanical Engineering, HKU discovered that Fibro-Gel with controllable physicochemical properties and drug release profiles can be precisely tailored by simply adjusting the microfiber lengths.

They found that the mechanical properties of Fibro-Gel vary depending on the length of the microfibers. Fibro-Gel with shorter microfibers exhibits lower stiffness and a more fluid-like behavior, resulting in faster rates of drug release. Conversely, Fibro-Gel with longer microfibers demonstrates higher stiffness and a more solid-like behavior, leading to slower drug release rates.

Leveraging this controllable feature, the researchers designed a drug release system with multiple drugs at different drug release rates at the same time, addressing the drawbacks of existing hydrogel systems. Extensive in vitro testing has demonstrated the favorable biocompatibility of Fibro-Gel and its potential to aid vascularization.

This discovery overcomes the limitations of conventional drug delivery via hydrogel. Along with the controllable physicochemical properties suiting different tissues, Fibro-Gel exhibits tremendous potential for the development of advanced therapies and treatment modalities.

Researchers from the Department of Mechanical Engineering at the University of Hong Kong (HKU) have recently achieved a remarkable breakthrough in the injectable hydrogel with the development of Fibro-Gel. This groundbreaking innovation successfully overcomes the challenges of scalable manufacturing and on-demand drug release, while also demonstrating exceptional biocompatibility and the potential for vascularization.

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To investigate the application of Fibro-Gel in tissue regeneration, the researchers conducted in vivo tests using a mice excision skin model. The results indicate that Fibro-Gel promotes wound healing with an accelerated rate of new tissue regeneration and the appearance of de novo regenerated healthy tissue, in comparison to a commercial gel. Furthermore, the researchers demonstrated that the release of distinct drugs at different rates could further enhance wound healing with higher efficiency using a two-layer Fibro-Gel model.

"Our research on Fibro-Gel has provided valuable insights into the controlled release rates of drugs and the tunable physicochemical properties essential for wound healing," said Ph.D. student Yanting Shen who observed the process, highlighting the remarkable effects of the release of distinct drugs at varying rates from Fibro-Gel on wound healing. "This innovative approach has significantly accelerated the rate of healing, resulting in the formation of intact new tissue."

Professor Shum was optimistic about the collaborative effort, "Our multidisciplinary research collaboration has enabled us to address the topic of wound healing from multiple perspectives, namely, microfluidics, hydrogel and drug delivery, leading to the development of Fibro-Gel. This novel hydrogel has immense potential to address critical medical needs that require more versatile and compatible soft materials."

The successful partnership between HKU and Princeton University, supported by the Research Impact Fund by the Research Grants Council of Hong Kong, exemplifies the power of cross-border collaboration and highlights the significance of pooling expertise to drive groundbreaking research in the field of regenerative medicine.

Professor Shum and his team are dedicated to pushing the boundaries of scientific and engineering discovery and fostering innovation in the biomedical field. He believes this research opens up new possibilities for material systems with extensive biomedical applications, including therapeutic agent delivery for infectious diseases and tissue regeneration.

Phys Org, 09 August 2023

https://phys.org

Breast cancer screening for women over 70 is not without risks, according to new research from Yale School of Medicine's COPPER Center. Although some guidelines recommend continuing screening for older women, a new study emphasizes the importance of assessing potential harms associated with testing, such as overdiagnosis, which, researchers say, can negatively affect quality of life.

Breast Cancer Screening for Older Women Could Risk Overdiagnosis, Study Suggests

2023-08-09

The findings were published Aug. 7 in Annals of Internal Medicine.

"The goal of this work was to quantify the risk of overdiagnosis associated with screening mammography among older women," said the first author of the paper, Ilana Richman, assistant professor of medicine (general medicine) at Yale School of Medicine and member of Yale Cancer Center. "Overdiagnosis refers to a phenomenon where we find breast cancers through screening that never would have caused symptoms. Overdiagnosis can occur when cancers grow very slowly or if a person's life expectancy is short. Finding these breast cancers can lead to worry and can result in intensive treatments, without improving length or quality of life. The findings from this study emphasize the need for a careful evaluation of the benefits and harms of screening older women," Richman said.

The study included 54,635 women who had no previous history of breast cancer and had recently undergone screening. The researchers compared the cumulative incidence of breast cancer between women who continued screening and those who did not. The analysis used data from the National Cancer Institute's Surveillance, Epidemiology, and End Results Medicare Registry.

Among women aged 70 to 74 years, the researchers found that about six out of every 100 women who had received regular mammography screening were diagnosed with breast cancer, compared to about four cases per 100 unscreened women. This higher rate of breast cancer diagnosis among screened women suggests that a substantial proportion of breast cancers identified through screening in older women did not cause symptoms or otherwise show up in unscreened women. Study authors estimated that about 31% of breast cancer cases among screened women aged 70 to 74 would likely not cause any symptoms or harm.

The study further revealed that 47% of breast cancer diagnoses in women 75 to 84 and 54% of diagnoses in women aged 85 and older were overdiagnosed, meaning that these cancers were unlikely to have become symptomatic or caused health problems. The study did not show statistically significant reductions in the risk of dying of breast cancer among women who were screened.

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"While our study focused on overdiagnosis, it is important to acknowledge that overdiagnosis is just one of many considerations when deciding whether to continue screening. A patient's preferences and values, personal risk factors, and the overall balance of risks and benefits from screening are also important to take into account when making screening decisions." Richman said.

Reference: Richman IB, Long JB, Soulos PR, Wang SY, Gross CP. Estimating breast cancer overdiagnosis after screening mammography among older women in the United States. Ann Intern Med. 2023:M23-0133. doi: 10.7326/M23-0133

Technology Networks, 09 August 2023

https://technologynetworks

A simple process solves the problem of polyester recycling

2023-08-06

Polyester got a bad rap in the '70s, mainly because it was used to make some horrendous 'fashion.' Nowadays, while fashions have arguably improved, we're more aware of the environmental impact of polyester, the second most used textile in the world.

The fabric has its pros: it's long-lasting, lightweight, moisture resistant, quick drying and easy to clean. However, on the downside, making the polyethylene terephthalate (PET) and cotton blend relies on fossil fuels and produces a lot of carbon dioxide. And once you're done wearing it, rather than being recycled, the bulk of polyester ends up in a landfill where it doesn't degrade (at least, not for a very long time).

Now, researchers from the University of Copenhagen may have developed a solution to the polyester problem, developing a simple, green way of recycling the product.

"The textile industry urgently requires a better solution to handle blended fabrics like polyester/cotton," said Yang Yang, lead author of the study. "Currently, there are very few practical methods capable of recycling both cotton and plastic – it's typically an either-or scenario. However, with our newly discovered technique, we can depolymerize polyester into its monomers while simultaneously recovering cotton on a scale of hundreds of grams, using an incredibly straightforward and environmentally friendly approach."

Researchers have developed a way of recycling one of the most popular but environmentally problematic of fabrics: polyester. Their new method is simple, non-toxic for humans and the environment and, what's more, it preserves the integrity of the cotton removed from the fabric so that it's ready for reuse.

The game-changing method requires only three things: heat, a non-toxic solvent and hartshorn salt, otherwise known as ammonium carbonate, a product used in baked goods.

"For example, we can take a polyester dress, cut it up into small pieces and place it in a container," said Shriaya Sharma, a study co-author. "Then, add a bit of mild solvent, and thereafter hartshorn salt, which many people know as a leavening agent in baked goods. We then heat it all up to 160° C [320 °F] and leave it for 24 hours. The result is a liquid in which the plastic and cotton fibers settle into distinct layers. It's a simple and cost-effective process."

When heated, ammonium bicarbonate breaks down into ammonia, carbon dioxide and water. When ammonia and carbon dioxide combine they act as a catalyst, setting off a selective depolymerization reaction that breaks down the plastic but preserves the cotton. While ammonia is toxic on its own, when paired with carbon dioxide it's safe for humans and the environment.

After discovering that carbon dioxide could be used as a catalyst to break down nylon, the researchers explored the addition of hartshorn salt and were pleasantly surprised by the results.

"At first, we were excited to see it work so well on the PET bottle alone," said study co-author Carlo Di Bernado. "Then, when we discovered that it worked on polyester fabric as well, we were just ecstatic. It was indescribable. That it was so simple to perform was nearly too good to be true."

At this stage, the researchers have only tested their method in the lab but are shopping around for companies to adopt it, touting its scalability as a selling point.

"We're hoping to commercialize this technology that harbors such great potential," Yang said. "Keeping this knowledge behind the walls of the university would be a huge waste."

New Atlas, 06 August 2023

https://newatlas.com

The discipline of systems chemistry deals with the analysis and synthesis of various autocatalytic systems and is therefore closely related to the study of the origin of life, since it investigates systems that can be considered as a transition between chemical and biological evolution: more complex than simple molecules, but simpler than living cells.

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Small-molecule autocatalysis may have paved the way for the emergence of evolution by natural selection

2023-08-09

Tibor Gánti described the theory of self-replicating microspheres as early as 1978. These still lacked genetic material, but concealed within their membranes an autocatalytic metabolic network of small molecules, isolated (compartmentalized) within their membranes.

As the autocatalytic process takes place, the membrane-building material is also produced, leading to the division of the sphere. This system may appear to be a living cell, and although it lacks genetic material, this can only be verified experimentally. These microspheres can be considered as "infrabiological" chemical systems, since they do not reach the level of biological organization, but they exceed the complexity of normal chemical reactions.

Years ago, we started to think about the possibility of experimentally realizing the process whereby the growth of a small molecule metabolic network leads to the growth of the compartments that enclose the network, to the effect that they can divide. Tibor Gánti has already identified one of the most promising candidates for this system as the formose reaction, an autocatalytic sugar-producing reaction that consumes formaldehyde and involves the circular transformation and propagation of glycolaldehyde molecules. The reaction does not require enzymes.

The study was carried out in the biochemistry laboratory of the École Supérieure de Physique et de Chimie Industrielles (ESPCI) in Paris by Professor Andrew Griffiths and his colleagues. The experiment involved creating tiny water droplets in an oil medium that did not fuse and therefore acted as artificial cells. The work is published in the journal Nature Chemistry.

Some of the "cells" were given glycolaldehyde as an autocatalyst (in addition to formaldehyde as a nutrient), others were not. In the former group, the formose reaction was triggered and, by osmosis, it sucked water away from compartments that did not contain glycolaldehyde. This allowed them to grow and to divide under external influence. Many researchers have suggested that before the emergence of regulated cell division, the initial cells divided in response to external influences such as turbulent flow.

The significance of this study is that we are the first in the world to show that the operation of a network of small-molecule autocatalytic reactions, without genetic material and enzymes, leads to the growth and division of compartments, i.e., the formation of new generations.

This has never been demonstrated before, so the result is fundamental to the experimental verification of the principles of systems chemistry and points the way forward in the study of the origin of life.

Phys Org, 09 August 2023

https://phys.org

Inflammation found to slow the progression of the malaria parasite

2023-08-09

Malaria infection develops cyclically. After a bite from a mosquito infected with Plasmodium parasites, the parasites first infect liver cells as sporozoites and mature into schizonts, which rupture and release daughter parasites called merozoites. The merozoites then infect red blood cells, where they mature from trophozoites into schizonts, rupture the cells and release merozoites, which continue the cycle by invading other red blood cells.

Using a mouse model, a team led by researchers from the Doherty Institute in Melbourne and the Kirby Institute in Sydney found that when the immune system triggered inflammation, it altered the chemical composition of the plasma, creating inhibitory factors that directly impaired the malaria parasites' maturation during the trophozoite stage in red blood cells.

"First, we discovered that inflammation in the body prevented the early stage of the parasites from maturing," said Ashraful Haque, the study's corresponding author. "We also noticed that inflammation triggered significant changes in the composition of the plasma – we were actually quite surprised by the magnitude of these changes. As we dug deeper, we found substances in the altered plasma that, we believe, are what may inhibit parasite growth in the body."

Using genome sequencing, the researchers saw that after four hours circulating in the altered plasma, the trophozoites had adjusted their genetic and protein activity, leading to slower maturation.

It's not often that inflammation gets a good rap. It's been linked to heart disease, diabetes, cancer, and autoimmune diseases. But a new study may have uncovered a positive use for the body's natural response to irritants. Researchers have found that inflammation leads to changes in the make-up of blood plasma that slow the growth of the parasites that cause malaria. They hope their discovery may one day be used to control or even prevent the disease.

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"Parasites residing in red blood cells rapidly sense and respond to their new environment, showing fascinating adaptability," said study co-author David Khoury. "Using cutting-edge genome sequencing technology, we observed that even after just four hours in this changed plasma, the parasites adjusted their genetic and protein activity, resulting in slower maturation within red blood cells. It's almost like the parasites actively sense an inhospitable host environment and as a result, trigger a coping mechanism."

The study's findings suggest a mechanism by which the development of the disease can be slowed, which, the researchers say, offers potential benefits.

"This study, while based on animal models, broadens our understanding of malaria," said co-author Miles Davenport. "It provides a foundation for further investigations into the specific mechanisms involved in the modulation of parasite maturation by inflammation and opens avenues for future studies to explore the identified inhibitory factors, genetic changes and their implications for malaria development. Ultimately, our work aims to, one day, inform the development of potential new strategies to control, prevent and reduce the burden of malaria, which affects over 240 million people globally."

The release of the current study is timely. In the US, in the last few months, Florida and Texas have reported eight malaria cases, the first locally acquired cases since 2003. Health experts have put the resurgence down to worsening climate change and an uptick in international travel since the relaxation of COVID-19 restrictions and urge health professionals to be vigilant. Malaria can lead to severe health problems such as seizures, brain damage, difficulty breathing, organ failure and death if left untreated.

The study was published in the journal mBio.

New Atlas, 09 August 2023

https://newatlas.com

F-Actin Protein Could Be Key for Osteoarthritis Prevention

2023-07-08

Osteoarthritis currently lacks a cure

OA is the most prevalent form of arthritis and affects over 32.5 million Americans. Caused by the breakdown of articular cartilage, which provides

Scientists at the University of Delaware (UD) have identified a protein – adseverin – that is protective against osteoarthritis (OA). The research, conducted in cartilage cell and animal models, is published in Science Advances.

cushioning for bone ends, it frequently occurs in the hands, knees or hips. OA can be incredibly painful and debilitating, and currently lacks a cure. Standard-of-care treatment options might include physical therapy, medications that target pain or surgery in worst case scenarios.

UD professor Dr. Justin Parreno was working on cartilage therapy when he observed that healthy cartilage cells expressed large amounts of a protein called adseverin. A former hockey player and now a dedicated basketball and weightlifting enthusiast, he has encountered his fair share of injuries in the past. "I've always been into the musculoskeletal system just because of sports. I think I was predisposed to orthopedic research because of that," he says.

In the lab, Parreno and colleagues generated knockout mouse models lacking adseverin and discovered that articular chondrocyte function was compromised via a reduction in filamentous actin (F-actin). Chondrocytes are the only cell type in cartilage tissue, where they secrete a mélange of growth factors and enzymes to support extracellular matrix synthesis.

Parreno describes that F-actin acts as a "shield", protecting cartilage cells from stress that occurs through joint movement. In animal studies, he discovered that loss of F-actin ultimately causes these cells to die. "The cells are really round, and you have F-actin around the cells," he says.

"If you lose F-actin, those cells are sensitive because there is mechanical stress on them, and they will probably undergo death. Dead cells aren't able to produce the molecules that are required to regenerate cartilage, and eventually the cartilage degrades. The cells that remain are also producing hypertrophic molecules resulting in mineralization and tissue stiffness, which leads to a really bad joint," Parreno adds. In adseverin knockout mice, these molecular changes made the articular cartilage weaker and enhanced OA severity in mice that underwent surgery to induce the condition.

Adseverin as a therapeutic target for OA?

At the Delaware Center for Musculoskeletal Research, Parreno is continuing to explore F-actin's relationship to OA development. Currently, his lab is exploring another F-actin-binding protein called tropomyosin. "What I really find groundbreaking about this work is not necessarily adseverin, but that F-actin is reduced in OA and leads to all of these changes," Parreno describes. "We know all of these changes are happening and if we can find out what's the critical node in regulating all of these

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things, then we may be able to develop an OA therapy. I think targeting F-actin might be that and we have just uncovered the tip of the iceberg."

It's possible that other molecules – beyond adseverin – could regulate F-actin, potentially leading to novel therapeutic avenues for OA. "Once we figure out which molecules are important, perhaps we can chemically target them to prevent joint degradation," Parreno says.

Reference: Chan B, Glogauer M, Wang Y, et al. Adseverin, an actin-binding protein, modulates hypertrophic chondrocyte differentiation and osteoarthritis progression. Sci Adv. 9(31):eadf1130. doi:10.1126/sciadv.adf1130

Technology Networks, 08 August 2023

https://technologynetworks.com

Human scent receptors could help 'sniff out' nerve gases in new sensor

2023-08-09

Nerve gases are often very potent, requiring highly sensitive sensors to detect them quickly and accurately. One method of boosting sensitivity combines human scent receptors with nanomaterials such as reduced graphene oxide to create a "bioelectronic nose." But since these nerve gases are still highly dangerous even in laboratory settings, many scientists rely on safer, substitute molecules instead.

In the case of the sarin or soman nerve agents, dimethyl methylphosphonate (DMMP) is a common replacement. Previously, the receptor protein hOR2T7 has been used to detect DMMP, but it could only do so when the nerve agent substitute was in a liquid form, rather than as a gas. So, Tai Hyun Park, Jyongsik Jang and colleagues wanted to design a "nose" of their own that was both highly sensitive and selective for the gaseous form, using nanodiscs containing the hOR2T7 receptor.

To create nanodiscs, researchers combined hOR2T7 with a membrane scaffold protein and other lipids. The hOR2T7 squeezed inside the scaffold, almost like an inflatable innertube, which kept it upright to readily bind DMMP. The disks were then stuck to the reduced graphene oxide layer of the sensor, which was decorated with nickel atoms to help hold the disks in the right position. Even when exposed to compounds with similar shapes or smells, the sensor only detected DMMP, and was sensitive enough to sense a concentration as low as 0.037 parts per billion.

By some estimates, the human nose can detect up to a trillion different smells with its hundreds of scent receptors. But even just catching a quick whiff of certain chemicals known as nerve agents can be lethal, even in tiny amounts. Researchers reporting in ACS Sensors have developed a sensitive and selective nerve gas sensor using these human scent receptors. It reliably detected a substitute for deadly sarin gas in simulated tests.

The team also showed that the device was suitable for real-world scenarios, such as smoky conditions and during repeat tests. Though further experiments are needed, the researchers say that this work shows that human scent receptors are useful components for highly sensitive and selective gas sensors.

Phys Org, 09 August 2023

https://phys.org

Researchers discover antifungal molecule

2023-08-07

"The molecule we're excited about is called persephacin," said Robert Cichewicz, Ph.D., principal investigator and Regents Professor in the Department of Chemistry and Biochemistry, Dodge Family College of Arts and Sciences at OU. "This antifungal discovery appears to work on a broad spectrum of infectious fungi, and it is reasonably non-toxic to human cells, which is a huge deal because many current treatments are toxic to the human body."

The rise in fungal infections is due, in part, to the successful treatment of other diseases. As people live longer and successfully undergo treatments like chemotherapy and organ transplants, they often live with weakened immune systems. When drugs that treat arthritis and other ailments that also weaken immune systems are added to the mix, a perfect storm is created for potentially deadly fungal infections.

Cichewicz, who has been researching fungi for nearly 20 years, leads the Natural Products Discovery Group at OU. This team of researchers discovered this novel molecule and developed a unique method for testing plants for their antifungal properties.

"Fungi are found throughout the botanical world, and plants and fungi often work together. Some of these fungi kill competitors or deter insects from eating the plant," Cichewicz said. "We hypothesized that if these plant-dwelling fungi, known as endophytes, could help the plants fight off infections by killing the invading fungi, then these molecules might also be able to protect humans and animals from fungal pathogens. As it turns out, we were right."

The team developed a novel way to procure leaf samples using a laser device called the Fast Laser-Enabled Endophyte Trapper, or FLEET. This method helps generate samples in a sterile environment and drastically increases the number of samples that can be acquired.

Fungal infections are killing thousands of Americans each year, some with a morbidity rate of nearly 80%. To make matters worse, only a handful of antifungal treatments are available, and even those are becoming less effective as fungi become more resistant. However, University of Oklahoma researchers have recently published findings in the Journal of Natural Products indicating that a novel breakthrough treatment may have been discovered.

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"Using traditional methods, we could process roughly four to six samples per minute," Cichewicz said. "But our FLEET system is capable of aseptically generating between 500-600 tissue specimens in 10 minutes. This allows us to rapidly screen more samples and enhances the opportunity for potential drug discoveries."

With assistance from the Office of Technology Commercialization at the University of Oklahoma, Cichewicz was awarded a U.S. patent for using persephacin to control infectious pathogens.

"It's taken us a long time to get to this point, but now we're hoping to work with an industry partner to help us develop this treatment," Cichewicz said. "Antifungal resistance keeps evolving, and this could provide a new alternative. That's why this molecule is so exciting."

New Atlas, 07 August 2023

https://newatlas.com

Carpets found to retain a stubborn grip on pollutants from tobacco smoke

2023-08-09

When thirdhand smoke settles into surfaces, it doesn't stay there. Chemicals re-enter the air, sometimes transforming into new types of contaminants. Carpet is a major sink for thirdhand smoke. In this study, the researchers evaluated the effects of ozonation, a common cleaning method, on smoke-exposed carpet.

The study, which was recently published in the journal Environmental Science and Technology, examined smoke-contaminated aged carpets that had been retrieved from homes in the San Diego area, as well as new carpet exposed to fresh smoke in the lab.

The team found that while ozonation partially removed a group of compounds named polycyclic aromatic hydrocarbons from both aged and fresh carpet samples, it was relatively ineffective at removing deeply embedded nicotine, because the fibers and other chemical constituents in the material serve as a chemical shield. They evaluated the samples in a room-size environmental chamber at Berkeley Lab's Air Quality Testing Laboratory, with additional tests carried out at the Molecular Foundry, a DOE Office of Science user facility at Berkeley Lab.

The research, which was supported by grants from the University of California Tobacco-Related Disease Research Program, highlights carpets

In rooms where smoking has taken place regularly, tobacco's imprint lingers on indoor surfaces, even long after regular smoking has stopped. The leftover residues, known as thirdhand smoke, can be a long-term source of indoor pollutants. New research from a team led by the Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) zeroes in on carpets as an especially potent—and difficult to clean—reservoir of tobacco contaminants.

as a common and important reservoir and source of contaminants from thirdhand smoke.

"Because it does not reach deeply into materials, ozone has a limited ability to 'clean' permanently," said Berkeley Lab researcher Xiaochen Tang, the study's lead author. "In the case of carpet, the best solution may be replacing it with a new one."

The work builds on a previous study from Berkeley Lab's Indoor Environment Group, which found that ozonation could remove tobacco contaminants from a room. In that 2021 study, the ozonation was conducted only on freshly generated thirdhand smoke.

Ozone generators release ozone gas so that it can react with harmful compounds and remove them from the air and from surfaces. But the generator also creates a burst of contaminants when running, the previous study showed, pointing to the need for ventilation and a waiting period before people can re-enter a space after ozonation.

Berkeley Lab Senior Scientist Hugo Destaillats noted that ozonation has been used as a remediation method for years because it is good at removing odors—but that can create a false sense of efficacy.

"Ozone generators are also used to remediate fire damage and mold, but they have limitations, as we saw in this study," Destaillats said. "The lack of a detectable smell does not mean that all of the contaminants we are concerned about have been eliminated." Next steps in this research will evaluate the role of other indoor reservoirs, such as drywall and upholstery.

Phys Org, 09 August 2023

https://phys.org

Insulin-Like Growth Factors Can Remodel the Brain

2023-08-04

To understand how IGF1 and IGF2 promote brain health, scientists investigated the activation of this signaling pathway in the hippocampus, an area of the brain critical for learning and memory. Specifically, they wanted to explore whether IGF signaling was active during synaptic plasticity, the cellular process that strengthens connections between neurons during memory formation and protects against cognitive decline.~swebsite, date

The insulin superfamily of hormones, including insulin, insulin-like growth factor 1 (IGF1), and insulin-like growth factor 2 (IGF2), play a crucial role not only in regulating blood sugar, metabolism, and growth, but also in healthy brain development and function, including learning and memory. These hormones can enter the brain through the bloodstream from the liver or can be synthesized directly in neurons and glial cells within the brain. They bind to receptors, including the IGF1-Receptor, activating signals that modulate neuron growth and activity. Disruption of this signaling pathway is

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To do this, Max Planck scientists developed a biosensor that detected when the IGF1-Receptor was active, allowing them to visualize the activity of the signaling pathway involved in plasticity. When a synapse was undergoing plasticity, the scientists observed that the IGF1-Receptor was robustly activated in the strengthening synapse and nearby synapses. This receptor activation was critical for synaptic growth and strengthening during plasticity. However, where the IGF that activates the receptor was coming from was unknown.

Lead researcher and first author of the scientific publication, Dr. Xun Tu, however, described how being able to visualize the receptor activation during plasticity gave them a clue. "The fact that the activation of the IGF-Receptor was localized near the synapse undergoing plasticity suggested that IGF1 or IGF2 might be produced in hippocampal neurons and locally released during plasticity," she explained.

To explore this hypothesis, the scientists tested whether IGF1 and IGF2 were produced and could be released from hippocampal neurons. Interestingly, they found a region-specific difference in the production of IGF1 and IGF2. One group of neurons in the hippocampus, CA1 neurons, produced IGF1; another group, CA3 neurons, produced IGF2 (see picture). When either CA1 or CA3 neurons were activated in a way that mimicked synaptic plasticity, IGF was released. Importantly, when the scientists disrupted the ability of the neurons to produce IGF, the activation of the IGF1-Receptor during plasticity and synaptic growth and strengthening was blocked.

Senior author on the publication and Max Planck Scientific Director, Dr. Ryohei Yasuda, summarized the findings. "This work reveals a local, autocrine mechanism in neurons that is critical for brain plasticity. When a synapse undergoes plasticity, IGF is released locally to activate the IGF1-Receptor on the same neuron. Disrupting this mechanism impairs the plasticity, highlighting its critical role in maintaining cognitive health."

This discovery of this new mechanism sheds light on how memories are encoded in the brain and highlights the importance of further study on the insulin superfamily of hormones in the brain. The scientists hope that understanding the mechanism through which IGF hormones facilitate brain plasticity, will lead to research into whether targeting this signaling pathway could prevent cognitive decline and combat diseases like Alzheimer's.

Reference: Tu X, Jain A, Parra Bueno P, Decker H, Liu X, Yasuda R. Local autocrine plasticity signaling in single dendritic spines by insulin-like growth factors. Sci Adv. 2023;9(31):eadg0666. doi: 10.1126/sciadv.adg0666

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Groundbreaking Epstein-Barr virus vaccine may prevent MS

2023-08-08

After a landmark study published last year found that the risk of developing multiple sclerosis (MS) increased 32-fold after infection with Epstein-Barr virus (EBV), researchers from QIMR Berghofer Medical Research Institute set about developing a vaccine against the virus.

A member of the herpes family of viruses, EBV is carried by about 95% of the population. Most are infected during childhood, after which time the virus lays dormant. But infection in adolescence or early adulthood can cause infectious mononucleosis, "mono" or glandular fever, which is considered a major risk factor in developing EBV-related diseases, including MS. In addition, EBV has been associated with multiple types of lymphoma and nasopharyngeal (nose and throat) cancer.

While preexisting antibodies produced by B cells are known to provide a defense against acute viral infection (humoral immunity), research has shown that effective long-term control depends on the cellular immunity provided by so-called killer T cells, which are responsible for destroying virus-infected cells. So, the researchers designed a vaccine that targets both arms of the immune system.

"Other vaccine efforts have focused on inducing neutralizing antibodies against the virus, which blocks infection of immune B cells during primary acute infection," said Rajiv Khanna, corresponding author of the study. "But EBV in its latent state hides inside B cells, turning them into tiny virus factories ready to divide and spread whenever our immune defenses are down. It is our killer T cells that detect and control these infected B cells."

Testing their vaccine by injecting it into the lymph nodes of mice, where the immune response is initiated, the researchers found it produced potent humoral and cellular immunity during primary and latent infection with EBV that was sustained for over seven months. The immune response produced by the vaccine also eliminated or significantly delayed the growth of EBV-positive lymphoma tumor cells in lab models.

The researchers say their vaccine shows promise as a means of providing immunity against EBV and, therefore, the diseases it can lead to.

"Our vaccine formulation induces that killer T cell immune response as well as the neutralizing antibody immune response," said Khanna. "We think that in susceptible individuals, EBV-infected B cells travel to the brain and

Researchers have developed a ground-breaking vaccine that generates two types of immunity against the Epstein-Barr virus, a virus that almost all of us carry and which has been found to be a primary cause of diseases like multiple sclerosis and some cancers.

cause inflammation and damage. If we can prevent this at an early stage of infection then the infected B cells can't go on to cause the development of secondary disease like MS."

In addition to treating the cause of MS, the vaccine could potentially be used to prevent EBV-related cancers and to treat immunocompromised organ transplant recipients for whom EBV infection can be life-threatening.

"QIMR Berghofer has been researching the role of EBV in disease and cancer for decades," said the study's lead author Vijayendra Dasari. "It is a really proud moment for us to see all of this work coming together, with this vaccine now heading towards the next important stages of development."

Those next stages include human trials.

The study was published in the journal Nature Communications and the below video, produced by QIMR Berghofer, explains what EBV is and how the vaccine works.

New Atlas, 08 August 2023

https://newatlas.com/a>

Honeybee venom destroys breast cancer cells in less than 30 minutes

2023-06-09

The European honeybee (Apis mellifera) has been the source of a number of products used medicinally by humans, such as honey, propolis, and venom for thousands of years. However, the molecular determinants of the anticancer activity of bee venom remain poorly understood, particularly in breast cancer, the most common cancer in women worldwide.

Understanding the molecular basis and specificity of bee venom against cancer cells is key for developing and optimizing novel effective therapeutics from a natural product that is widely available and cost-effective to produce in many communities around the world.

The active component of honeybee venom is melittin, comprising half of honeybee venom by dry weight. Melittin is a positively charged, amphipathic 26-amino-acid peptide that associates with the phospholipids of the membrane bilayer, causing cell death by forming

The cancer community is buzzing over a new study that says venom from bees can kill cancer cells.

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~4.4 nm-diameter transmembrane toroidal pores that may enable the internalization of additional small molecules with cytotoxic activities.

Scientists at the Harry Perkins Institute of Medical Research in Western Australia tested venom from more than 300 honeybees and bumblebees against two types of aggressive, hard to treat breast cancer: triple negative and human epidermal growth factor receptor 2 (HER2) enriched. They found that a compound in the venom called melittin could destroy breast cancer cells within an hour, without causing harm to other cells.

As the active component of honeybee venom, melittin is a positively charged, amphipathic 26-amino-acid peptide. Researchers found it was able to target cancer cells by shutting down the activity of molecules overexpressed in these cancers. They also found that when used in conjunction with chemotherapy drugs, the melittin helped formed pores in the cancer cell membrane which could potentially allow therapies to better penetrate the cells.

While the tests for this study were only done in a lab setting, the researchers believe the compound can be synthetically reproduced as a treatment for breast cancer.

Dr. Marilena Tauro, a breast cancer researcher at Moffitt Cancer Center, says while the discovery is impressive, more research would need to be done before it could become a viable therapy.

"The good news is this study has shown that melittin can disrupt signaling pathways in breast cancer cells that are responsible for growth and spread of the disease," she said. "However, there have been many studies where compounds have proved successful at killing cancer cells in the lab or animal models, but it has taken many years for those discoveries make it to patients, if at all."

Tauro added that approximately half of all current drugs are derived from natural products, which demonstrates the potential of using bee venom for drug discovery.

"Nature is a great supplier of active elements and chemical synthesis has made it possible to provide many drugs of natural origin in the dosage required for therapeutic use, despite the often very limited supply from their original sources," she said.

Honey Bee Venom

There are around 20,000 species of bees: with the study looking at the European honeybee found in Australia, Ireland and England. The bee populations from each country produced almost identical effects in breast cancer cells.

It also looked at the venom from bumblebees: but this did not have the same effect and was unable to induce cell death.

One of the first reports of the effects of bee venom was published in 1950, where venom reduced the growth of tumours in plants. Over the past two decades, interest in apitherapy has grown, as has interest in the effects on honeybee venom on different cancers.

Despite this, the molecular mechanisms and selectivity of biomolecular components of honeybee venom as anticancer agents remain largely unknown – prompting the new study.

"Understanding the molecular basis and specificity of bee venom against cancer cells is key for developing and optimizing novel effective therapeutics from a natural product that is widely available and cost-effective to produce in many communities around the world," Say researchers.

Briter Side of News, 09 June 2023

https://brighterside.news

Microplastics trigger brain inflammation, found in heart tissue

2023-08-09

Although small, at less than 5 mm (0.2 in) wide, microplastics have gained big notoriety of late, being found everywhere in the world, from the summits of Mount Everest to the depths of the ocean. So it's hardly surprising that microplastics have also made their way into our internal organs.

Two recent studies have investigated microplastics in organs and the effects they might have. The first, undertaken by researchers at South Korea's Daegu Gyeongbuk Institute of Science and Technology (DGIST), examined the effect of ingested weathered microplastics on the brains of rats. The second, by the Capital Medical University in Beijing, China, looked at microplastics found in the heart and bloodstream before and after surgery.

Microplastics are everywhere, including being found to enter our bodies through cavities exposed to the outside world.

Two new studies have further examined the effect of microplastics on our health, with one finding that they cause brain inflammation and the second finding them in the heart, a completely enclosed organ.

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The DGIST study concerned the toxicity of weathered microplastics, which have undergone natural degradation after exposure to ultraviolet (UV) light and wind. With previous studies showing that microplastics can enter the tissues of living organisms, including humans, the researchers wanted to see whether they produced harmful effects on the brain.

Weathering caused by sunlight, air, heat, rain and wind alters the physical and chemical properties of microplastics. UV light, for example, causes a reaction that produces free radicals and promotes the fragmentation of the plastic into smaller particles called secondary microplastics. However, the precise biological effects of weathered microplastics are poorly understood.

The researchers artificially created secondary microplastics by replicating the process of natural weathering, subjecting crushed microplastics to UV light and physical impact for seven days. They then orally administered the weathered microplastics, measuring 100 micrometers or less, to rats once a day for seven days. Another group of rats were fed unweathered microplastics.

They found that, compared to the control group, the rats fed weathered microplastics showed a significant increase in the expression of inflammatory proteins associated with neurodegeneration and cell death, as well as a decrease in pro-inflammatory proteins in the external brain tissue. After conducting experiments using a human microglial cell line, the cells that regulate brain inflammation, the researchers found that the weathered microplastics stimulated the microglia to activate an inflammatory response.

The researchers say their findings suggest that weathered microplastics are more toxic than unweathered ones.

"Through proteomics-based analysis, we have, for the first time, identified that plastic leaked into the environment undergoes an accelerated weathering process, transforming into secondary microplastics that can serve as neurotoxic substances, leading to increased inflammation and cell death in the brain," said Seong-Kyoon Choi, corresponding author of the study. "The implications of microplastics' harmfulness are particularly alarming, as secondary microplastics exposed in natural environments induce a more severe inflammatory response in the brain."

The DGIST study demonstrates that microplastics can produce harmful effects when ingested, but can microplastics make their way to our innermost organs, such as the heart, which is not directly exposed to the

environment? The Capital Medical University study shows that the answer to that question is 'yes.'

In this study, researchers collected heart samples from 15 people during heart surgery, in addition to pre- and postoperative blood samples from seven of the participants. Analyzing the samples using laser direct infrared imaging, they found microplastics in the heart and surrounding tissues.

Microplastics were not found in all tissue samples, but nine types were found across five types of heart tissue, measuring between 20 and 500 micrometers in width. Nine types of microplastics were also detected in pre- and postoperative blood samples.

The plastics found were polyethylene (PE), polyethylene terephthalate (PET), polyurethane (PU), polyvinyl chloride (PVC), polycarbonate (PC), polypropylene (PP), polyamine (PA), polystyrene (PS), and poly(methyl methacrylate) (PMMA). PET was the most prevalent (77%) in tissue samples. The most prevalent plastics in blood samples were PA (49%) and PET (22%).

Tens to thousands of individual microplastic pieces were observed in most tissue samples, though amounts and plastic types varied across participants. All of the blood samples – pre- and post-surgery – contained plastic particles of diverse types, but after surgery, their average size decreased.

The researchers say their study provides preliminary evidence that microplastics can accumulate in the heart despite being enclosed in the chest cavity. They say it also shows that an overlooked path of microplastic exposure, especially the larger particles, is invasive medical procedures, which may permit direct access to the bloodstream and tissues.

Further studies are needed to investigate how microparticles enter the heart tissues and their potential effects on long-term prognosis following heart surgery.

The study about weathered microplastics and brain inflammation was published in the journal Environmental Research, while the study about microplastics in the heart was published in the journal Environmental Science & Technology.

New Atlas, 09 August 2023

https://newatlas.com

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A New Vaccine for EBV, The World's Most Successful Virus

2023-08-08

The coronavirus pandemic showed how an infectious virus could shut down society. While the steps governments took to control the virus will be debated in public health for decades to come, in March 2020 the need to do something – anything – to stop the spread of a virus that could infect the whole human race was inescapable.

But before SARS-CoV-2 captured headlines and reshaped our society, another virus had already established itself as a master infector of the human race: EBV. A member of the herpesvirus family, EBV has, without any of the panic produced by SARS-CoV-2, come to infect more than 95% of the human population. One reason for the relaxed response to the mass spread of EBV is that the disease it causes, infectious mononucleosis or mono, pales in comparison to the effects of COVID-19. As EBV is so successful, most people are infected in their young adulthood, an age group in which mono causes nearly 1 in 10 sore throats.

Once the fever and swollen neck caused by mono resides, EBV doesn't go away. It nests in a subset of our immune cells called B cells. It then stays there – for life. B cells are an essential component of our immune system – orchestrating antibody responses to other infections – meaning we can't just excise these infected cells. Instead, the body settles into an uneasy truce, where infected cells are marshaled by another immune cell type – T cells – that stop the infection from spreading. But a growing understanding of how EBV works suggests that the impact of letting a virus live in our body for life may be greater than we realized.

A silent and successful virus

"EBV is associated with multiple lymphoid and epithelial cancers such as Burkitt lymphoma (BL), Hodgkin lymphoma (HL), B-, T-, natural killer cell lymphoma, post-transplant lymphoproliferative disorder (PTLD), gastric carcinoma (GC) and nasopharyngeal carcinoma (NPC). In fact, it is estimated that EBV is responsible for approximately 265,000 new cases of cancers and 164,000 cancer deaths globally per year," explain Vijayendra Dasari and Rajiv Khanna, authors of the new paper and researchers at the Berghofer Medical Research Institute's Centre for Immunotherapy and Vaccine Development in Brisbane, Australia.

A seismic paper published last year also showed that EBV infection is required for people to develop multiple sclerosis (MS). A vaccine against

EBV could open the possibility of massively reducing the incidence of these diseases in future generations.

Complex virus, complex vaccine

A vaccine against EBV has proved elusive to researchers; the virus hasn't become so successful by being easy to hunt. It's a complex agent that shifts over its life cycle, making it hard to aim a vaccine at any one viral target. An effective vaccine, say Dasari and Khanna, will need to "induce both antibody and cellular immune responses against multiple viral proteins."

One approach that might usually serve this purpose, subunit vaccination, incorporates whole sections of viral protein into a vaccine's structure, helping the immune system better recognize and neutralize the real virus later on. But in addressing EBV, subunit vaccination is a non-starter; the virus is so oncogenic that its use in a vaccine might increase cancer risk in the vaccinated.

Instead, the team designed a vaccine using an innovative approach that matches the complexity and ingeniousness of the virus itself.

Rather than including whole proteins or protein subunits in their vaccine, the team instead constructed their vaccine using epitopes – small sequences of amino acids that activate an immune response. By using this more compact approach, the team was also able to add multiple epitopes onto a vaccine "chain" – incorporating 20 EBV epitopes in total. Each epitope targets one of the proteins that EBV expressed at different stages of its life cycle. Dasari and Khanna hope that when the human immune system is exposed to the vaccine, it will generate cells that can respond to EBV in both its acute and latent phases.

Dasari and Khanna's team also designed a novel adjuvant – a vaccine ingredient that enhances its power and targeting ability. This adjuvant, they say "allows trafficking of vaccine antigens directly to lymph nodes which are the primary sites for induction of both humoral and cellular immune responses."

Genetically altered mice

The power and precision of the new vaccine have been demonstrated in a series of experiments using mice genetically altered to feature a human-like immune system. Vaccinated mice produced a robust immune response against EBV that lasted for more than seven months – a serious chunk of time in the roughly two-year mouse lifespan.

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EBV increases the risk of developing an immune cell cancer called B cell lymphoma. While unvaccinated mice injected with cancerous B cells quickly developed tumors, the cancer's spread was largely neutralized in vaccinated mice.

Dasari and Khanna's research remains at an early stage, and future work will have to assess how well the vaccine can boost the human, rather than mouse, immune system. But the significant and silent burden of EBV infection shouldn't be ignored any longer, say the authors.

While the vaccine has been designed to treat future generations not yet infected with EBV, the team plan to see whether it can have uses in the here and now. "It will be interesting to see if this vaccine can also help to protect EBV-infected individuals from future emergence of EBV-associated diseases such as MS," they add.

Technology Networks, 08 August 2023

https://technologynetworks.com

Could the world go PFAS-free? Proposal to ban 'forever chemicals' fuels debate

2023-08-01

These chemicals, per- and poly-fluoroalkyl substances (PFASs), are all around us. They coat non-stick cookware, smartphone screens, weatherproof clothing and stain-resistant textiles. They are also used in microchips, jet engines, cars, batteries, medical devices and refrigeration systems (see "Forever chemicals' in Europe').

PFASs are extraordinarily useful. Their fluorine-swaddled carbon chains let grease and water slide off textiles, and they protect industrial equipment from corrosion and heat damage. But their strong carbon–fluorine bonds cannot be broken apart by natural processes. So after PFASs escape from factories, homes and vehicles into the environment1, they add to a forever-growing pollution problem. The February proposal estimates that tens of thousands of tonnes of these chemicals escape annually in Europe alone.

Several PFASs are now known to be toxic. They have been linked to cancers and damage to immune systems, and are now banned under national and international laws. Most PFASs, however, have not yet undergone toxicology assessments or been linked to health harms. But officials at the agencies that submitted the plan to the ECHA say their

This February, the European Chemicals Agency (ECHA) in Helsinki published a proposal that could lead to the world's largest-ever clamp-down on chemicals production. The plan, put forward by environmental agencies in five countries — Denmark, Germany, the Netherlands, Norway and Sweden — would heavily restrict the manufacture of more than 12,000 substances, collectively known as forever chemicals.

persistence means they will inevitably build up until as-yet unknown safe thresholds are crossed.

"We see that there is an unacceptable risk now," says Richard Luit, a policy adviser at the Dutch National Institute for Public Health and the Environment in Bilthoven.

There's no prospect of an instant ban. The ECHA is consulting on the idea before it takes a position. European legislators are unlikely to have a plan to vote on before 2025, and even the current proposal offers grace periods — of more than a decade in some cases — to allow manufacturers to develop alternative materials or systems. Several permanent exemptions are also offered (including for fluorinated drugs, such as Prozac, and for materials used to calibrate scientific instruments).

But taken as a whole, the idea is to shrink PFAS use to a minimum. "We are asking society to make quite a shift," says Luit. "We are asking to reverse all of it, go back to the drawing table and invent alternative solutions."

Change is already under way for consumer use of PFASs. The notoriety of the toxic examples has pushed more than 100 companies and brands, including Apple, to pledge to phase out PFASs, even before it's clear whether other materials can do the same job.

For industrial users, however, the idea of life without PFASs is a more shocking prospect. So February's proposal has ignited debate about which uses of fluorinated chemicals the world could leave behind — and which must stay.

Three forms of forever

A peculiarity with fluorinated compounds, researchers say, is that some kill, whereas others are safe enough for use in medical products. "Fluorine compounds are really, really, incredibly strange in this regard," says Mark McLinden, a chemical engineer at the US National Institute of Standards and Technology in Boulder, Colorado. "Certain fluorine compounds are incredibly toxic. And then you have things like [the gas] R134a, which is benign enough that you're shooting it directly into your lungs in asthma inhalers".

Forever chemicals come in three distinct forms (see 'Fluorinated world'). The notoriously toxic kinds are fluorosurfactants. These molecules resemble those in soap, made of two parts: carbon chains with fluorine atoms wrapped around them, that repel everything, and a water-loving

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portion at one end of the chains that allows the molecules to dissolve in water.

After some of these molecules were linked to serious health harms and widespread water pollution, individual substances were banned or severely restricted internationally: first PFOS (perfluorooctanesulfonic acid) in 2009, then PFOA (perfluorooctanoic acid) in 2019, and, last year, PFHxS (perfluorohexanesulfonic acid). Manufacturers have moved on to other fluorosurfactants, many of which lack toxicity studies.

The February proposal suggests phasing out all the fluorosurfactants at once to avoid "regrettable" substitutions, says Jona Schulze, a staff scientist at the German Environment Agency in Dessau-Roßlau.

But the proposal goes further than that. The five agencies behind it have adopted the Organisation for Economic Co-operation and Development's definition of PFASs: any molecule with a carbon atom in a chain that's bonded to two fluorine atoms (or, if at the end of the chain, three). Restrictions under this expansive definition cover the other two kinds of forever chemicals.

There are the fluoropolymers, the plastic-like form that most consumers encounter. The most famous example is Teflon, or polytetrafluoroethylene (PTFE), long carbon chains wrapped in fluorine atoms. A Teflon-based coating makes frying pans non-stick; in medical products, it helps catheters to glide through the body, safeguards implants from deterioration, and, coated on the inside of bottles and blister packs, prevents drugs from interacting with their glass or foil containers. Stain-resistant textiles use a variant of this structure, in which fluorine-wrapped side chains hang off a main carbon chain.

The third category of PFASs is made up of small, light fluorocarbon molecules that generally exist as gases or liquids. R134a, the asthma-inhaler propellant, is also a common refrigerant in refrigerators and mobile air-conditioning systems, for instance. Sensitive equipment that is prone to overheating, such as servers in a data centre, can be submerged in fluorocarbon fluids that cool the apparatus without shorting its circuits or running the risk of fire.

Although fluoropolymers and fluorocarbons haven't been shown to harm consumers directly, the problems come when they're produced and when their useful lives end. Fluoropolymers are created using toxic fluorosurfactants, which pollute water and soil around fluoropolymer plants worldwide. Some researchers also suspect that fluoropolymers

might, during their long lifetimes, shed fragments small enough to be ingested, as is known to happen with microplastics (Nature 593, 22–25; 2021). As for the fluorocarbons, some are powerful greenhouse gases, and others break up into a small-molecule PFAS that is now accumulating in water.

"If no action is taken, at some point the societal costs due to continued use are likely to exceed the costs which are now associated with their restriction," says Schulze.

The electric-car conundrum

To see all three forms of PFAS in one product, look no further than cars. Their air-conditioning systems use a fluorocarbon refrigerant, the hydraulic fluids usually contain fluorosurfactant additives that prevent corrosion, the painted chassis probably has a weatherproof fluoropolymer coating, and the seats are usually covered in a stain-resistant fluorinated textile.

Electric vehicles are even more reliant on fluoromaterials because of their lithium-ion batteries. These batteries get their high energy density, and therefore range, by operating at relatively high voltages, explains Gao Liu, a chemist at Lawrence Berkeley National Laboratory in Berkeley, California. The metallic content in their cathodes is usually a powder that must be bound together with a material that can withstand the high voltage. In the 1990s, that was PTFE; today, battery makers use a cheaper fluoropolymer called polyvinylidene fluoride (PVDF), containing half the fluorine.

Smaller fluorinated molecules have become crucial, too. Adding them to battery electrolytes allows a protective layer of lithium fluoride to form on the electrodes, improving performance and extending lifetime by preventing cracks, says Cheng Zhang, a chemist at the University of Queensland in Brisbane, Australia. This area has become a battleground for battery manufacturers, who are developing cocktails of fluorinated additives.

Liu has developed a fluorine-free binder, but it works only for a lower-voltage battery such as one based on lithium iron phosphate. These batteries do have advantages: they last longer and don't use critical minerals such as cobalt, nickel or manganese, important factors to consider as battery production ramps up in the fight against climate change, Liu says. But even though lithium iron phosphate batteries would work for stationary storage and already power half of Chinese electric vehicles, they might not be cost-effective for long-range vehicles.

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"The whole field needs to look into better chemistries," says Liu. "The reason we switch to batteries is to protect the environment. It doesn't make sense to invent something that's dirtier than before."

The hydrogen economy

The push for clean energy involves fluoromaterials on another front: building the hydrogen economy. Central to this effort are electrolysers that generate 'green' hydrogen by splitting water, powered by renewable electricity.

The fluctuations of wind and sun favour a type of electrolyser that uses a proton-exchange membrane system (PEM). Such systems can ramp up and down quickly, unlike an older, well-established electrolyser for splitting water. As the name suggests, PEMs involve membranes that control the movement of protons (that is, positively charged hydrogen ions) between electrodes. Fluorinated materials are favoured for the membrane because they can tolerate the acidic operating conditions.

Seeking to enter green hydrogen production, the fluorochemicals manufacturer Chemours this January announced a US$200-million expansion in France to produce more of its fluorinated Nafion membrane. (Nafion is currently used for the valuable chlor-alkali process, which splits brine into chlorine and sodium hydroxide, products that in turn are used in half of all industrial chemical processes.)

But PFASs aren't necessary for green hydrogen: an emerging alternative to PEMs involves systems that instead move negatively charged hydroxide ions across membranes in an alkaline environment, says Benjamin Britton, a chemist who co-founded the start-up Ionomr Innovations in Vancouver, Canada. Ionomr is among firms creating non-fluorinated membranes for such anion-exchange systems2.

It could prove harder to replace Nafion in the chlor-alkali process, however: there, fluorinated membranes are better than other materials at withstanding corrosive chlorine attack. Still, some researchers are studying whether this process can work without membranes at all.

The refrigeration battle

By far the largest source of PFAS emissions comprises the light fluorocarbon gases. Their main application is as refrigerants. Although ammonia, an early refrigerant, is still used for industrial applications, it was fluorinated compounds, specifically chlorofluorocarbons (CFCs), that brought air conditioning and refrigeration to the masses. That's because,

unlike ammonia, they are not irritants and they are non-flammable, says McLinden.

CFCs were phased out because they deplete atmospheric ozone, and were replaced by hydrofluorocarbons such as R134a. But these are greenhouse gases — and so there is an ongoing switch to hydrofluoroolefins (HFOs)3. These contain a double bond between two carbon atoms, a link that's susceptible to attack by atmospheric compounds, which helps these molecules to break apart in weeks.

Problem solved? Not exactly. Environmental scientists and officials are now advocating the phasing out of HFOs because those molecules break up in the atmosphere to form a PFAS called trifluoroacetic acid or TFA. Karsten Nödler, an analytical chemist at the German Water Centre in Karlsruhe, says that although TFA has not been linked to any health issues, its accumulation warrants concern because it is extraordinarily difficult to remove from water. Should the time come when a clean-up is required, the only option will be reverse osmosis, an expensive technique of last resort.

Other than ammonia, the fluorine-free refrigerant options are hydrocarbons, which are flammable, or carbon dioxide, which suffers efficiency losses, especially in hot weather when cooling is needed most, McLinden says. European refrigerators already use hydrocarbons, but these substances might pose too great a fire risk in large air-conditioning systems, for example. Air conditioners for small residences have become safe enough for hydrocarbons, argues Audun Heggelund, a senior adviser to the Norwegian Environmental Agency in Oslo. The February proposal gives the air-conditioning industry 12 years to switch to hydrocarbons, but it grants a permanent exemption where safety codes prohibit the use of flammable refrigerants.

McLinden suggests that a common-sense approach is to crack down on leaks. Refrigerants operate in a closed loop — in that if they leak, the device doesn't work. So if manufacturers could assure no leaks, any refrigerant would be fine, he argues.

Heavy industries

The simplest but most pervasive uses of PFASs in machinery — from engines to chemical reactors — are at the interfaces between parts. Fluoropolymer greases lubricate moving surfaces, and fluoroelastomer O-rings, gaskets and seals join parts together. (Elastomers are polymers that regain their shape after being deformed.) Fluoromaterials are the only flexible ones that can resist aggressive chemical corrosion, very high

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temperatures and, in some applications, ultraviolet radiation, says Michael Eason, a materials engineer at James Walker, a company headquartered in Woking, UK, that manufactures high-performance sealing products. Fluoroelastomer seals are also usefully non-stick when equipment is disassembled for maintenance.

Fluoromaterials' resistance to heat alone sets them apart from other soft materials: PTFE, for instance, can withstand a constant temperature of 260 °C for 10 years while losing only 1% of its mass, says Barbara Henry, a materials scientist at W. L. Gore, a materials-science company based in Newark, Delaware. This allows seals to last the lifetime of their equipment, for instance in an oil-well head, minimizing maintenance and therefore worker exposure to occupational hazards. It also allows machinery such as jet engines to operate at higher temperatures, and therefore more efficiently. "Because fluorinated polymers exist, every piece of equipment that's followed a capitalist process, trying to get faster, quicker, more efficient, has adopted fluorinated materials," says Eason.

PTFE also protects workers in heavy industries. A thin internal layer of PTFE in multilayered textiles allows garments to remain light and breathable while providing enough heat resistance to withstand arc flashes, the explosive electrical discharges that can melt textiles on to skin. Gore has developed fluorine-free weatherproof outerwear for consumers (using expanded polyethylene), but high-performance gear still demands PTFE, says Henry.

Aware of the push to ban PFASs, however, Eason and Chaoying Wan, a materials scientist at the University of Warwick, UK, are starting a collaboration to find alternatives. A replacement that has all the properties of PTFE would be "almost impossible" to find, Eason says. But substitutes could emerge for applications where just one or two properties of PTFE are needed, although this would complicate supply chains. Eason expects that the outcome might be dozens of specialized products, whereas now a handful of fluoropolymers meet the needs of industries ranging from aerospace to pharmaceuticals to semiconductors.

Computer chips

Fluorochemical producers are also buoyed by the world's race for semiconductor dominance. Last September, Chemours announced an expansion at its North Carolina facility to support domestic semiconductor production. And this year, Asahi Glass Company, a chemicals and glass manufacturer in Tokyo, also cited strong demand from the semiconductor

industry when it announced a ¥35-billion ($250-million) expansion in fluorochemicals production.

PFASs are used in many ways to make computer chips. In one crucial step, manufacturers coat a silicon wafer's surface with a 'photoresist' material containing PFASs: when the photoresist is illuminated, those PFASs generate strong acids that eat away at portions of the material, leaving a carefully patterned gap. In a second step, the exposed parts of the wafer are etched away — and in 'dry etching', a mixture of gases is used, usually containing some fluorocarbons. (Fluoropolymers are also used in a variety of microchip coatings.)

It is not easy to find alternatives to the strong acids or the etching gases. Fluorine atoms impart the necessary acidity, and fluorocarbon gases are prized for their precision in etching. The Semiconductor Research Corporation, a consortium based in Durham, North Carolina, is promoting research into ways to limit PFAS emissions and to find alternatives in the microchip industry.

In one case, companies have managed to ditch a small use of fluorosurfactants in 'wet etching' — processes that involve chemicals in solution. Here, fluorosurfactants helped the solutions to spread over the surfaces to be etched, says Christopher Christuk, president of electronic chemicals supplier Transene in Danvers, Massachusetts. Transene is now using fluorine-free surfactants that were identified by researchers at the University of Massachusetts Lowell (UML)4. Key support for this switch came from the Massachusetts Toxics Use Reduction Institute, a state agency funded by fees levied on businesses that use toxic chemicals, which set up the partnership between Transgene and UML and funded the research project, Christuk says.

The magic of fluorine: myth or fact?

Industries that have known nothing but fluorine chemistry need to break away from believing in its magic, says Martin Scheringer, an environmental scientist at the Swiss Federal Institute of Technology in Zurich (ETHZ). "PFASs are a block to innovation," he says, pointing to the example of firefighting foams. Despite making foams from PFOS for decades, the multinational technology company 3M managed to create fluorine-free firefighting foam in 2002, but only after PFOS became a high-profile pollutant. Many other industries now need to make similar breakthroughs. "We need lots of materials that have not been invented that are fluorine-free," Scheringer says.

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In December, 3M announced it would stop making all its fluorochemical products — including fluoropolymers and fluorocarbon gases and liquids — by 2025, but did not say what would take their place. This June, it reached a $10-billion settlement to pay to clean fluorosurfactants from drinking water in parts of the United States, although it faces other unresolved lawsuits.

For the moment, most of the funding granted to PFAS topics relates to cleaning up pollution, and neither of the huge government-funded European Union or US programmes to boost clean energy or the manufacture of semiconductor chips specify the need to find alternatives to PFASs. "We should channel more of the funding to the research that will find new solutions," says Jonatan Kleimark, an adviser at ChemSec, a non-profit organization based in Gothenburg, Sweden, that advocates for safer chemicals.

Eason and Wan are trying to find ways to manufacture fluoropolymers without using toxic fluorosurfactants. If that can be achieved, Eason argues, it should be fine to continue using fluoropolymers where they cannot be substituted, provided that recycling at the end of their life is also resolved. But Eason recognizes the problem of persistence with fluoropolymers. "The ECHA proposal has made everyone realize they have to do something different," he says. "In my view, a responsible company should be looking to minimize the use of fluorinated materials."

The officials who proposed the ban say that they welcome proposals from manufacturers to extend producer responsibility and develop closed-loop systems for recycling fluorochemicals. "They have to provide the information and step forward," says Heggelund. But he is highly sceptical, noting the low rates of plastic recycling. And if fluoropolymers could be made without toxic surfactants, then manufacturers should have done it from the start instead of reacting to regulation, he says.

The ECHA is collecting feedback on the proposal until the end of September. After that, it will revise the plan and carry out a techno-economic assessment to evaluate the costs and benefits for society.

The agency is the only one in the world contemplating such comprehensive PFAS restrictions. But enacting a ban would send a signal to the rest of the world about the acceptability of the chemicals. Zhanyun Wang, an environmental scientist at ETHZ, thinks that the proposal will spur innovative research for applications that don't have obvious alternatives to fluorinated chemicals. And for those that do, Wang hopes the proposal and market changes that follow could act as a "lighthouse",

as he puts it: showing industries around the world how to ditch forever chemicals for good.

Nature, 01 August 2023

https://nature.com

"Quantum superchemistry" observed in lab experiments for first time

2023-08-07

All sorts of spooky behaviors emerge on the quantum scale. Atoms can exist in multiple states at once, become so entangled that they share information instantaneously over any distance, or tunnel through barriers that they shouldn't be able to cross. Scientists are trying to tap into these phenomena for more powerful computing, communication systems and other technologies.

And now, a team has found the first direct evidence of a previously predicted quantum effect known as superchemistry. It starts with a strange state of matter called a Bose-Einstein condensate, in which a cloud of atoms is cooled to almost absolute zero, causing them to enter the same quantum state and begin behaving like one big atom. It's been proposed that coaxing atoms in this state into chemical reactions would yield different results than usual.

In classical chemistry, atoms in a mixture will randomly collide and with each collision there's a chance they'll link up to form a molecule. But if the atoms are all in the same quantum state, they now perform actions together instead.

"You are no longer treating a chemical reaction as a collision between independent particles, but as a collective process," said Cheng Chin, lead researcher on the study. "All of them are reacting together, as a whole."

For their experiments, the researchers cooled cesium atoms down to the extreme temperatures required, then coaxed them into the same quantum state. And sure enough, the atoms seemed to be forming molecules in a way that resembled superchemistry.

This process has a few consequences that make it stand out from regular old chemistry. For one, because the atoms are all acting together, the reactions happen much faster – and it gets even faster the more atoms there are in the system. The molecules that are produced in the end all share the same state, the team says, which is useful for creating large

Scientists at the University of Chicago have detected the first evidence of a phenomenon called "quantum superchemistry." Long predicted but never confirmed, this effect could speed up chemical reactions, give scientists more control over them, and inform quantum computing.

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batches of identical molecules more reliably than through traditional chemistry.

The team also saw evidence of a strange phenomenon during the process – three-body interactions took place more often than two-body interactions. Essentially, three atoms would collide, with two linking up to form a molecule and the third aiding the process somehow.

This breakthrough could help pave the way for new technologies in quantum chemistry, quantum computing, and helping scientists study the laws of physics. So far this superchemistry has only been conducted with two-atom molecules, but the team plans to expand the work to include more complex molecules.

"What we saw lined up with the theoretical predictions," said Chin. "This has been a scientific goal for 20 years, so it's a very exciting era."

New Atlas, 07 August 2023

https://newatlas.com

First Pill for Postpartum Depression Approved by FDA

2023-08-08

Approximately one in seven women develop PPD. Thought to be a result of a combination of factors such as hormonal changes and sleep deprivation, PPD typically occurs after birth but can also begin during the later stages of pregnancy.

PPD is characterized by symptoms such as sadness, loss of interest in activities and a decreased ability to feel pleasure. These can also present alongside cognitive impairment, feelings of inadequacy, loss of energy and suicidal ideation.

"Postpartum depression is a serious and potentially life-threatening condition in which women experience sadness, guilt, worthlessness – even, in severe cases, thoughts of harming themselves or their child. And, because postpartum depression can disrupt the maternal–infant bond, it can also have consequences for the child's physical and emotional development," said Dr. Tiffany R. Farchione, director of the Division of Psychiatry in the FDA's Center for Drug Evaluation and Research, in a press release from the FDA.

The only other available treatment specifically for PPD, brexanolone, was approved in 2019. However, this is only available as an IV infusion,

A pill for PPD

requiring it to be administered by a healthcare professional in a clinical setting and coming at a significant cost. Research shows that just 15.8% of women with PPD symptoms go on to receive treatment, highlighting the need for better and more easily accessible treatments. "Having access to an oral medication will be a beneficial option for many of these women coping with extreme, and sometimes life-threatening, feelings," Farchione added.

Zuranolone, produced by biopharmaceutical companies Biogen and Sage Therapeutics, is an oral medication that targets the GABA system, a major signaling pathway that regulates the central nervous system. It has now been approved by the FDA as the first oral medication for the treatment of PPD.

Rapid improvement in symptoms

Data from clinical trials show that a once-daily course of zuranolone for 14 days led to improvements in depressive symptoms. The two trials – SKYLARK and ROBIN – were performed in women with PPD to assess the efficacy of zuranolone compared to placebo.

In the SKYLARK study, patients received either a 50 mg dose of zuranolone (98 patients) or a placebo (also 98 patients) every evening over a 2-week period. In the ROBIN study, patients received either a placebo (74 patients) or 30 mg zuranolone (76 patients), also over a 2-week period.

Both studies met their primary goal. Zuranolone treatment led to a significant reduction in depressive symptoms on day 15 after starting treatment, measured by the widely used Hamilton depression rating scale (HAMD-17). These improvements in depressive symptoms were also sustained at four weeks after the last dose.

"Today marks a groundbreaking day for the treatment of PPD, as with Zurzuvae we now have an oral treatment option that can provide rapid improvements in depressive symptoms in as early as three days for women with PPD," said Dr. Kristina Deligiannidis, a principal investigator in the Zurzuvae clinical development program and associate professor at the Feinstein Institutes for Medical Research. "As a perinatal psychiatrist, I see the devastating impact PPD has on mothers, particularly on the important mother–infant bond and long-term child development. Once available, I believe Zurzuvae will be a meaningful option for patients in need."

The most common side effects that occurred in over 10% of patients included drowsiness and dizziness, necessitating a boxed warning from

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the FDA advising that zuranolone can impact the ability to drive or perform other potentially hazardous activities for 12 hours after each dose. Zuranolone is also due to be scheduled as a controlled substance by the FDA and is expected to be commercially available in late 2023.

"Today's approval is welcome news for the estimated 500,000 women in the United States who report experiencing symptoms of this devastating and often misunderstood illness each year," said Dr. Wendy N. Davis, executive director at Postpartum Support International. "Women with PPD desperately need prompt care and additional treatment options that can provide quick relief so they can be healthy and present during this momentous time in their lives."

Technology Networks, 08 August 2023

https://technologynetworks.com

New link between acid reflux medicines and dementia

2023-08-09

Previously linked to a higher risk of stroke and heart attack, popular acid reflux medicines have now been connected to an increased likelihood of developing age-related dementia.

The medicines are a specific kind of treatment known as proton pump inhibitors (PPIs), which as the name suggests act on the proton pumps that produce acid released into the stomach. This prevents excess acid flowing into the esophagus and causing heartburn and other serious gastrointestinal issues, which can even lead to cancer.

They're one of the most commonly used medicines across the globe, with an estimated 15 million Americans taking them annually. They're both available with prescription and in over-the-counter form.

In the US, you'll find Omeprazole (Prilosec, Prilosec OTC, Zegerid), Esomeprazole (Nexium, Nexium 24HR), Lansoprazole (Prevacid, Prevacid 24HR), Dexlansoprazole (Dexilant), Pantoprazole (Protonix), Rabeprazole (AcipHex) and Esomeprazole/ Naproxen (Vimovo).

"Proton pump inhibitors are a useful tool to help control acid reflux, however long-term use has been linked in previous studies to a higher risk of stroke, bone fractures and chronic kidney disease," said study author Kamakshi Lakshminarayan, of the University of Minnesota School of Public Health in Minneapolis. "Still, some people take these drugs regularly, so we examined if they are linked to a higher risk of dementia. While we did not find a link with short-term use, we did find a higher risk of dementia associated with long-term use of these drugs."

The American Academy of Neurology researchers looked at 5,712 people in the Atherosclerosis Risk in Communities (ARIC) Study, aged 45 to 64, who did not have dementia at the time of their first health assessment (1987-1989).

Nearly 1,500 participants, more than a quarter, took PPIs during the study time. After adjusting figures for age, sex, race and comorbidities such as high blood pressure, the researchers found that those using PPIs for 4.4 years or longer had a 33% higher risk of developing dementia than those who never took the drugs. Some 497 participants reported prolonged PPI use (more than four years, four months) and 58 developed dementia.

However, there was no elevated risk for anyone who had intermittent PPI use or took them for a period less than the statistical red flag of four years and four months.

Of course, this study does not probe causation, but provides a lot of new scope for studying long-term medicine usage and what other mechanisms might be triggered by proton pump inhibition.

"While there are various ways to treat acid reflux, such as taking antacids, maintaining a healthy weight, and avoiding late meals and certain foods, different approaches may not work for everyone," said Lakshminarayan. "It is important that people taking these medications speak with their doctor before making any changes, to discuss the best treatment for them, and because stopping these drugs abruptly may result in worse symptoms."

There are also PPI alternatives such as H2 blockers, which act by binding to the histamine type 2 receptors on the surface of gastric parietal cells, disrupting acid production and secretion.

However, the scientists urge caution with altering medications and note that the study has its limitations, such as accuracy in self-reporting, and confounding health links such as the potential elevated risk of dementia due to depleted B12 levels (B12 was not assessed in participants). And not all previous work on PPIs and cognition have offered conclusive negative results.

"More research is needed to confirm our findings and explore reasons for the possible link between long-term proton pump inhibitor use and a higher risk of dementia," said Lakshminarayan.

New Atlas, 09 August 2023

https://newatlas.com

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Research provides insights into ion hydration in water-based solutions for industrial design and manufacturing

2023-08-08

In a study published in Nature Communications, researchers from the Institute of Industrial Science, The University of Tokyo have proposed an explanation for the ion-specific properties of ion hydration in water-based solutions. By revealing the nature of ion hydration and how it can be dramatically stabilized, they have advanced a broad spectrum of applications across various fields, such as chemistry, biology, and materials science.

To explain salt ion hydration, researchers have long grouped such ions into those that are structure-forming (facilitate formation of water molecule networks) and structure-breaking (disrupt these networks). However, recent evidence that this explanation is too simplistic suggests the need for a new molecular-level explanation of ion hydration.

Deriving such an explanation has been attempted in prior work by focusing on the ionic field, which depends on the relationship between the ionic charge and the ion–water distance, as a possible driving force for ion hydration. These investigations have focused on ions with discrete sizes and charges that are present in nature, rather than on synthetic or unnatural ions.

Corresponding studies that also include unnatural salt ions with continuous size and charge would greatly aid in developing a comprehensive understanding of the ionic field. Obtaining such understanding by computational simulations is the problem that the researchers sought to address.

"Our molecular dynamics simulations focus on pseudo-main-group cations that interact with water through two intermolecular forces, Coulomb and Van der Waals interactions," explains Rui Shi, lead author. "Our work reveals previously unknown details of the ion hydration shell and their impact on water dynamics."

The researchers' main result is that ions with a lower charge density interact with more water molecules, which undergo weak bonding with each other. This result is general, regardless of the ion. The distance at which the ion–water interaction is as strong as water–water hydrogen bonding can be viewed as the crossover between accelerating versus decelerating water dynamics around the ion.

Optimum performance of upcoming thermochemical energy storage and other technologies depends on proper applications of the principles that underpin salt ion hydration. Now, researchers from Japan have solved a long-standing puzzle of ion hydration that will be useful in electrolyte design for such technologies.

"We also reveal an explanation for the 11 orders of magnitude difference in the residence times of hydration water," says Hajime Tanaka, senior author. "By tuning the ion size and charge to specific combinations, we realize the bond-orientational order of hydrated water molecules can develop and stabilize the hydration shell. This leads us to establish a new mechanism for the highly stable hydration of certain ions."

This work has broad applications across multiple disciplines, including chemistry, biology, materials science, and various industries. For example, research on using salt hydrates for energy storage and purification technologies for RNA-based medical therapeutics will benefit from modern insights into the principles that underpin ion hydration in water-based media.

Phys Org, 08 August 2023

https://phys.org

In a world first, gluten is found to trigger brain inflammation

2023-08-08

On a study with mice, the scientists found that animals consuming a 4.5% gluten diet experienced inflammation in the hypothalamic region of the brain, an area that plays an integral role in metabolic functions such as blood sugar regulation.

"Mice are an excellent model to study human physiology," said lead researcher Alex Tups, an associate professor at the University of Otago. "They have a very similar circulatory, reproductive, digestive, hormonal and nervous system.

"So, it is quite possible that the same inflammation we found in mice could happen in humans."

It's estimated that 20 million Americans have a gluten sensitivity, and conservative numbers suggest around 1% of the population suffers from the serious celiac disease, a genetic autoimmune condition that can be incredibly debilitating and for which there is no cure besides avoiding gluten and potential contaminants altogether.

"The brain has two types of immune cells similar to macrophages in the blood," Tups said. "These are called astrocytes and microglia. We found that gluten as well as HFD (high fat diet) increases the number of those immune cells. The effect of gluten added to [a] normal diet increased the

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cell number to the same extent as if mice were fed a HFD. When gluten was added to the HFD, the cell number went up even further."

The researchers don't know why this inflammation is occurring, but it does seem to be linked to an extreme immune system response like what's seen in celiac disease.

"This is entirely new and so we don't know yet why it is the case," Tups said. "It could be that digestion resistant components of gluten can lead to an immune response as seen in celiac patients that then manifests in the brain."

Tups cautions that this discovery is very preliminary and more studies are needed. But it underpins how complex gluten sensitivity is and how far-reaching the health implications are.

"If gluten led to hypothalamic inflammation in humans and therefore brain damage, it can be bad in the long run, such as increase in body weight and impaired blood sugar regulation," he said. "If these effects became persistent they might exacerbate the risk of, for example, impaired memory function, which is linked to disturbed blood sugar regulation."

However, some good news: there's no reason to ban the bread if you have no issues with digesting gluten.

"We are not saying that gluten is bad for everyone," Tups said. "For gluten-tolerant people to go entirely gluten free may have health implications that may outweigh potential benefits. Often people don't consume wholefoods, and highly processed gluten-free products are often low in fiber and high in sugar."

The research was published in the Journal of Neuroendocrinology.

New Atlas, 08 August 2023

https://newatlas.com

While we've been aware of how gluten can negatively impact the digestive tract and body mass, New Zealand scientists have now identified for the first time that it can also cause brain inflammation.

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