

Bulletin Board

Contents

MAR. 01, 2024

(click on page numbers for links)

REGULATORY UPDATE

ASIA PACIFIC

Codes, carbon credits and scope 3 emissions: Greenwashing in 2024.....	4
China Mandates Annual Report Submission for New Chemical Registration	5

AMERICA

Supreme Court leans towards limiting air pollution regulations	6
EPA Extends Review Period For CBI Claims For The Identity Of Chemicals On The TSCA Inventory	7
Deadline For Filing Annual Pesticide Production Reports — March 1, 2024	7
EPA Proposes To Modify The Definition Of Hazardous Waste And Add Multiple PFAS As Hazardous Constituents.....	8

EUROPE

The EU Parliament and Council reached an agreement on ESG rating	9
EU Targets Greenwashing Practices in New Directive.....	10
Veterinary Medicinal Products - Guidance to Applicants for Marketing Authorisations Under Regulation (EU) 2019/6.....	11
Fluorinated gases and ozone-depleting substances: Council greenlights new rules to reduce harmful emissions	12

INTERNATIONAL

Lockdowns lead to a significant drop in asthma emergencies due to cleaner air.....	13
'They lied': plastics producers deceived public about recycling, report reveals.....	14
WWF Urges Biden to Tackle Plastic Pollution Government-Wide.....	15

REACH UPDATE

ECHA Consults on Recommending Five Substances for Authorization List.....	17
---	----

JANET'S CORNER

Splitting the Atom.....	19
-------------------------	----

CONTACT US

subscribers@chemwatch.net
tel +61 3 9572 4700
fax +61 3 9572 4777

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

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

Bulletin Board

Contents

MAR. 01, 2024

HAZARD ALERT

Bromopropane.....20

GOSSIP

Glowing jellyfish protein lights the way for better lifting of fingerprints...24
 Bright and tough: A material that heals itself and glows.....25
 Washing Clothes Releases More Than Just Microplastics.....26
 Food Emulsifiers Linked to Increased Breast and Prostate Cancer Risk.....28
 Scientists create single-atom catalysts for efficient electrooxidation
 of water30
 Boron cluster family breaks electron counting rules.....31
 Using mussels and silkworm cocoons to stop organ bleeding32
 Light stimulates a new twist for synthetic chemistry.....33
 The smallest known molecular knot is made of just 54 atoms.....35

CURIOSITIES

Your Gas Stove May Be Releasing More Harmful Nanoparticles Than
 Vehicle Exhaust37
 First synthetic protein motor creates its own fuel as it 'mows'.....39
 From PFAS to Microplastics, What Might Be Leaking Out of Your Teabag? 40
 Researchers develop novel method to photosynthesize hydrogen
 peroxide using water and air43
 90% of US tattoo inks contain ingredients not listed on the label.....44
 Iodine compounds accelerate cloud formation over oceans and the
 poles.....46
 Plastic recycling with a protein anchor47
 New dyeing method could help jeans shrink toxic problem49
 Glutenin: A New Game-Changer in Lab-Grown Meat Production50
 Chemists synthesize unique anticancer molecules using novel approach51

TECHNICAL NOTES

(Note: Open your Web Browser and click on Heading to link to section) ...54
 CHEMICAL EFFECTS54
 ENVIRONMENTAL RESEARCH54
 PHARMACEUTICAL/TOXICOLOGY54

Bulletin Board

Contents

MAR. 01, 2024

OCCUPATIONAL.....54

Bulletin Board

Regulatory Update

MAR. 01, 2024

ASIA PACIFIC

Codes, carbon credits and scope 3 emissions: Greenwashing in 2024

2024-02-18

The greenwashing space is continuing to develop globally, and Australian developments are only stoking the fire. Below we detail some key recent updates from closer to home.

Key takeaways

- Industry self-regulation is emerging as a means to address greenwashing, in addition to the regulatory efforts of the ACCC and ASIC. An example is the Australian Association of National Advertisers' Environmental Claims Code, which is a voluntary industry code enforced by Ad Standards that regulates environmental claims made in advertisements by AANA members. This code is currently in the process of being updated.
- The use of carbon credits to offset emissions and meet emissions reductions targets has been the focus of recent greenwashing litigation. Greenpeace is suing Woodside over claims that it misrepresented the true extent of its emissions generation given that it had relied on carbon credits to offset its emissions. The ACCC has flagged that it will release guidance for businesses and consumers specifically on emission and offset claims. Companies should carefully consider how they communicate and qualify their net zero or carbon neutral targets, particularly with respect to whether those targets take into account the company's downstream scope 3 emissions. The Greenpeace / Woodside case may provide some clarification on a company's obligations in communicating emissions reductions targets.

A rise in industry self-regulation

While the ACCC and ASIC have been leading the charge on regulatory greenwashing efforts (see our summary of the ACCC's environmental guidance and ASIC's Mercer proceeding), there has also been movement on industry self-regulation as a form of managing environmental and sustainability-related advertising risks. The Australian Association of National Advertisers (AANA) – the peak body for advertisers and marketers in Australia – is currently in the process of revamping its Environmental Claims Code (ECC).

Bulletin Board

Regulatory Update

MAR. 01, 2024

The ECC is a voluntary industry code that applies to all AANA members, including many non-advertiser corporate members. It seeks to develop and maintain standards for advertisements making environmental claims. As a voluntary industry code, the AANA's independent Ad Standards Community Panel adjudicates complaints received by the community on its members' ads.

[Read More](#)

Lexology, 18-02-24

<https://www.lexology.com/library/detail.aspx?g=22e50ad0-f641-4ac2-9a77-1958ef269435>

China Mandates Annual Report Submission for New Chemical Registration

2024-02-24

Given that there are about two months left before the deadline (April 30, 2024), it is recommended to prepare and submit the annual report in a timely manner to ensure your chemical activities in China are legal and compliant.

China's Solid Waste and Chemicals Management Center (SCC) under the Ministry of Ecology and Environment (MEE) recently issued a notice to notify regular registration certificate holders to submit the 2023 annual report on registered new chemicals via the online registration system before April 30, 2024. The SCC-MEE also provided a list of certificate holders (or their appointed agents) who are obliged to submit the 2022 annual report. Details of the list can be accessed [here](#), including specific certificate codes, target certificate holder's or their appointed agent's name, and the province where the company is located.

Target Scope

- New hazardous chemicals for priority environmental management that have obtained Regular Registration Certificate under MEP Order No. 7.
- New chemicals that have obtained Regular Registration Certificate under MEE Order No. 12, on which annual reporting is specified as a post-registration obligation.

What Shall Be Reported?

- Annual production or import quantity.
- Processors and users' information.

Bulletin Board

Regulatory Update

MAR. 01, 2024

- Implementation situation of information.
- Information transmission to downstream users.
- Emissions to the environment.
- Implementation of environmental risk control measures and environmental management requirements.

Read More

REACH 24, 20-02-24

<https://www.reach24h.com/en/news/industry-news/chemical/china-mandates-annual-report-submission-for-new-chemical-registration.html>

AMERICA

Supreme Court leans towards limiting air pollution regulations

2024-02-24

The Supreme Court's conservative majority is likely to restrict the Biden administration's environmental efforts, specifically the U.S. Environmental Protection Agency's plan to reduce cross-state air pollution, impacting public health and environmental policies.

In short:

- The "good neighbor" plan aimed to cut ozone pollution affecting downwind states is under threat, with a decision expected by June.
- This follows a trend of the court limiting the EPA's authority on environmental issues, including climate change and water pollution.
- The plan's suspension could delay pollution control efforts, affecting states reliant on upwind pollution reduction.

Read More

EHN, 22-02-24

<https://www.ehn.org/supreme-court-leans-towards-limiting-air-pollution-regulations-2667340413.html>

Bulletin Board

Regulatory Update

MAR. 01, 2024

EPA Extends Review Period For CBI Claims For The Identity Of Chemicals On The TSCA Inventory

2024-03-01

EPA announced on January 24, 2024, that it is extending the review period for confidential business information (CBI) claims for specific identity of all active chemical substances listed on the confidential portion of the Toxic Substances Control Act (TSCA) Inventory submitted to EPA under TSCA. 89 Fed. Reg. 4605. EPA states that it "has determined that an extension of the statutory review period for the review of CBI claims under TSCA are necessary to allow the Agency to complete the required reviews under TSCA." According to EPA, the additional time is necessary "given the volume of submissions that require review, information technology issues, and other legal and administrative delays that have affected the review process." EPA extended the review period to February 19, 2025. As this extended deadline approaches, EPA may further extend the deadline as necessary to complete the reviews

Read More

JDSupra, 23-02-24

<https://www.jdsupra.com/legalnews/wrap-up-of-federal-and-state-chemical-5798811/>

Deadline For Filing Annual Pesticide Production Reports — March 1, 2024

2024-02-23

The March 1, 2024, deadline for all establishments, foreign and domestic, that produce pesticides, devices, or active ingredients to file their annual production for the 2023 reporting year is fast approaching. Pursuant to FIFRA Section 7(c)(1) (7 U.S.C. § 136e(c)(1)), "Any producer operating an establishment registered under [Section 7] shall inform the Administrator within 30 days after it is registered of the types and amounts of pesticides and, if applicable, active ingredients used in producing pesticides" and this information "shall be kept current and submitted to the Administrator annually as required." Reports must be submitted on or before March 1 annually for the prior reporting year's production and distribution. The report, filed through the submittal of EPA Form 3540-16: Pesticide Report for Pesticide-Producing and Device-Producing Establishments, must include the name and address of the producing establishment; and pesticide production information, such as product registration number,

Bulletin Board

Regulatory Update

MAR. 01, 2024

product name, and amounts produced and distributed. The annual report is always required, even when no products are produced or distributed. More information regarding the submission of the annual pesticide production reports is available in our January 31, 2024, blog item.

[Read More](#)

JDSupra, 23-02-24

<https://www.jdsupra.com/legalnews/wrap-up-of-federal-and-state-chemical-5798811/>

EPA Proposes To Modify The Definition Of Hazardous Waste And Add Multiple PFAS As Hazardous Constituents

2024-02-24

EPA announced on February 1, 2024, two proposed rules that will add to its comprehensive approach to tackling PFAS pollution and the commercial bottom line for hundreds of businesses facing costs for cleanup. The first proposed rule would modify the definition of hazardous waste as it applies to cleanups at permitted hazardous waste facilities. 89 Fed. Reg. 8598. EPA states that this modification “would assure that EPA’s regulations clearly reflect EPA’s and authorized states’ authority to require cleanup of the full range of substances that the Resource Conservation and Recovery Act (RCRA) intended, including emerging chemicals of concern, such as PFAS, that may present substantial hazards, at permitted facilities.” Comments are due March 11, 2024. The second proposed rule would amend the RCRA regulations to add multiple PFAS compounds as hazardous constituents. 89 Fed. Reg. 8606. According to EPA, these PFAS “would be added to the list of substances identified for consideration in facility assessments and, where necessary, further investigation and cleanup through the corrective action process at hazardous waste treatment, storage and disposal facilities [TSDF].” Comments on the second proposed rule are due April 8, 2024. More information on the proposed rules is available in our February 5, 2024, memorandum.

[Read More](#)

JDSupra, 23-02-24

<https://www.jdsupra.com/legalnews/wrap-up-of-federal-and-state-chemical-5798811/>

Bulletin Board

Regulatory Update

MAR. 01, 2024

EUROPE

The EU Parliament and Council reached an agreement on ESG rating

2024-02-14

On 5 February 2024, the European Parliament (the Parliament) and the Council of the European Union (the Council) reached a provisional agreement on the EU Commission’s proposal from June 2023 for a regulation governing environmental, social, and governance (ESG) rating activities. This rating aims to offer an assessment of a company’s or a financial instrument’s sustainability profile, ultimately bolstering investor confidence in sustainable products. ESG ratings’ new rules appear as a priority, as they will strengthen the reliability and comparability of ESG ratings and improve the transparency of the operation of ESG rating providers.

Specifically, the provisional agreement provides that ESG rating providers established in the EU will be authorised and supervised by the European Securities and Markets Authority (ESMA) regarding their methodology and sources of information. Conversely, third-country-based ESG rating providers seeking to operate within the EU will either need:

- to obtain an endorsement of their ESG ratings by an EU-authorised ESG rating provider;
- to be recognised based on quantitative criterion; or
- to be included in the EU registry of ESG rating providers based on an equivalence decision.

Furthermore, the agreement clarifies various aspects of the regulatory scope by defining circumstances and territorial boundaries and provides more detailed information on applicable exclusions. Additionally, the Council and Parliament offer further clarity on practical matters, such as the requirement for financial market participants or advisers disclosing ESG ratings in their marketing communications to include information about their methodologies on their websites, and the option to present separate E, S, and G ratings.

Small undertakings and groups providing ESG ratings would also be able to benefit from a lighter, temporary, and optional registration regime introduced by the Council and the Parliament. This temporary regime encompasses general organisational principles and governance

Bulletin Board

Regulatory Update

MAR. 01, 2024

requirements, overseen by ESMA. Such small ESG ratings providers may also be exempted from certain requirements by ESMA.

Read More

Lexology, 14-02-24

<https://www.lexology.com/library/detail.aspx?g=21b86af2-471a-4153-984a-632aeb19c05a>

EU Targets Greenwashing Practices in New Directive

2024-02-16

The Directive on Empowering Consumers for the Green Transition Through Better Protection Against Unfair Practices and Information (Directive) has been passed by the European Parliament.

It will enter into force once it is formally adopted by the Council and published in the Official Journal of the European Union. Member states will have 24 months to transpose it into national law, with such national law required to come into effect within a further six months.

The purpose of the Directive is to empower eco-conscious consumers to make informed purchasing decisions by prohibiting traders from adopting unfair commercial practices that could mislead consumers as to the environmental impact of a purchase. A European Commission study conducted in 2020 found that just over 50% of the EU products included in the study were promoted using vague, misleading or unfounded claims about their environmental impact.

Strengthening of existing consumer protection legislation

The Directive aims to protect consumers from such claims by amending both the Unfair Commercial Practices Directive (UCPD) and the Consumer Rights Directive. In particular, the Directive broadens the scope of misleading commercial practices under the UCPD to specifically include "greenwashing" claims. The Directive also adds to the blacklist of commercial practices which are, in all circumstances, treated as unfair, and introduces new obligations on traders to make information on product repairability and durability available to consumers at the point of sale.

Prohibited practices

The changes introduced by the Directive will be particularly relevant to traders who promote the sustainability of their products or services. Such traders should be aware that any environmental claims made in respect of

Bulletin Board

Regulatory Update

MAR. 01, 2024

products or services will now come under far greater scrutiny. Specifically, the Directive will prohibit the following commercial practices:

- Any commercial practice which misleads the consumer as to the environmental or social impact, durability or repairability of the product or the results to be expected from its use;
- The making of claims about future environmental performance (such as carbon-neutrality) of the product where such claims are not supported by clear, objective, verifiable and publicly available commitments and targets and without an independent monitoring system;
- Advertising benefits for consumers that are considered a common practice in the relevant market (e.g. if it is common practice in an industry to omit a certain chemical from a product, then the omission of that chemical should not be advertised as a benefit to the environment);

Read More

Lexology, 16-02-24

<https://www.lexology.com/library/detail.aspx?g=2f777723-8aae-4313-bef8-704461076c26>

Veterinary Medicinal Products - Guidance to Applicants for Marketing Authorisations Under Regulation (EU) 2019/6

2024-02-16

On 14 February 2024, the Official Journal of the European Union published a Commission Notice providing guidance to applicants (the Guidance) for marketing authorisations (MAs) for veterinary medicinal products (VMPs) under Regulation (EU) 2019/6 of 11 December 2018 on veterinary medicinal products (Regulation 2019/6).

The 44-page Guidance was developed by the European Commission in consultation with the competent authorities of the Member States and the European Medicines Agency. It aims to assist stakeholders, and applicants for MAs for VMPs in particular, in complying with their obligations under Regulation 2019/6. Regulation 2019/6 applies since 28 January 2022 and repealed Directive 2001/82/EC (see, Van Bael & Bellis Life Sciences News and Insights of 10 January 2019).

Bulletin Board

Regulatory Update

MAR. 01, 2024

The Guidance describes the ways and conditions for obtaining MAs for VMPs and also governs their lifecycle management, including the need to continuously update them to take account of scientific and technical progress and new regulatory requirements (sections 1-4). Further, it clarifies the rules that protect technical documentation (section 5). Section 6 of the Guidance discusses the mandatory environmental risk assessment for new MAs for VMPs imposed by Regulation 2019/6.

[Read More](#)

Lexology, 16-02-24

<https://www.lexology.com/library/detail.aspx?g=0fce3290-37d8-49df-a93a-b8187a979ae6>

Fluorinated gases and ozone-depleting substances: Council greenlights new rules to reduce harmful emissions

2024-01-29

The Council today has adopted two regulations to phase down fluorinated gases (F-gases) and other substances that cause global warming and deplete the ozone layer.

While existing EU legislation has already limited the use of these gases and substances significantly, the new rules will further reduce their emissions into the atmosphere and contribute to limiting global temperature rise, in line with the Paris Agreement.

Many products we use in everyday life, such as refrigerators and air conditioning, rely on extremely detrimental substances that undermine our environment. The new rules we have put in place impose clear bans and restrictions on such damaging substances, while encouraging the development of sustainable alternatives to protect people's health. Credit goes to our Czech, Swedish, and Spanish predecessors for the invaluable work they carried out on this crucial legislation, in order to bring the EU closer to reaching its ambitious climate targets.

Fluorinated gases

Under the new rules, the consumption of hydrofluorocarbons (HFCs) will be completely phased out by 2050. On the other hand, the production of HFC, in terms of production rights allocated by the Commission to produce HFCs, will be phased down to a minimum (15%) as of 2036. Both

Bulletin Board

Regulatory Update

MAR. 01, 2024

production and consumption will be phased down on the basis of a tight schedule with a degressive quota allocation (Annexes V and VII).

The text introduces a full ban on placing products and equipment containing HFCs on the market for several categories for which it is technologically and economically feasible to switch to F-gas alternatives, including certain domestic refrigerators, chillers, foams and aerosols. It also sets specific dates for the complete phase-out of the use of F-gases in air conditioning, heat pumps and switchgears:

- 2032 for small monoblock heat pumps and air conditioning (<12kW)
- 2035 for split air conditioning and heat pumps, with earlier deadlines for certain types of split systems with higher global warming potential
- 2030 for medium-voltage switchgears (up to and including 52 kV) relying on F-gases
- 2032 for high-voltage switchgears (>52kV)

The impacts and effects of the regulation, including an assessment of the existence of cost-effective, technically feasible and sufficiently available alternatives to replace F-gases, will be reviewed by the Commission no later than 1 January 2030. By 2040 the Commission will also have to evaluate the feasibility of the 2050 phase-out date for the consumption of HFCs and the need for HFCs in sectors where they are still used, taking into account technological developments and the availability of alternatives to HFCs for the applications in question.

[Read More](#)

European Commission, 29-01-24

<https://www.consilium.europa.eu/en/press/press-releases/2024/01/29/fluorinated-gases-and-ozone-depleting-substances-council-greenlights-new-rules-to-reduce-harmful-emissions/>

INTERNATIONAL

Lockdowns lead to a significant drop in asthma emergencies due to cleaner air

2024-02-12

A study from Oxford reveals a notable decrease in asthma-related hospital admissions in 2020, linking it to the reduction of air pollution amid COVID-19 lockdowns.

Bulletin Board

Regulatory Update

MAR. 01, 2024

In short:

- Emergency admissions for asthma in Oxford fell by 41% in 2020, as air quality improved with fewer vehicles on the road.
- The study correlates peaks in asthma admissions with air pollution levels, pointing to a direct link between air quality and asthma exacerbations.
- Testimonies from individuals with asthma documented personal improvements in lung function during lockdown periods.

Key quote:

“The Covid-19 pandemic led to a unique opportunity where we could study the impacts of rapid changes in human activities on air quality.”

— Dr. Suzanne Bartington, lead researcher, University of Birmingham

Why this matters:

This finding emphasizes the direct impact of air quality on health, particularly for those with respiratory conditions like asthma. It supports the need for cleaner air policies, not only for environmental reasons but as an important public health measure.

Read More

EHN, 12-02-24

<https://www.ehn.org/lockdowns-lead-to-a-significant-drop-in-asthma-emergencies-due-to-cleaner-air-2667225291.html>

‘They lied’: plastics producers deceived public about recycling, report reveals

2024-02-15

Companies knew for decades recycling was not viable but promoted it regardless, Center for Climate Integrity study finds

Plastic producers have known for more than 30 years that recycling is not an economically or technically feasible plastic waste management solution. That has not stopped them from promoting it, according to a new report.

“The companies lied,” said Richard Wiles, president of fossil-fuel accountability advocacy group the Center for Climate Integrity (CCI), which

Bulletin Board

Regulatory Update

MAR. 01, 2024

published the report. “It’s time to hold them accountable for the damage they’ve caused.”

Plastic, which is made from oil and gas, is notoriously difficult to recycle. Doing so requires meticulous sorting, since most of the thousands of chemically distinct varieties of plastic cannot be recycled together. That renders an already pricey process even more expensive. Another challenge: the material degrades each time it is reused, meaning it can generally only be reused once or twice.

The industry has known for decades about these existential challenges, but obscured that information in its marketing campaigns, the report shows.

The research draws on previous investigations as well as newly revealed internal documents illustrating the extent of this decades-long campaign.

Read More

The Guardian, 15-02-24

<https://www.theguardian.com/us-news/2024/feb/15/recycling-plastics-producers-report>

WWF Urges Biden to Tackle Plastic Pollution Government-Wide

2024-02-10

Today, World Wildlife Fund (WWF) joined several NGO’s and foundations to issue a letter to President Biden calling for him to institute a whole-of-government approach at the federal level to advance ambitious solutions to plastic pollution, both in the U.S. and internationally. WWF issued the following statement from Alejandro Pérez, senior vice president of policy and government affairs:

“With plastic pollution devastating our environment and threatening the economic and human health of our communities, we need bold action at all levels of society with the U.S. government leading the way. We are calling on the President to elevate this issue across his Administration, activating the full power of the federal government and signaling American leadership on an issue of global significance.

“The Administration has already demonstrated significant leadership, including by working with other countries toward securing an international agreement to end plastic pollution. We must seize this once-

Bulletin Board

Regulatory Update

MAR. 01, 2024

in-a-generation opportunity to set ourselves on a course to a future where plastic no longer ends up in nature.

[Read More](#)

Mirage News, 10-02-24

<https://www.miragenews.com/wwf-urges-biden-to-tackle-plastic-pollution>

Bulletin Board

REACH Update

MAR. 01, 2024

ECHA Consults on Recommending Five Substances for Authorization List

2024-03-01

Once substances are added to the list, companies will need to apply for authorisation to continue using them.

On February 7, 2024, European Chemicals Agency (ECHA) released a draft 12th recommendation to the European Commission, which recommends the inclusion of 5 substances to the REACH Authorisation List.

ECHA is looking for further information on the uses of these substances in scope of authorization, their possible exemptions from the authorisation requirement and on the structure and complexity of the supply chains. The consultations are open until May 7, 2024.

The proposed list of substances with examples of uses in the scope of authorization are presented below:

	Substance name	SVHC-relevant intrinsic property	Volume range in	Examples of uses in
1	Melamine	Equivalent level of concern having probable serious effects to human health (Article 57(f) - human health). Equivalent level of concern having probable serious effects to the environment (Article 57(f) - environment)	> 10,000 t/y	use as additive in foams and coatings, use in resins

Bulletin Board

REACH Update

MAR. 01, 2024

	Substance name	SVHC-relevant intrinsic property	Volume range in	Examples of uses in
2	Bis(2-ethylhexyl)	vPvB (Article 57e)	100 - 1,000 t/y	use in the production of rubber articles, in plastics, in adhesives and sealants, in foam
3		PBT (Article 57d)	100 - <1,000 t/y	use in lubricants and greases e.g. in vehicles or machinery
4		Toxic for reproduction (Article 57 c)	1,000 - <10,000 t/y	use as photoinitiator in UV-curable inks, coatings and adhesives
5	Barium diboron tetraoxide	Toxic for reproduction (Article 57c)	100 - <1,000 t/y	use in coatings and paints, thinners, paint removers

Read More

Chemlinked, 19-02-24

<https://chemical.chemlinked.com/news/chemical-news/echa-proposes-to-recommend-five-substances-for-authorisation-list>

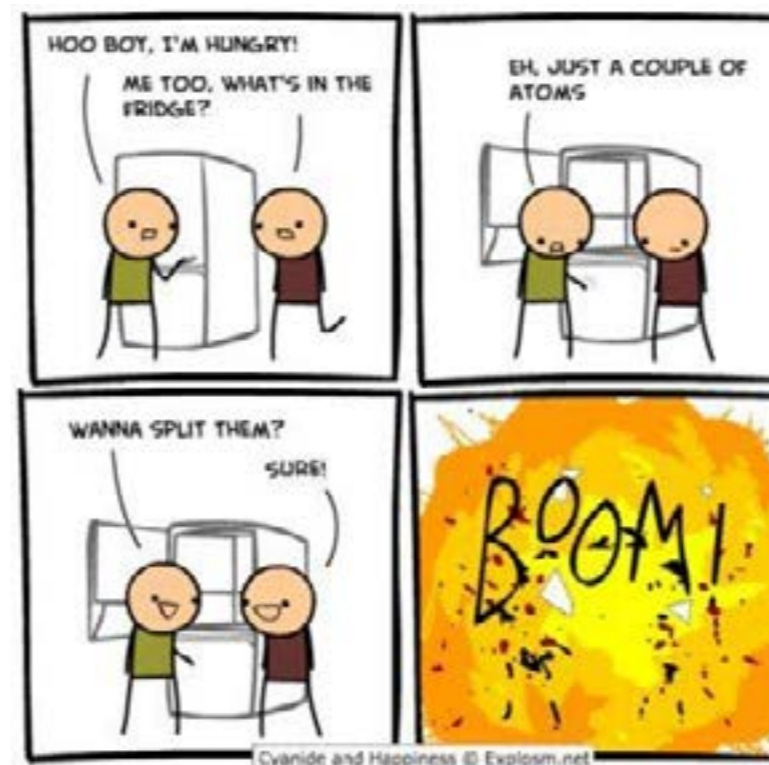
Bulletin Board

Janet's Corner

MAR. 01, 2024

Splitting the Atom

2024-03-01



Explosm.net

Bulletin Board

Hazard Alert

MAR. 01, 2024

Bromopropane

2024-03-01

USES [2,3]

Phenanthrene is used to make dyes, plastics and pesticides, explosives and drugs. In addition, it has been used to make bile acids, cholesterol and steroids. Phenanthrene can be used as a feed stock of carbon black. It is a raw material of phenanthrenequinone, which is widely used in the synthesis of dyes, agrochemical and preservatives. [1,2]

EXPOSURE SOURCES & ROUTES OF EXPOSURE [3]

Exposure Sources

- Exposure to 1-bromopropane is mainly an occupational problem.
- Workers using 1-bromopropane as a spray adhesive have the highest exposures.
- Workers involved in the production of 1-bromopropane or those using it in commercial applications have potential for high exposure.
- You may be exposed to 1-bromopropane in air when it is used during aerosol applications.

Routes of Exposure

- **Inhalation** – Principal route of exposure for workers using 1-bromopropane in aerosol applications. Potential route of exposure for populations living near industrial facilities where 1-bromopropane is used in aerosol applications.
- **Oral** – Not an important route of exposure because 1-bromopropane has not been detected in food or water.
- **Dermal** – Important route of exposure for workers using 1-bromopropane as a spray adhesive.

HEALTH EFFECTS [4]

Acute Health Effects

Short-term exposure to 1-bromopropane can result in irritation of the eyes, nose, throat or respiratory tract.

Bromopropane [1,2]

Bulletin Board

Hazard Alert

MAR. 01, 2024

Carcinogenicity

Presently, no epidemiological studies or case reports have been identified that examine the relationship between human cancer and exposure to 1-bromopropane.

Other Effects

Animal studies have shown that inhalation exposure to 1-bromopropane can result in decreased foetal weight and skeletal variations. In addition, similar studies in animals have shown 1-bromopropane to cause decreased fertility, decreased prostate weight and effects on sperm quality. Some case studies of female workers occupationally exposed to 1-bromopropane reported altered menstrual periods.

SAFETY

First Aid Measures [5]

- **Eye Contact:** Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.
- **Skin Contact:** In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.
- **Serious Skin Contact:** Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.
- **Inhalation:** If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
- **Serious Inhalation:** Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.
- **Ingestion:** Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a

Bulletin Board

Hazard Alert

MAR. 01, 2024

physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Personal Protective Equipment [5]

The following personal protective equipment is recommended when handling 1-bromopropane:

- Splash goggles;
- Lab coat;
- Vapour respirator (be sure to use an approved/certified respirator or equivalent);
- Gloves.

REGULATION

United States

ACGIH: The American Conference of Governmental Industrial Hygienists has set a Threshold Limit Value (TLV) for 1-bromopropane of 10 ppm, 50 mg/m³ TWA

REFERENCES

1. <https://en.wikipedia.org/wiki/1-Bromopropane>
2. http://www.chemicalbook.com/ChemicalProductProperty_EN_CB8341613.htm
3. <http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=1473&tid=285>
4. <http://www.atsdr.cdc.gov/toxguides/toxguide-209.pdf>
5. <http://www.nclabor.com/osha/etta/indguide/ig52.pdf>
6. <http://www.sciencelab.com/msds.php?msdsId=9923169>
7. https://www.osha.gov/dts/chemicalsampling/data/CH_222006.html

Bulletin Board

Gossip

MAR. 01, 2024

Zinc Could Be Key to Reducing Bacterial Infections in Cystic Fibrosis

2024-02-23

University of Queensland researchers have identified an opportunity to reduce infections in people living with cystic fibrosis.

Professor Matt Sweet, Dr Kaustav Das Gupta and Dr James Curson from UQ's Institute for Molecular Bioscience have discovered a fault in the bacteria-killing function of immune cells in people with CF and a potential way to get around it.

CF is a chronic disease in which defects in the CFTR (cystic fibrosis transmembrane conductance regulator) channel cause a build-up of mucus in the lungs, airways and digestive system, leading to recurring infections.

Professor Sweet said the team has found that in people with CF, immune cells called macrophages are defective in a zinc pathway that the body uses to kill bacteria.

"One way that macrophages destroy bacteria is by poisoning them with toxic levels of metals such as zinc," Professor Sweet said.

"We discovered that the CFTR ion channel is crucial to the zinc pathway and because it doesn't work properly in people with CF, it may partly explain why they're more susceptible to bacterial infections."

Importantly, the researchers also identified a zinc transport protein that can restore the macrophages' ability to kill bacteria when the CFTR protein is not working.

"Our goal now is to deliver this zinc transport protein to macrophages in people with CF with the expectation that it would reactivate their immune response and reduce infections," Professor Sweet said.

Around 3,600 Australians live with cystic fibrosis, which can reduce life expectancy to an average of 47 years.

Professor Peter Sly at UQ's Child Health Research Centre, a paediatric respiratory physician and key collaborator on the project, said discovering more about how CF affects the immune system is key to patient care.

"People with CF have a hyper inflammatory state in their airways and are very susceptible to bacterial infections but frequent treatment with antibiotics can often lead to antibiotic-resistant infections," Professor Sly said.

A fault has been identified in the bacteria-killing immune cells of people with cystic fibrosis, and zinc might help restore function.

Bulletin Board

Gossip

MAR. 01, 2024

“Current treatments can restore many aspects of CFTR function but they don’t resolve or prevent lung infections so there is a need to restore immune functions.”

Technology Networks, 23 February 2024

<https://technologynetworks.com>

Glowing jellyfish protein lights the way for better lifting of fingerprints

2024-02-27

Current methods of lifting fingerprints from crime scenes utilize fine powders or fuming chemical reagents. In both cases, obtaining a usable print takes at least a few minutes. Additionally, compounds in the powders or reagents may damage DNA in the sweat or skin oil that makes up the print.

Scientists from Britain’s University of Bath and China’s Shanghai Normal University have now come up with an alternative, in the form of the new non-toxic, water-soluble spray.

There are actually two versions of it containing two different dyes, namely LFP-Yellow and LFP-Red. Users choose one or the other depending on the color of the surface from which they’re lifting prints, so that the prints really stand out against their background when made visible.

Both dyes are derived from a substance produced by jellyfish, called Green Fluorescent Protein (GFP). That protein is already widely used in scientific studies to visualize biological processes, without affecting those processes. It likewise doesn’t affect the DNA which may be present in fingerprints.

As soon as the spray has been applied to a surface, the positively-charged dye molecules bind with negatively-charged fatty or amino acid molecules in the fingerprint sweat or oil. The dye molecules are then “locked in place” along all the telltale whorls and ridges of the print.

When exposed to blue light, those molecules fluoresce in their yellow or red color within no more than 10 seconds. A smartphone camera can then be used to record their images for subsequent reference.

The spray itself is made up of very fine droplets, so it won’t physically damage fingerprints by splashing on them. It’s also effective at lifting prints off of rough surfaces such as brick, which can be very difficult when

Bulletin Board

Gossip

MAR. 01, 2024

using traditional techniques. What’s more, those prints can be lifted up to one week after being left by the suspect.

“We hope this technology can really improve the detection of evidence at crime scenes,” said the principal investigator, Shanghai Normal University’s Prof. Chusen Huang. “We are now collaborating with some companies to make our dyes available for sale. Further work is still ongoing.”

The research is described in a paper that was recently published in the Journal of the American Chemical Society.

New Atlas, 27 February 2024

<https://newatlas.com>

Bright and tough: A material that heals itself and glows

2024-02-22

In 2019, Zhaomin Hou and his team at RIKEN CSRS successfully copolymerized ethylene and anisylpropylene using a rare-earth metal catalyst. The resulting binary copolymer displayed remarkable self-healing properties against damage. The copolymer’s soft components, alternating units of ethylene and anisylpropylene, coupled with hard crystalline units of ethylene-ethylene chains, acted as physical cross-linking points, forming a nano-phase-separated structure that proved crucial for self-healing.

Building upon this success, they incorporated a luminescent unit, styrylpyrene, into a monomer and then formed polymers that also included anisylpropylene and ethylene. This process led to the synthesis, in a single step, of a self-healing material with fluorescence characteristics.

“Fluorescent materials are very useful, as they can be used for organic light emitting diodes (OLEDs), organic field-effect transistors (OFETs), and solar cells. One of the main problems of these materials, however, is their short lifetime during usage. Our new material can be expected to afford longer lifetime of the products and increased reliability,” says Masayoshi Nishiura, Hou’s collaborator for this study.

There was an added surprise. The resulting copolymer not only proved to be tough, but also exhibited self-healing without external stimuli or energy. Its tensile strength fully recovered within 24 hours, demonstrating a high self-healing speed compared to binary copolymers. The material was able to self-heal even in water, acidic, and alkaline solutions giving it potential uses in a variety of environments.

An experimental new forensic spray allows latent fingerprints to be made visible in just 10 seconds, plus it doesn’t require the use of any messy powders. What it does incorporate, however, is a glowing protein that’s obtained from jellyfish.

A research team at the RIKEN Center for Sustainable Resource Science (CSRS) has succeeded in developing a self-healing material that is also capable of emitting a high amount of fluorescence when absorbing light.

Bulletin Board

Gossip

MAR. 01, 2024

The copolymer's network structure, which involves physical cross-linking points formed by the styrylpyrene units and crystalline ethylene-ethylene nanodomains and soft segments composed of the alternating units, facilitated the self-repair.

The material also showed an added property. The research team was able to successfully transfer a two-dimensional image onto the fluorescent self-healing film through photolithography. Although the image remained invisible under natural light, it became recognizable under ultraviolet light, suggesting potential applications for the film as an information storage device. The film maintained its excellent self-healing and elastomeric properties even with the images.

"The material we synthesized, through a one-step reaction, gave us the ability to control its optical and mechanical properties by adjusting the composition of the monomer. We think it could contribute significantly to the development of novel functional materials with high self-healing capabilities in various practical environments," says Hou.

Phys Org, 22 February 2024

<https://phys.org>

Washing Clothes Releases More Than Just Microplastics

2024-02-23

This release of micro- and nanoplastics from textiles is a significant source of plastic pollution in our oceans. But what if some of these nanoplastics weren't nanoplastics at all?

New analysis by researchers at the Swiss Federal Laboratories for Materials Science and Technology (EMPA) suggests that some of the supposed nanoplastics released during textile washing are not nanoplastics, but are actually clumps of water-insoluble oligomer molecules. The research is published in Nature Water.

Little is known about the toxicity or potential health effects of exposure to these oligomers, the researchers warn.

Washing clothes releases nanoparticulate oligomers

Studying 12 different types of polyester fabrics, including microfiber, satin and jersey samples, the researchers washed each sample up to 4 times and examined what particles were released by the fabrics.

Bulletin Board

Gossip

MAR. 01, 2024

This is no easy task, as tiny plastic particles are all around us. "Plastic, especially nanoplastics, is everywhere, including on our devices and utensils," said study author Bernd Nowack, leader of the Environmental Risk Assessment and Management Group at EMPA. "When measuring nanoplastics, we have to take this 'background noise' into account."

To distinguish between plastic nanoparticles and other background noise, the researchers rinsed the particles they recovered in ethanol solvent. Plastic particles, whether they are micro- or nano-sized, do not dissolve in ethanol.

After the ethanol rinse, the researchers found that between 34–89% of the nanoparticles isolated from the fabric washing experiments were soluble in ethanol, meaning that they were not true nanoplastics.

"This allowed us to show that not everything that looks like nanoplastics at first glance is in fact nanoplastics," Nowack said.

Using scanning electron microscopy (SEM) and transmission electron microscopy (TEM) images, alongside scanning TEM energy-dispersive X-ray (STEM-EDX) analysis, the researchers were able to study the morphology and elemental composition of the unknown particles.

They concluded that the most likely explanation for these water-insoluble, ethanol-soluble particles was that they were small clusters of polyethylene terephthalate (PET) oligomers. Oligomers are medium-sized polymer molecules consisting of relatively few repeating monomer units. PET oligomers are known to be soluble in ethanol.

How concerning are these particles?

The mechanism through which these particles are released from textiles is still unclear, for both nanoplastics and oligomer clusters. However, the researchers found that the number of particles released did appear to decrease significantly with repeated washes. The nature of the textile and the cutting method used to make the fabric samples – scissors or laser cutting – also had no major impact on the quantity of particles produced.

The researchers suggest that these oligomer particles might be created during the manufacturing of the textiles or alternatively, they could be the result of chemical processes taking place during storage.

The effect that these oligomers might have on the environment and human health is also unknown, though it is a concern. "With other plastics, studies have already shown that nanoparticulate oligomers are more toxic

When clothes made from synthetic fibers are washed, they release tiny fragments of plastic into the water.

Bulletin Board

Gossip

MAR. 01, 2024

than nanoplastics," said Nowack. "This is an indication that this should be investigated more closely."

Nowack and his team plan to continue to study the release of fibers from textiles – this time from fabrics made with renewable raw materials.

"Semi-synthetic textiles such as viscose or lyocell are being touted as a replacement for polyester," Nowack said. "But we don't yet know whether they are really better when it comes to releasing fibers."

Reference: Yang T, Xu Y, Liu G, Nowack B. Oligomers are a major fraction of the submicrometre particles released during washing of polyester textiles. *Nat Water*. 2024;2(2):151-160. doi:10.1038/s44221-023-00191-5

Technology Networks, 23 February 2024

<https://technologynetworks.com>

Food Emulsifiers Linked to Increased Breast and Prostate Cancer Risk

2024-02-21

The weight of evidence against ultra-processed foods just got a little heavier.

As if the products' added salt, sugar and fat levels weren't damaging enough to our health, a new study has linked the foods' emulsifiers to higher incidences of certain cancers.

After analyzing the health data of 92,000 adults – and accounting for other risk factors like age and weight – a team from several French research institutes found that those who ate more processed foods containing emulsifiers were more likely to develop breast and prostate cancers.

While this link was observational – not biochemically proven – the researchers say their findings add to the debate around ultra-processed food regulations.

Their paper was published in *PLoS Medicine*.

Immersed in emulsifiers

Emulsifiers are added to food to help blend any oil and water, which would otherwise separate. The chemicals are often found in ultra-processed foods such as mayonnaise, ice cream, peanut butter, margarine, processed meats and bread.

Bulletin Board

Gossip

MAR. 01, 2024

As such foods have become staples in western diets in recent decades, researchers have wondered what effect emulsifiers could be having on population health.

To test whether the chemicals could be influencing cancer rates, the researchers from the French Nutritional Epidemiology Research team analyzed data from an ongoing national survey, the French NutriNet-Santé cohort.

The team looked at the entries of 92,000 adults, who were 45 years old on average, and 79% women. that participated in the cohort between 2009 and 2021.

All participants had given at least three days of dietary records on what food and drink they had consumed.

The researchers began by matching these diaries against food databases and testing the mentioned items (2,677 food-additive pairs were analyzed) to identify which emulsifiers the participants would have consumed and in what volume.

Between 2009 and 2021, 2,604 cases of cancer were diagnosed within the cohort. The researchers then compared these cancer rates to the diets of the cohorts using a statistical model that accounted for other cancer risk factors, such as age, weight, family history, etc.

After an average follow-up of seven years, the researchers found that higher intakes of mono- and diglycerides of fatty acids (E471) were associated with increased risks of cancer overall (a 15% higher risk among those consuming the most compared with those consuming the least), breast cancer (a 24% higher risk) and prostate cancer (a 46% higher risk).

Women with higher carrageenan intakes (E407 and E407a) had a 32% higher risk of developing breast cancer, compared with the group with lower intakes.

Despite the study's limitations – no causal proof, under-representation of men, etc. – the authors say their findings are robust and add to the growing body of evidence that ultra-processed foods are a cancer risk.

Another study, published in the *Lancet* last year, noted that, among a UK cohort, ultra-processed consumption was linked to an increased burden and mortality for ovarian cancer.

Bulletin Board

Gossip

MAR. 01, 2024

In response to these results, regulators should consider reassessing what they allow ultra-processed foods to contain, said the French research team.

“While these findings need to be replicated in other studies worldwide, they bring new key knowledge to the debate on re-evaluating the regulations around the use of additives in the food industry, in order to better protect consumers,” Mathilde Touvier, a research director at the French National Institute of Health and Medical Research, and Bernard Srour, a junior professor at the National Institute of Agronomic Research – both lead authors of the study – said in a statement.

Reference: Sellem L, Srour B, Javaux G, et al. Food additive emulsifiers and cancer risk: Results from the French prospective NutriNet-Santé cohort. Plos Med. 2024 doi: 1004338.

Technology Networks, 21 February 2024

<https://technologynetworks.com>

Scientists create single-atom catalysts for efficient electrooxidation of water

2024-02-28

Currently, the means of regulating metal-carrier interactions are generally to replace the carrier or to treat the catalyst with hydrogen reduction, which could cause changes in the carrier or sacrifice the stability of the catalyst. Therefore, the development of a method to regulate metal-carrier interactions without changing the carriers is urgently needed.

A research team led by Prof. Zeng Jie from the Hefei National Research Center for Physical Sciences at the Microscale, the University of Science and Technology of China (USTC) of the Chinese Academy of Sciences has constructed single-atom catalysts with efficient electrooxidation of water using site-specific MSIs. The study was published in Nature Communications.

The researchers employed an electrochemical deposition strategy to effectively modulate the site-specific metal-carrier interactions of Ir single atoms anchored on Ni layered double hydroxide (Ni LDH). Cathodic deposition drove Ir atoms anchored to triple neutral vacancies (Ir1/Ni LDH-T) and anodic deposition drove Ir atoms anchored to oxygen vacancy sites (Ir1/Ni LDH-V). Strong MSIs between Ir atoms and carriers induced the switch of active sites from Ni to Ir sites, optimizing the adsorption strength of the intermediates and thus increasing the catalytic activity.

Single-atom catalysts (SACs), due to their excellent catalytic activity, have been a hot topic in the field of energy catalysis.

Bulletin Board

Gossip

MAR. 01, 2024

The researchers revealed that, in accordance with the electrochemical deposition principle and X-ray absorption fine structure, Ir1/Ni LDH-T has more covalent bonds between the Ir sites and the coordinated oxygen from Ni LDH. The Ni 2p XPS peaks of Ir1/Ni LDH-T shifted to high binding energy, indicating stronger MSIs of Ir single atoms in Ir1/Ni LDH-T.

The test results of electrocatalytic water oxidation reaction showed that the mass and intrinsic activities of Ir single-atom catalysts with strong MSIs were increased by 19.5 and 5.2 times, respectively. Oxygen-isotope-labeling in situ Raman spectra showed that the ¹⁸O-labeled oxygen in Ir1/Ni LDH-V and Ni LDH was readily exchanged with the ¹⁶O atoms in the electrolyte during the water oxidation reaction, suggesting that Ni was the main active sites in these two catalysts. In contrast, ¹⁸O-labeled Ni³⁺-O in Ir1/Ni LDH-T would not be exchanged by ¹⁶O, indicating that Ir is the main active sites.

In addition, theoretical calculations revealed that the stronger MSI in Ir1/Ni LDH-T optimized the adsorption energy of oxygenated intermediates, thus enhancing the performance.

Phys Org, 28 February 2024

<https://phys.org>

Boron cluster family breaks electron counting rules

2024-02-28

Kenneth Wade first proposed what are now known as the Wade–Mingos electron counting rules in 1971 before Michael Mingos went on to develop them further. The rules predict and order metallaborane clusters by correlating the number of framework electrons with the structure of boron clusters. However – and despite being revised many times – they fail to explain the electronic structure of more unusually-shaped polyhedral clusters.

The new class of osmaborane clusters, isolated by Sundargopal Ghosh and coworkers at the Indian Institute of Technology Madras, have a deltahedral shape as opposed to the usual rounded geometries of metallaborane dianion clusters. In borate dianions, the number of skeletal electron pairs correspond to the total number of boron atoms present. But the new osmaboranes possess one fewer electron pair than the number of boron atoms, thereby defying the established electron counting rules.

Scientists have isolated a new class of osmaborane clusters that defy the Wade–Mingos electron counting rules.

Bulletin Board

Gossip

MAR. 01, 2024

To make the clusters, Ghosh's team reacted osmaboranes [Cp*OsBr₂]₂ with various borane reagents to form intermediates, before using a thermolysis reaction to isolate them.

The structural uniqueness of the clusters is because they undergo diamond-square-diamond rearrangements. Theoretical analysis indicates that strong interactions between the metallic osmium bonds play a fundamental role in determining the electron count as well as the rearrangements and shapes of the clusters.

Chemistry World, 28 February 2024

<https://chemistryworld.com>

Using mussels and silkworm cocoons to stop organ bleeding

2024-02-23

A collaborative team, led by Professor Hyung Joon Cha (Department of Chemical Engineering and the School of Convergence Science and Technology) and Dr. Jaeyun Lee (Department of Chemical Engineering) at Pohang University of Science and Technology (POSTECH), Professor Kye Il Joo (Department of Chemical Engineering and Materials Science) at Ewha Womans University, and Dr. Jong Won Rhie (Department of Plastic and Reconstructive Surgery) at Seoul St. Mary's Hospital of the College of Medicine at the Catholic University of Korea, has developed a bilayer nanofiber membrane hemostat using natural proteins derived from mussels and silkworm cocoons.

The findings of this research have been recently published online in the latest issue of *Small*, an international journal specializing in nanoengineering.

Conventional hemostatic agents such as gauze or medical bands are limited to application on the surface of the skin.

Although there are certain materials that naturally degrade within the body like fibrin glue and collagen sponges, they necessitate proteins sourced from humans or animals, making them considerably expensive.

Moreover, existing hemostatic materials lack consistent adherence to bleeding sites and are prone to infection from external contaminants.

In recent news, there has been a case where a patient experienced pain due to a surgical procedure involving sutures, resulting in the unintended presence of gauze within the patient's body.

Bulletin Board

Gossip

MAR. 01, 2024

In response, the researchers developed a bilayer adhesive hemostat utilizing mussel adhesive proteins that exhibit strong tissue adhesion underwater and silk fibroin extracted from silkworm cocoons.

In the research, mussel adhesive proteins demonstrated excellent hemostatic effects including platelet activation.

The researchers employed methanol vapor to modify the secondary structure of silkworm silk proteins, resulting in a nanofiber membrane with a hydrophobic outer surface.

In light of this, the team engineered a hemostatic agent featuring an inner layer with mussel adhesion proteins for wound adhesion and an outer protective layer entirely composed of silkworm silk proteins.

Through animal experiments, the hemostatic agent demonstrated rapid acceleration of tissue adhesion and hemostasis in bleeding wounds, effectively preventing the infiltration of water containing infectious agents such as bacteria.

Using two proteins that are both highly biocompatible and biodegradable, the researchers have introduced a novel hemostatic agent capable of clotting blood and providing defense against infection.

Professor Hyung Joon Cha of the POSTECH who led the study remarked, "We have validated the exceptional hemostatic performance of a multifunctional topical adhesive hemostatic agent that is derived from nature and is based on degradable proteins in the human body." He added, "We will continue further research to assess its applicability in real-world patient care or surgical settings."

The research was conducted with support from the Marine BioMaterials Research Center Program of the Ministry of Oceans and Fisheries and the Mid-Career Research Program of the National Research Foundation of Korea.

Science Daily, 23 February 2024

<https://sciencedaily.com>

Light stimulates a new twist for synthetic chemistry

2024-02-28

Researchers at Hokkaido University, led by Assistant Professor Akira Katsuyama and Professor Satoshi Ichikawa at the Faculty of Pharmaceutical Sciences, have extended the toolkit of synthetic chemistry by making a

Molecules that are induced by light to rotate bulky groups around central bonds could be developed into photo-activated bioactive systems, molecular switches, and more.

Bulletin Board

Gossip

MAR. 01, 2024

new category of molecules that can be induced to undergo an internal rotation on interaction with light. Similar processes are believed to be important in some natural biological systems.

Synthetic versions might be exploited to perform photochemical switching functions in molecular computing and sensing technologies or in bioactive molecules, including drugs. Their report is pending in Nature Chemistry.

“Achieving a system like ours has been a significant challenge in photochemistry,” says Katsuyama. “The work makes an important contribution to an emerging field in molecular manipulation.”

Insights into the possibilities for light to significantly alter molecular conformations have come from examining some natural proteins. These include the rhodopsin molecules in the retina of the eye, which play a crucial role in converting light into the electrical signals that create our sense of vision in the brain. Details are emerging on how the absorption of light energy can induce a twisting rearrangement of part of the rhodopsin molecule required for it to perform its biological function.

“Mimicking this in synthetic systems might create molecular-level switches with a variety of potential applications,” Katsuyama explains.

A key innovation by the Hokkaido team was to achieve photo-induced (i.e., light-driven) rotation of molecular groups around a series of chemical bonds that incorporate a nitrogen atom together with other bonded carbon atoms.

The rotational properties were enabled by adding molecular components that contained an atom from the ‘chalcogen’ group of elements in the periodic table, specifically sulfur or selenium, to a simple organic molecule: an amide compound. This brought a new level of control and versatility to synthetic photo-induced rotational systems.

Some of the chemical groups that rotate around the central bonds were relatively large, based on rings of six bonded carbon atoms. This facilitated the large-scale molecular changes that might be required for practical use in molecular switching systems.

In addition to demonstrating the photo-induced changes, the team also performed theoretical calculations that gave insights into the likely mechanisms by which the rearrangements proceeded. The team also explored the effects of temperature on the transformations. The combination of theoretical and experimental work should help guide

Bulletin Board

Gossip

MAR. 01, 2024

future research toward exploring and controlling modifications to the systems already achieved.

“Our next research priority is focused on the potential of our methods for making new bioactive molecules activated by light. These could be applied in biological research or possibly developed as drugs,” Ichikawa concludes.

Using light to activate the conformational changes allows control over where and when the changes occur. This could be vital for precisely targeted applications in biological systems, including eventual therapeutic possibilities.

A version of the study is available on the journal ChemRxiv pre-print server.

Phys Org, 28 February 2024

<https://phys.org>

The smallest known molecular knot is made of just 54 atoms

2024-02-05

Chemists have tied together just 54 atoms to form the smallest molecular knot yet. Described January 2 in Nature Communications, the knot is a chain of gold, phosphorus, oxygen and carbon atoms that crosses itself three times, forming a pretzel shape called a trefoil. The previous smallest molecular knot, reported in 2020, contained 69 atoms.

Chemist Richard Puddephatt, working with colleagues at the Chinese Academy of Sciences in Dalian, created the new knot by accident while attempting to build complex structures of interlocked ring molecules, or catenanes. Someday catenanes could be used in molecular machines — essentially, switches and motors at the molecular scale — but for now scientists are still figuring out how they work, which, in this case, resulted in producing something else by “It was just serendipity really, one of those lucky moments in research that balances out all the hard knocks that you take,” says Puddephatt, of the University of Western Ontario in London, Canada.

The new trefoil knot is also the tightest of its kind. Researchers calculate a molecular knot’s tightness by dividing the number of atoms in the chain by the number of chain crossings to get what’s called the backbone

Imagine a knot so small that it can’t be seen with the naked eye. Then think even smaller.

Bulletin Board

Gossip

MAR. 01, 2024

crossing ratio, or BCR. The smaller the BCR, the tighter the knot. The new knot has a BCR of 18. The previous tightest trefoil knot had a BCR of 23.

Studying small molecular knots could someday lead to new materials (SN: 8/27/18). But for now, the team is still trying to determine why this combination of atoms results in a knot at all. *mistake.*

Science News, 05 February 2024

<https://sciencenews.com>

Bulletin Board

Curiosities

MAR. 01, 2024

~dCuriosities

Your Gas Stove May Be Releasing More Harmful Nanoparticles Than Vehicle Exhaust

2024-02-28

"Combustion remains a source of air pollution across the world, both indoors and outdoors. We found that cooking on your gas stove produces large amounts of small nanoparticles that get into your respiratory system and deposit efficiently," said Brandon Boor, an associate professor in Purdue's Lyles School of Civil Engineering, who led this research.

Based on these findings, the researchers would encourage turning on a kitchen exhaust fan while cooking on a gas stove.

The study, published in the journal PNAS Nexus, focused on tiny airborne nanoparticles that are only 1-3 nanometers in diameter, which is just the right size for reaching certain parts of the respiratory system and spreading to other organs.

Recent studies have found that children who live in homes with gas stoves are more likely to develop asthma. But not much is known about how particles smaller than 3 nanometers, called nanocluster aerosol, grow and spread indoors because they're very difficult to measure.

"These super tiny nanoparticles are so small that you're not able to see them. They're not like dust particles that you would see floating in the air," Boor said. "After observing such high concentrations of nanocluster aerosol during gas cooking, we can't ignore these nano-sized particles anymore."

Using state-of-the-art air quality instrumentation provided by the German company GRIMM AEROSOL TECHNIK, a member of the DURAG GROUP, Purdue researchers were able to measure these tiny particles down to a single nanometer while cooking on a gas stove in a "tiny house" lab. They collaborated with Gerhard Steiner, a senior scientist and product manager for nano measurement at GRIMM AEROSOL.

Called the Purdue zero Energy Design Guidance for Engineers (zEDGE) lab, the tiny house has all the features of a typical home but is equipped with sensors for closely monitoring the impact of everyday activities on a home's air quality. With this testing environment and the instrument from GRIMM AEROSOL, a high-resolution particle size magnifier—scanning

Cooking on your gas stove can emit more nano-sized particles into the air than vehicles that run on gas or diesel, possibly increasing your risk of developing asthma or other respiratory illnesses, a new Purdue University study has found.

Bulletin Board

Curiosities

MAR. 01, 2024

mobility particle sizer (PSMPS), the team collected extensive data on indoor nanocluster aerosol particles during realistic cooking experiments.

This magnitude of high-quality data allowed the researchers to compare their findings with known outdoor air pollution levels, which are more regulated and understood than indoor air pollution. They found that as many as 10 quadrillion nanocluster aerosol particles could be emitted per kilogram of cooking fuel — matching or exceeding those produced from vehicles with internal combustion engines.

This would mean that adults and children could be breathing in 10-100 times more nanocluster aerosol from cooking on a gas stove indoors than they would from car exhaust while standing on a busy street.

“You would not use a diesel engine exhaust pipe as an air supply to your kitchen,” said Nusrat Jung, a Purdue assistant professor of civil engineering who designed the tiny house lab with her students and co-led this study.

Purdue civil engineering PhD student Satya Patra made these findings by looking at data collected in the tiny house lab and modeling the various ways that nanocluster aerosol could transform indoors and deposit into a person’s respiratory system.

The models showed that nanocluster aerosol particles are very persistent in their journey from the gas stove to the rest of the house. Trillions of these particles were emitted within just 20 minutes of boiling water or making grilled cheese sandwiches or buttermilk pancakes on a gas stove.

Even though many particles rapidly diffused to other surfaces, the models indicated that approximately 10 billion to 1 trillion particles could deposit into an adult’s head airways and tracheobronchial region of the lungs. These doses would be even higher for children — the smaller the human, the more concentrated the dose.

The nanocluster aerosol coming from the gas combustion also could easily mix with larger particles entering the air from butter, oil or whatever else is cooking on the gas stove, resulting in new particles with their own unique behaviors.

A gas stove’s exhaust fan would likely redirect these nanoparticles away from your respiratory system, but that remains to be tested.

“Since most people don’t turn on their exhaust fan while cooking, having kitchen hoods that activate automatically would be a logical solution,” Boor said. “Moving forward, we need to think about how to reduce our

Bulletin Board

Curiosities

MAR. 01, 2024

exposure to all types of indoor air pollutants. Based on our new data, we’d advise that nanocluster aerosol be considered as a distinct air pollutant category.”

Reference: Patra SS, Jiang J, Ding X, et al. Dynamics of nanocluster aerosol in the indoor atmosphere during gas cooking. PNAS Nexus. 2024;3(2):pgae044. doi: 10.1093/pnasnexus/pgae044

Technology Networks, 28 February 2024

<https://technologynetworks.com>

First synthetic protein motor creates its own fuel as it ‘mows’

2024-02-27

“Imagine if a Roomba could be powered only by the dirt it picks up,” said Nancy Forde, Simon Fraser University (SFU) physics professor and co-corresponding author of a study in which she and her fellow researchers outline their creation, a synthetic molecular motor that harnesses the energy of biological reactions to propel itself.

All living organisms, from humans to bacteria and plants, are kept alive by protein-based molecular motors that convert energy from one form into mechanical forces and motion that enable cell division, cargo delivery, movement towards food or light, and maintaining healthy tissues. SFU researchers, in collaboration with Lund University, Sweden, built on decades of research into the molecular motors seen in nature to realize their novel creation.

“If the rules that we’ve learned from studying nature’s molecules are correct and sufficient, then we should be able to build motors out of different protein parts and have them work in expected ways,” Forde said.

The researchers were inspired by a class of molecular motors known as burnt-bridge ratchets (BBRs). BBRs achieve directed motion over long distances by consuming and destroying energy-rich substrates as they travel, preventing backward movement. From this inspiration, they created the first molecular motor from naturally occurring proteins, which they dubbed The Lawnmower.

The Lawnmower is a sphere covered in trypsin, an enzyme that helps the body break down proteins. Once it lands on a surface, the trypsin ‘blades’ bind to and cleave peptides, shorter-length proteins, converting them into energy. The lack of peptides left in The Lawnmower’s wake creates a

The body uses protein-based molecular motors to perform functions essential to life. Now, researchers have created ‘The Lawnmower,’ the first synthetic motor modeled on those found in nature that propels itself by harnessing the energy it creates as it cuts through fields of proteins.

Bulletin Board

Curiosities

MAR. 01, 2024

free energy gradient, pushing it towards the uncleaved peptide 'grass'. It continues to 'mow' as it goes, achieving average speeds of up to 80 nm/s, comparable to The Lawnmower could have important applications in medicine and biocomputing. The dysfunction of molecular motors in the neurons is related to many human neuronal diseases. Knowing how these motors work in healthy and diseased states may be key to understanding and treating motor neuron diseases like multiple sclerosis and spastic paraplegia. They could also be used for targeted drug delivery.

"Influenza is thought to work as a molecular motor to infiltrate the area around cells in order to infect them," said Forde. "Maybe synthetic motors could use the same approach, but rather than infecting cells, they could be engineered to deliver drug payloads to specifically target diseased cells."

The study was published in the journal Nature Communications.

New Atlas, 27 February 2024

<https://newatlas.com>

From PFAS to Microplastics, What Might Be Leaking Out of Your Teabag?

2024-02-19

Depending on the brand, your favorite cup of tea could be contaminated with billions of microplastics and/or traces of per- and polyfluoroalkyl substances (PFAS).

What damage are these compounds wreaking? The research is still in its infancy, but here's what we know so far.

Microplastics and tea

Although teabags are typically made from paper, some companies have opted to use nylon and polyethylene terephthalate (PET), both of which can degrade in contact with hot water.

One paper published in 2019 found that, when brewed with boiling water, a single plastic teabag can release approximately 11.6 billion microplastics and 3.1 billion nano-plastics into a single cup of tea.

The researchers concluded that the levels of nylon and PET particles released from the teabag packaging were "several orders of magnitude higher" than plastic loads previously reported in other foods.

Bulletin Board

Curiosities

MAR. 01, 2024

Another study published in 2021 found that this kind of particle release is further amplified by microwaving the mug of tea.

Many brands have recently scrapped these types of plastic bags in response to this research and the larger consumerism trend away from plastics. Some of the new paper bags, however, reportedly still contain plastic fibers in their sealant.

So, how unhealthy is it to ingest millions of microplastics? Science doesn't know yet. Microplastics research is an expanding field and while some plastics are known to be toxic to humans and linked to lung irritation, headaches, asthma and even cancers, it's yet to be determined if the average level of microplastics in a typical person is past the threshold for such harm.

What is known is that tea is far from the sole dietary source of minuscule plastics. Seafood, fruit, vegetables and drinking water have all been linked to microplastic contamination. Even the air you're breathing now may be contaminated with tiny polymers that have shed from some nearby plastic product.

PFAS and tea

Microplastics have had their fair share of bad press at this point, so many tea drinkers will try (as challenging as that is) to avoid them if they can. PFAS, on the other hand, are less well-known. Many tea drinkers will be unaware they risk slurping them down. So, what are PFAS?

PFAS are a group of surfactants used to waterproof consumer products like pans, paints and packaging – including teabags. They're known as the "forever chemicals" because they have an almost-unbreakable highly-fluorinated alkyl chain backbone that makes them extremely chemically stable and difficult to degrade naturally.

This robustness is all the more troubling considering the recent wave of research linking the chemicals to some cancer types and low birth weights.

How much of a health risk does PFAS in teabags carry? It's hard to say; only a few studies have been conducted so far.

One recent paper revealed that young people who drank more tea were more likely to have high PFAS levels in their blood than those who drank more sugary drinks. The researchers didn't test the teabags to ascertain

Bulletin Board

Curiosities

MAR. 01, 2024

whether the PFAS was indeed leeching from the bags, but that was their suspicion.

“In our study, the findings showed that PFAS levels were higher in people who reported drinking more tea,” Hailey Hampson, a PhD candidate at the University of Southern California, told Technology Networks. “Because of this, our study does not tell us which component of tea may be contaminated with PFAS.”

“PFAS in tea could potentially come from one or more sources, but more research is needed to determine which part of tea may be a source of PFAS.”

“With this in mind, we can still hypothesize about how PFAS may contaminate teas, based on previous scientific studies,” Hampson continued. “Our primary hypothesis is currently based on a study published last year, which found that some tea bags have PFAS in them. This study, which was conducted in India, tested 108 tea bag samples that were collected from the Indian market and found that 90% of them contained detectable concentrations of PFAS.”

“Independent of the findings from our study, this study shows that tea bags can be a source of PFAS contamination. However, we need more research on commercially available tea bags in the USA to determine the degree to which PFAS contamination in tea bags is an issue in the USA. Based on our findings and the findings from other researchers, we are currently performing a study to test for PFAS contamination in tea bags from the US market.”

What to drink?

Microplastics and PFAS are impossible to avoid in the modern world; both contaminants have been found as far afield as the Arctic.

But for those regular tea drinkers concerned about their daily dose of the forever chemicals, the best option would appear to be ditching the bag all together and straining your tea the old fashioned way.

Technology Networks, 19 February 2024

<https://technologynetworks.com>

Bulletin Board

Curiosities

MAR. 01, 2024

Researchers develop novel method to photosynthesize hydrogen peroxide using water and air

2024-02-28

Traditional industrial production of H₂O₂ via the anthraquinone process using hydrogen and oxygen is highly energy-intensive. This approach employs toxic solvents and expensive noble-metal catalysts and generates substantial waste from side reactions.

In contrast, photocatalytic production of H₂O₂ from oxygen and water offers an energy-efficient, mild, and clean route. Most importantly, it addresses the common drawbacks of existing photocatalytic systems, such as low activity, heavy use of additional alcohol sacrificial donors, and the necessity for pure oxygen gas input.

A research team led by Professor Jiang Donglin from the NUS Department of Chemistry has developed a new type of photocatalyst for the efficient artificial photosynthesis of H₂O₂ from water and air. The researchers constructed hexavalent covalent organic frameworks (COFs) in which the skeleton is designed to be donor-acceptor π columns for high-rate photo-induced charge generation and catalytic active sites.

In parallel, the pore is engineered with hydraulically sensitive trigonal microporous channels for immediate delivery of reactants water and oxygen. As a result, these hexavalent COFs produce H₂O₂ spontaneously and efficiently from water and atmospheric air when exposed to visible light in both batch and flow reactors.

Under laboratory conditions, the COFs demonstrate a quantum efficiency of 17.5 percent under visible light at 420 nm in batch reactors. This system can be developed to construct self-cleaning surfaces and for disinfection treatments.

The research findings were published in Nature Catalysis.

Prof Jiang said, “In this work, we successfully addressed a key and common issue in photocatalysts, electrocatalysts, and heterogeneous catalysts, which is the efficient supply of charges and mass to catalytic sites. Our focus on precise structural design at the atomic level to explore both the skeletons and pores of COFs has led to the creation of an artificial

Researchers at the National University of Singapore (NUS) have developed a microporous covalent organic framework with dense donor-acceptor lattices and engineered linkages for the efficient and clean production of hydrogen peroxide (H₂O₂) through the photosynthesis process with water and air.

Bulletin Board

Curiosities

MAR. 01, 2024

photosynthesis system for H₂O₂ production, achieving unprecedented photocatalytic efficiency.”

Phys Org, 28 February 2024

<https://phys.org>

90% of US tattoo inks contain ingredients not listed on the label

2024-02-27

Tattoos are all about self-expression, rebellion, reminders of family and traditions, and even drunken impulsiveness. Regardless of the reason, everyone who gets a tattoo expects that the ink that’s used is safe.

A study by researchers from Binghamton University (Bing U), New York, has found that that might not be the case. Of the 54 tattoo inks they analyzed, from big-name US brands to smaller manufacturers, 90% had major labeling discrepancies, specifically unlisted additives and pigments.

Here’s what the researchers found:

- Polyethylene glycol (PEG) was the most common unlisted additive. While it’s regularly used to treat constipation, prolonged exposure to PEG can cause harmful effects, including kidney or heart failure.
- The second most common was propylene glycol, associated with skin irritation and allergic reactions.
- Butylated hydroxytoluene (BHT), a food preservative that can disrupt the endocrine system, impacting testosterone levels and affecting sperm quality. In addition, it may cause liver enlargement, kidney dysfunction, and lung inflammation.
- Hexamethylenetetramine, an antibiotic commonly used to treat urinary tract infections.
- 2-phenoxyethanol, an antimicrobial agent. Though rare, there have been cases of contact dermatitis and hives following exposure to this substance. The US FDA has warned against nervous system problems and diarrhea with nursing infants exposed to 2-phenoxyethanol by their mothers.
- 1-butanol. An alcohol commonly used as a solvent and fuel and reported to irritate eyes, lungs, and skin following repeated or prolonged exposure.
- Inks from the following brands were analyzed: Intenze, Dynamic, Solid Ink, Starbrite, World Famous, Mom’s Ink, Solong, One Tattoo World,

Bulletin Board

Curiosities

MAR. 01, 2024

and Raw Ink. Of these, Dynamic was the only manufacturer who had correct labeling across all pigments.

The researchers point out that the unlisted substances found in tattoo inks were present at concentrations of 2,000 parts per million (ppm) or more, considered a high concentration. Other components may be present at concentrations too low to observe but that are otherwise significant, further emphasizing the need for careful manufacturing controls. Compared to the US, the European Chemicals Agency (ECHA) imposes stricter regulations on tattoo inks available on the European market.

“We’re hoping the manufacturers take this as an opportunity to reevaluate their processes, and that artists and clients take this as an opportunity to push for better labeling and manufacturing,” said John Swierk, the study’s corresponding author.

The researchers couldn’t say whether unlisted substances were intentionally added or if the manufacturer was provided with incorrectly labeled or contaminated materials. Further, it’s not uncommon for multiple ink manufacturers to have the same owner, raising a concern that labeling issues may extend to inks not analyzed in the study.

Prior to 2022, the FDA classified tattoo inks as ‘cosmetic,’ so they weren’t regulated. Congress passed the Modernization of Cosmetics Regulation Act (MoCRA) that year, regulating them for the first time.

“The FDA is still figuring out what that is going to look like, and we think this study will influence the discussions around MoCRA,” Swierk said. “This is also the first study to explicitly look at inks sold in the United States and is probably the most comprehensive because it looks at the pigments, which nominally stay in the skin, and the carrier package, which is what the pigment is suspended in.”

The researchers say their research is aimed at empowering tattoo artists and their customers.

“Our goal in a lot of this research is to empower artists and their clients,” said Swierk. “Tattoo artists are serious professionals who have dedicated their lives to this craft and they want the best possible outcomes for their clients. We’re trying to highlight that there are some deficiencies in manufacturing and labeling.”

New Atlas, 27 February 2024

<https://newatlas.com>

Bulletin Board

Curiosities

MAR. 01, 2024

Iodine compounds accelerate cloud formation over oceans and the poles

2023-12-19

Cloud cover affects temperature by both reflecting incoming heat to space and preventing outgoing heat from escaping and so is a significant factor in climate models. Before water vapour can condense into an aerosolised droplet, it requires a seed particle. But the complexity of the various coupled chemical reactions involved in this process forces climatologists to run drastically over-simplified simulations, explains atmospheric scientist Xu-Cheng He, currently a visiting scholar at the University of Cambridge in the UK. 'They may just use a few reactions to describe the aerosol precursors,' he notes. In particular, models usually focus on sulfuric acid.

To explain observed formation rates, sulfuric acid requires a stabiliser. In urban areas, this is usually ammonia. But over pristine environments, such as the ocean, ammonia is much scarcer, so modelling cloud formation becomes difficult. This is especially problematic as marine clouds are the most important to Earth's radiation balance. 'From space, water is literally dark, so it can absorb more solar radiation, whereas if you have white coverage of clouds, they reflect a lot of incoming radiation back to space,' says He.

In experiments at Cern's Cloud (Cosmics Leaving Outdoor Droplets) chamber in 2021, He and his colleagues discovered that iodic acid and iodous acid could nucleate aerosol particles at rates comparable with sulfuric acid in pristine marine conditions. In the new research, they show that the two nucleation mechanisms are not completely independent. Under ionised conditions in the atmosphere, iodic acid can enhance the ion-induced nucleation of sulfuric acid. More strangely, iodous acid can substitute for ammonia and behave as a base, accepting a proton from sulfuric acid to form a neutral dimer. In fact, it is a much more effective substitute: less than one part per trillion by volume of iodous acid gives the same rate as 500 parts per trillion of ammonia.

The overall implications of the research are highly uncertain, says He. Levels of sulfuric acid in the atmosphere have been falling thanks to increased pollution controls, whereas iodine emissions have tripled since the 1950s and continue to rise for many reasons including increased ozone concentrations and arctic ice thinning. Further investigations will therefore require field research and global Earth system modelling, although He speculates that 'recently it's become a hot topic that air pollution control in

Bulletin Board

Curiosities

MAR. 01, 2024

cities is going to warm the climate because it will lead to less sulfuric acid concentration ... I think that should be partly revised.'

Hamish Gordon of Carnegie Mellon University in Pittsburgh, US, believes the research is 'potentially a very important finding'. He says the role of iodine species in aerosol chemistry is not well understood, with the atmospheric mechanism(s) by which iodous acid is produced being uncertain. 'This is an impressive result because usually the lowest concentration species in these kinds of nucleating systems is sulfuric acid, and measuring sulfuric acid concentrations is difficult enough, so measuring concentrations of species that matter in even lower concentrations is kind of neat,' he says. 'There's going to be a lot of interesting work to figure out where iodous acid could be important and where it's unlikely to be produced even in the really low concentrations needed for making particles.'

Chemistry World, 19 December 2023

<https://chemistryworld.com>

Plastic recycling with a protein anchor

2024-02-20

Polystyrene -- alone or in combination with other polymers -- has many applications, from yogurt containers to instrument housings.

In its foam form, mainly known under the trademarked name Styrofoam, it is, for example, used for insulation and packaging.

A big disadvantage of polystyrene is its poor biodegradability, which leads to environmental pollution.

When clean and not mixed with other materials, polystyrene is recyclable, but not when it is contaminated, or combined with other materials.

In municipal recycling programs, mixed polystyrene plastic waste and degradation products, such as polystyrene nano- and microparticles, are difficult to process.

The problem lies in the fact that polystyrene is water-repellent and nonpolar and thus cannot react with common polar reactants.

For a simple, economical, and energy efficient process to break down mixed polystyrene waste, the polystyrene must first be equipped with polar functional groups.

Polystyrene is a widespread plastic that is essentially not recyclable when mixed with other materials and is not biodegradable.

Bulletin Board

Curiosities

MAR. 01, 2024

A team led by Ulrich Schwaneberg and Jun Okuda at the RWTH in Aachen (Germany) has now developed a novel biohybrid catalyst to carry out this step.

The catalyst is based on compounds known as anchor peptides coupled with a cobalt complex.

Anchor peptides are short peptide chains than can attach to surfaces.

The team developed a special anchor peptide (LCI, Liquid Chromatography Peak I) that binds to the surface of polystyrene.

One gram of this peptide is enough to coat a surface of up to 654 m² with a monolayer within minutes by either spraying or dipping.

A catalytically active cobalt complex is attached to the anchor peptide via a short linking piece.

The cobalt atom is “surrounded” by a macrocyclic ligand, a ring made of eight carbon and four nitrogen atoms (TACD, 1,4,7,10-tetraazacyclododecane). The catalyst accelerates oxidation of the C-H bonds in polystyrene to form polar OH groups (hydroxylation) by reaction with Oxone (potassium peroxydisulfate), a common oxidizing agent.

The binding of the anchor peptides is material-specific so in this case they immobilize the catalytically active cobalt near the polystyrene surface, which accelerates the reaction.

This simple, inexpensive, and energy-efficient process is scalable through dipping and spray applications and is suitable for use on an industrial scale.

Through the use of conjugated chemical catalysts, this hybrid catalyst concept employing material-specific binding by anchor peptides could allow for the material-specific breakdown of further hydrophobic polymers such as polypropylene and polyethylene that cannot be economically broken down by enzymes.

Science Daily, 20 February 2024

<https://sciencedaily.com>

Bulletin Board

Curiosities

MAR. 01, 2024

New dyeing method could help jeans shrink toxic problem

2024-02-27

Scientists have been searching for ways to make a more sustainable form of indigo, used for centuries to colour textiles, but which in its modern synthetic form needs toxic chemicals, large quantities of water and is linked to substantial carbon dioxide emissions.

But a study published in the journal Nature Communications suggests ditching the classic dye altogether.

Using Indican—a colourless compound also derived from indigo-producing plants—could reduce the environmental and societal impacts associated with dyeing jeans by around 90 percent because it does not need toxic chemicals, researchers said.

“It’s been known for some years that indigo could be replaced by this other chemical called indican, because you can use it without any strong chemicals,” study author Ditte Heddam Welner, a researcher at the Novo Nordisk Foundation Center for Biosustainability Enzyme Engineering and Structural Biology, told AFP.

The researchers engineered a variant of an enzyme found in the indigo-producing plant that could produce indican on an industrial scale.

While they said production of indican would still require polluting petrochemicals, so would not be significantly better than producing synthetic indigo, the benefits come when the dye is put to use.

Indican in powdered form can be dissolved in water then used on fabric and activated with either an enzyme or exposure to light.

The study found light-driven dyeing could cut the environmental damage of traditional indigo dyeing by 73 percent, while using the enzyme could slash the impacts by up to 92 percent.

In both cases, the classic blue jean colour turns up the same as when conventional indigo is used.

Researchers suggest that, if indican were to replace indigo to dye the nearly four billion jeans traded annually, there would be a significant reduction in production of toxic waste and global CO₂ emissions.

Can the multi-billion-dollar denim industry keep producing blue jeans in every shape, size and silhouette, while shrinking oversized levels of hazardous pollution?

Bulletin Board

Curiosities

MAR. 01, 2024

The authors, who have a published patent for their study, acknowledged limitations to their work, including a lack of facilities to simulate indican production at scale.

Indican could also be slightly more expensive than traditional dye, they said.

But the study said growing consumer demand for sustainable clothing could still make indican “a commercially viable route”.

Phys Org, 27 February 2024

<https://phys.org>

Glutenin: A New Game-Changer in Lab-Grown Meat Production

2024-02-26

Development of Plant-based Scaffolds for Cultured Meat

Cultured cells need a base or scaffold to adhere to produce lab-grown meat. Plant proteins are appealing candidates for the scaffolds because they are edible, abundant, and inexpensive. Previous researchers showed that a plant-based film made of glutenin was a successful base to cultivate cow skeletal muscle cells.

But for this technique to produce a promising meat-like alternative, the muscle cells need to form aligned fibers, similar to the texture in real tissues. Additionally, fat needs to be included in the 3D structure to replicate the composition of traditional meat products. To take advantage of using glutenin, a protein in gluten that people with celiac disease or a gluten sensitivity don't typically react to, Ya Yao, John Yuen, Jr., Chunmei Li, David Kaplan, and colleagues wanted to develop plant-based films with it to grow textured muscle cells and fatty layers.

Experimental Results and Future Directions

The researchers isolated glutenin from wheat gluten and formed flat and ridge-patterned films. Then they deposited mouse cells that develop into skeletal muscle onto the protein bases and incubated the cell-covered films for two weeks. Cells grew and proliferated on both flat and ridged films. As expected, compared to cells grown on control films made of gelatin, the performance of the glutenin-based films was inferior but sufficient. The researchers say further work needs to be done to improve how cells attach to the plant-based film to get closer to the growth on the

Bulletin Board

Curiosities

MAR. 01, 2024

animal-derived biomaterial. During the second week of the culture, the cells on the patterned film formed long parallel bundles, recreating the fiber structure of animal muscles.

In another test, mouse cells that produce fat tissues were deposited onto flat glutenin films. During the incubation period, as cells proliferated and differentiated, they produced visible lipid and collagen deposits.

The cultured meat and fat layers attached to the edible glutenin films could be stacked to form a 3D meat-like alternative protein. Because the glutenin material base supported the growth of both textured animal muscle and fat layers, the researchers say it could be used in an approach for more realistic cultivated meat products.

Reference: “Cultivated Meat from Aligned Muscle Layers and Adipose Layers Formed from Glutenin Films” by Ya Yao, John S. K. Yuen, Jr., Ryan Sylvia, Colin Fennelly, Luca Cera, Kevin Lin Zhang, Chunmei Li and David L. Kaplan, 16 January 2024, ACS Biomaterials Science & Engineering.

DOI: 10.1021/acsbmaterials.3c01500

The authors acknowledge funding from MilliporeSigma and the U.S. Department of Agriculture. Some authors are employees of MilliporeSigma, Inc.

SciTechDaily, 26 February 2024

<https://scitechdaily.com>

Chemists synthesize unique anticancer molecules using novel approach

2024-02-22

The chemical structures of these molecules, which consist of a dense, highly complex knot of oxidized rings and nitrogen atoms, has attracted the interest of organic chemists worldwide, who aimed to recreate these structures from scratch in the laboratory. However, despite considerable effort, it has remained an elusive task. Until now, that is.

A team of Yale chemists, writing in the journal Science, has succeeded in synthesizing eight of the compounds for the first time using an approach that combines inventive chemical strategy with the latest technology in small molecule structure determination.

Nearly 30 years ago, scientists discovered a unique class of anti-cancer molecules in a family of bryozoans, a phylum of marine invertebrates found in tropical waters.

Bulletin Board

Curiosities

MAR. 01, 2024

“These molecules have been an outstanding challenge in the field of synthetic chemistry,” said Seth Herzon, the Milton Harris ’29 Ph.D. Professor of Chemistry in Yale’s Faculty of Arts and Sciences and corresponding author of the new study. “A number of research groups have tried to recreate these molecules in the lab, but their structures are so dense, so intricately connected, that it hasn’t been possible. I’ve been reading about efforts to synthesize these compounds since I was a graduate student in the early 2000s.”

In nature, the molecules are found in some species of bryozoa -- small, aquatic animals that feed by filtering prey from the water via tiny tentacles. Researchers worldwide consider bryozoans to be a potentially valuable source of new medications, and many molecules isolated from bryozoans have been studied as novel anticancer agents. However, the complexity of the molecules often limits their further development.

Herzon’s team looked at a particular species of bryozoa called *Securiflustra securifrons*.

“We worked on these molecules about a decade ago, and though we were not successful in recreating them at that time, we gleaned insight into their structure and chemical reactivity, which informed our thinking,” Herzon said.

The new approach involved three key strategic elements. First, Herzon and his team avoided constructing a reactive heterocyclic ring, known as an indole, until the end of the process. A heterocyclic ring contains two or more elements -- and this specific ring is known to be reactive and create problems, Herzon said.

Second, the researchers used methods known as oxidative photocyclizations to construct some of the key bonds in the molecules. One of these photocyclizations involved the reaction of a heterocycle with molecular oxygen, which was first studied by Yale’s Harry Wasserman in the 1960s.

Lastly, Herzon and his team employed microcrystal electron diffraction (MicroED) analysis to help visualize the structure of the molecules. Herzon said conventional methods for structure determination were inadequate in this context.

The result of the new approach is eight new synthetic molecules with therapeutic potential -- and the promise of more new chemistry to come.

Bulletin Board

Curiosities

MAR. 01, 2024

“These molecules hit right at my love of complex synthetic challenges,” said Herzon, who is also a member of the Yale Cancer Center and holds joint appointments in pharmacology and therapeutic radiology at Yale School of Medicine. “On a molecular weight basis, they are modest relative to other molecules we’ve studied in my lab. But from the vantage point of chemical reactivity, they present some of the greatest challenges we’ve ever taken on.”

Co-first authors of the new study are Yale chemistry graduate students Brandon Alexander and Noah Bartfield. Co-authors are Vaani Gupta, a Yale chemistry graduate student; Brandon Mercado, a Yale X-ray crystallographer and lecturer in the Department of Chemistry; and Mark Del Campo of Rigaku Americas Corporation.

The National Science Foundation helped fund the research.

Science Daily, 22 February 2024

<https://sciencedaily.com>

Bulletin Board

Technical Notes

MAR. 01, 2024

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

CHEMICAL EFFECTS

[Integrative chemical, physiological, and metabolomics analyses reveal nanospecific phytotoxicity of metal nanoparticles](#)

ENVIRONMENTAL RESEARCH

[Potential Effects of Long-Term Exposure to Air Pollution on Dementia: A Longitudinal Analysis in American Indians Aged 55 Years and Older](#)

[Tetracyclines contamination in European aquatic environments: A comprehensive review of occurrence, fate, and removal techniques](#)

PHARMACEUTICAL/TOXICOLOGY

[Having Children and Being Married Are Predictors of Burnout and Obesity Among Working Men: Effects of Latent Profile Analysis](#)

[Prevalence of dermatitis including allergic contact dermatitis from medical devices used by children and adults with Type 1 diabetes mellitus: A systematic review and questionnaire study](#)

[Exposure to Per- and Polyfluoroalkyl Substances and Breast Cancer Risk: A Systematic Review and Meta-analysis of Epidemiologic Studies](#)

OCCUPATIONAL

[Estimating effects of longitudinal and cumulative exposure to PFAS mixtures on early adolescent body composition](#)

[Multifaceted ORganizational InterventiONs \(M-ORION\) project for prevention of depression and anxiety among workers: study protocol for a five-arm cluster randomized controlled trial](#)

[Long-term Exposure to Industrial Chemical Contamination Affects the Magnitude of Predator-induced Immunosuppression in a Free-living Passerine](#)