Bulletin Board
MAY. 17, 2019

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CHEMWATCH

(click on page numbers for links)

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TECHNICAL NOTES

ASIA PACIFIC

Decabromodiphenyl Ether – final PEC assessment report

2019-05-09

The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) has assessed decabromodiphenyl ether (decaBDE) as a priority existing chemical (PEC) under the Commonwealth Industrial Chemicals (Notification and Assessment) Act, 1989 (the Act), as amended. The final assessment report for decaBDE (PEC Report No. 41) has been published and is now publicly available on the NICNAS website: Final assessment report for decaBDE (PEC Report No. 41) [Word 490 KB]

Obligations

Under section 64 of the Act, there is an ongoing requirement to provide any significant new data to NICNAS. This is set out in the secondary notification section of the final report. This obligation will remain when the new scheme (Australian Industrial Chemicals Introduction Scheme) commences on 1 July 2020. The publication of this report revokes the declaration of decaBDE as a priority existing chemical under Section 62 of the Act.

NICNAS Chemical Gazette, 7 May 2019

http://www.nicnas.gov.au/Publications/Chemical_Gazette

The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) has assessed decabromodiphenyl ether (decaBDE) as a priority existing chemical (PEC) under the Commonwealth Industrial Chemicals (Notification and Assessment) Act, 1989 (the Act), as amended.

Cancellation of Active Constituent Approval at the Request of the Holder

2019-05-09

The Australian Pesticide and Veterinary Medicine Authority has announced that at the request of the holder, it has cancelled the approval of some active constituents. The following active constituent(s) have been cancelled:

Active no.	Active name	Approval holder	Date of effect
52133	Azafenidin	Du Pont (Australia)	12 April 2019
44472	Bensulfuron-Methyl	Du Pont (Australia)	12 April 2019

Regulatory Update

Active no.	Active name	Approval holder	Date of effect
44052	Bensulfuron-Methyl	Du Pont (Australia)	12 April 2019
44068	Bromacil	Du Pont (Australia)	12 April 2019
46845	Chlorsulfuron	Du Pont (Australia)	12 April 2019
44477	Diuron	Du Pont (Australia)	12 April 2019
44476	Diuron	Du Pont (Australia)	12 April 2019
52626	Ethametsulfuron-Methyl	Du Pont (Australia)	12 April 2019
61457	Ethephon	Du Pont (Australia)	12 April 2019
52567	Ethephon Manufacturing Concentrate	Du Pont (Australia)	12 April 2019
44557	Ethephon Manufacturing Concentrate	Du Pont (Australia)	12 April 2019
64031	Fenarimol	Du Pont (Australia)	12 April 2019
48317	Fenarimol	Du Pont (Australia)	12 April 2019
44169	Fenarimol	Du Pont (Australia)	12 April 2019
44069	Flusilazole	Du Pont (Australia)	12 April 2019
48098	Hexazinone	Du Pont (Australia)	12 April 2019
44321	Hexazinone	Du Pont (Australia)	12 April 2019
44030	Methomyl	Du Pont (Australia)	12 April 2019
48126	Metsulfuron-Methyl	Du Pont (Australia)	12 April 2019
44100	Metsulfuron-Methyl	Du Pont (Australia)	12 April 2019
57022	Oxamyl	Du Pont (Australia)	12 April 2019

Regulatory Update

Active no.	Active name	Approval holder	Date of effect
54114	Oxamyl Manufacturing Concentrate	Du Pont (Australia)	12 April 2019
44098	Oxamyl Manufacturing Concentrate	Du Pont (Australia)	12 April 2019
49414	Rimsulfuron	Du Pont (Australia)	12 April 2019
62649	Terbacil	Du Pont (Australia)	12 April 2019
48125	Thifensulfuron-Methyl	Du Pont (Australia)	12 April 2019
44236	Thifensulfuron-Methyl	Du Pont (Australia)	12 April 2019

SUPPLY

A person may supply or cause to be supplied the cancelled active constituent(s) manufactured prior to 12 April 2019 at wholesale and retail level, until the 12 April 2020. After 12 April 2020 it will be an offence against the Agvet Codes to have possession or custody of the cancelled active constituent(s) with the intention to supply.

USE

A person may continue to use the cancelled active constituent(s) until 12 April 2020. Any person who possesses, has custody of, uses, or otherwise deals with the cancelled active constituent(s) in accordance with the above instructions is taken to have been issued with a permit under the Agvet Codes to so possess, have custody of, use or otherwise deal with the cancelled active constituent after the approval has been cancelled until 12 April 2020.

The supply and use of the cancelled active constituents(s) must be in accordance with the conditions of approval. It is an offence to possess, have custody of, use, or deal.

APVMA Gazette, 7 May 2019

http://www.apvma.gov.au

Regulatory Update

Submissions open on application to import new fungicide

2019-05-09

New Zealand's Environmental Protection Authority (EPA) is seeking comments on an application to import for release the fungicide, KUSABI, for the control of powdery mildew. The active ingredient in KUSABI - pyriofenone - is a new active ingredient to New Zealand. The applicant, ISK New Zealand Limited, wants to import KUSABI for use in the control of powdery mildew in grapes, apples and curcubits (a family of plants that include pumpkins, cucumber and courgettes). The fungicide would be applied using an airblast sprayer on grapes and apples, and by aerial or ground-based broadcast sprayer for curcubits. KUSABI is currently approved for similar uses in a number of other countries, including Australia, Canada and the United States. This application is being publicly notified to enable people to provide us with information they believe we should be aware of, such as beneficial or adverse effects additional to those the applicant has described. Submissions close on 18 June 2019 at 5pm. Further information is available at: Visit the submissions page for more information

NZ EPA, 7 May 2019

http://www.epa.govt.nz

New Zealand's Environmental Protection Authority (EPA) is seeking comments on an application to import for release the fungicide, KUSABI, for the control of powdery mildew.

Japan Adds 15 Priority Assessment Chemicals

2019-05-09

On 1 April 2019, 15 substances (given number 237~251) were designated as "priority assessment chemicals" (PACs) under the Chemical Substance Control Law (CSCL) according to Japan's Gazette. This brings the total number of PACs to 223 (some deleted or grouped under one single entry in the past years). Although both General Chemical Substances and PACs under Japan CSCL require annual reporting if they are manufactured or imported above 1 ton/year, more information is required for PACs. Manufacturers and importers of PACs need to report during the period from April to June each year the production and/or import volume in the previous calendar year, the use category, and the production site, etc. However, the 15 substances will still be reported the same as general chemicals in this year. In addition, PACs manufacturers and importers need

to inform customers if their products are PACs or if the products contain PACs. Further information is available at: Gazette on Apr 1st

Chemlinked, 30 April 2019

http://chemlinked.com/en/news

AMERICA

EPA to Hold First Meeting of the Science Advisory Committee on Chemicals

2019-05-09

The United States Environmental Protection Agency (EPA) announced it will hold the first meeting of the Science Advisory Committee on Chemicals (SACC) under the Toxic Substances Control Act (TSCA), as amended by the Frank R. Lautenberg Chemical Safety for the 21st Century Act (Lautenberg Act), for Pigment Violet 29 (PV29), the first chemical of the initial 10 chemicals undergoing review. "This will be an important opportunity for the science experts on this new committee to provide their scientific and technical advice to EPA," said EPA Office of Chemical Safety and Pollution Prevention Assistant Administrator Alexandra Dapolito Dunn. "This peer review ensures scientific rigor and enhances transparency of the risk evaluation process." The purpose of the June 18-21, 2019, SACC meeting is for EPA to get the independent review of the science underlying the PV29 risk assessment, including the hazard assessment, assessment of dose-response, exposure assessment, and risk characterisation. Additionally, this meeting will include an orientation on TSCA and how EPA is evaluating chemicals in commerce as prescribed in the Lautenberg Act. EPA will use the scientific advice, information and recommendations from the SACC, as well as public comments, to inform the final risk evaluation. The public has an opportunity to provide comments before and during the meeting. In March 2019, EPA re-opened the public comment period on the draft risk evaluation. The public has from 17 April 2019 until 17 May 2019 to provide comments in docket EPA-HQ-OPPT-2018-0604 on www.regulations.gov. This peer review meeting was rescheduled from an earlier meeting that was previously cancelled due to the lapse in appropriations. Further information is available at: https://www.epa.gov/tsca-peer-review/members-science-advisory-

committee-chemicals and https://www.epa.gov/tsca-peer-review/peer-review-draft-risk-evaluation-pigment-violet-29.

U.S EPA, 8 May 2019

http://www.epa.gov

EPA Releases Proposed Interim Registration Review Decision for Glyphosate; ATSDR Announces Availability of Draft Toxicological Profile For Glyphosate

2019-05-09

On 6 May 2019, the United States Environmental Protection Agency (EPA) announced it was releasing its Proposed Interim Registration Review Decision (PID) for glyphosate acid and its various salt forms. 84 Fed. Reg. 19782. In the PID, EPA states that it "did not identify any human health risks from exposure to any use of glyphosate" but did identify "potential risk to mammals and birds" within the application area or areas near the application area and "potential risk to terrestrial and aquatic plants from off-site spray drift, consistent with glyphosate's use as a herbicide." Even with these potential risks, the PID states that "EPA concludes that the benefits outweigh the potential ecological risks when glyphosate is used according to label directions" and proposes certain risk mitigation strategies including:

- "To reduce off-site spray drift to non-target organisms, the EPA is proposing certain spray drift management measures" with specific spray drift mitigation language to be included on all glyphosate product labels for products applied by liquid spray application;
- "To preserve glyphosate as a viable tool for growers and combat weed resistance, the EPA is … proposing that herbicide resistance management language be added to all glyphosate labels" and to require measures "for the pesticide registrants to provide growers and users with detailed information and recommendations to slow the development and spread of herbicide resistant weeds";
- Inclusion on labels of a non-target organism advisory statement to alert users of potential impact to non-target organisms; and
- "EPA is also proposing certain labelling clean-up/consistency efforts to bring all glyphosate labels up to modern standards."

EPA states that these measures were discussed with glyphosate registrants, who do not oppose the proposed risk mitigation measures outlined in the PID. The public can submit comments on EPA's proposed decision

On 6 May 2019, the United States Environmental Protection Agency (EPA) announced it was releasing its Proposed Interim Registration Review Decision (PID) for glyphosate acid and its various salt forms.

at www.regulations.gov in Docket Number EPA-HQ-OPP-2009-0361. Public comments are due by 5 July 2019. In addition to the PID, EPA is also posting to the glyphosate docket EPA's response to comments on glyphosate's usage and benefits (dated 18 April 2018), EPA's response to comments on the human health risk assessment (dated 23 April 2019), and EPA's response to comments on the preliminary ecological risk assessment (dated 21 November 21). This PID was issued shortly after the Agency for Toxic Substances and Disease Registry's announcement on April 8, 2019, of the opening of a docket on the draft toxicological profile for glyphosate. 84 Fed. Reg. 13922. ATSDR seeks comments and additional information or reports on studies about the health effects of glyphosate for review and potential inclusion in the profile. Comments are due by 8 July 2019.

Commentary

EPA's PID and related documents, along with ATSDR's draft profile and the peer review which will follow, can be expected to become part of the larger debate about the potential risks of glyphosate. In 2017, EPA evaluated the carcinogenic risk of glyphosate, and released its draft human health and ecological risk assessments. EPA's PID is interesting not only for the conclusions EPA reached following its review of data submitted by registrants in response to a data call-in (DCI) and following the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Scientific Advisory Panel's (SAP) meeting to consider and review scientific issues related to EPA's evaluation of the carcinogenic potential of glyphosate, but for the issues that remain to be addressed. Notably, EPA states that it has not considered the petition filed on 27 September 2018, to reduce glyphosate's tolerance because the petition was filed after the comment period for the human health and ecological risk assessments closed. Instead, EPA plans to post the petition in the glyphosate docket and address the petition concurrently with the development of the Interim Registration Review Decision. In addition, EPA has not in the PID or related documents addressed issues regarding its Endangered Species Act (ESA) assessment or its Endocrine Disruptor Screening Program (EDSP) activities. EPA states it intends to complete an assessment of risk to ESA-listed species prior to completing its final registration review decision for glyphosate, and that it also will make an EDSP determination under Federal Food, Drug, and Cosmetic Act (FFDCA) Section 408(p) before completing its registration review. EPA also notes that it continues to evaluate risks to pollinators, and that if it determines "that additional pollinator exposure and effects data are necessary to help make a final registration review decision for glyphosate, then the EPA will issue a DCI to

obtain these data." Although there are significant areas that remain to be resolved, EPA issued the PID "so that it can (1) move forward with aspects of the registration review case that are complete and (2) implement interim risk mitigation."

National Law Review, 8 May 2019

http://www.natlawreview.com

Governments endorse global PFOA ban, with some exemptions

2019-05-09

More than 180 countries agreed 3 May to ban production and use of perfluorooctanoic acid (PFOA), its salts, and PFOA-related compounds under the international Stockholm Convention on Persistent Organic Pollutants (POPs). The International Agency for Research on Cancer considers PFOA possibly carcinogenic to humans. Exposure to the substance is also linked to hormonal disruption. At a meeting of Stockholm Convention treaty partners in Geneva, governments carved out exemptions that allow some applications of PFOA to continue, including use in fire-fighting foams—a practice that has contaminated groundwater in many areas around the globe. Tons of these foams are in storage, at the ready to help first responders douse petroleum-fuelled fires. Some of these foams also contain another fluorochemical, perfluorooctanesulfonic acid (PFOS), which has been tightly restricted but not banned under the Stockholm Convention for a decade. At their recent meeting, treaty partners agreed to ban the use of firefighting foams containing PFOA or PFOS in training exercises and to prohibit the production, import, or export of foams with either or both chemicals. The chemical industry group FluoroCouncil has pushed for a transition away from PFOA to modern fluorinated chemicals that have "enhanced human health and environmental profiles," says Jessica Bowman, the organisation's executive director. "Listing PFOA under the Stockholm Convention with minimal exemptions will help further this transition globally." Governments created an exemption for use of a PFOA-related chemical used to produce pharmaceuticals, says Pamela Miller, cochair of a coalition of public interest groups, the International POPs Elimination Network. The substance is perfluorooctyl iodide, which can degrade to PFOA. It is used to produce perfluorooctyl bromide, which is a processing aid in making some pharmaceuticals. Although the exemption for perfluorooctyl iodide will expire no later than 2036, treaty partners will review it and could potentially eliminate it before then, Miller tells C&EN. Treaty partners also

A widely used industrial fluorochemical that is linked to cancer and pollutes drinking water around the world is on its way to a global phaseout.

gave global, five-year exemptions for PFOA and its chemical cousins used in semiconductor manufacturing, worker-protection textiles, medical devices, and photographic coatings on films. They granted additional PFOA exemptions to China, the European Union, and Iran for PFOA use in production of fluoropolymers, medical textiles, and electrical wires. In addition, governments reduced the number of uses allowed for PFOS, its salts, and a related compound, perfluorooctane sulfonyl fluoride, under the Stockholm Convention. They eliminated exemptions for these substances in aviation hydraulic fluid and other specialty applications. However, they allowed use of the pesticide sulfluramid, which degrades into PFOS, to continue with no deadline for phaseout. Applied to control leaf-cutting ants, the insecticide is made in Brazil and used across Latin America and the Caribbean, causing PFOS pollution. "The continued use of sulfluramid in agriculture with no time limit protects Brazilian chemical companies, not human health and the environment," said Fernando Bejarano of the International POPs Elimination Network Hub for Latin America and the Caribbean. The US has signed the Stockholm Convention and attends negotiations related to the pact, but it is not an official treaty partner.

Chemical & Engineering News, 6 May 2019

http://pubs.acs.org/cen/news

OEHHA Publishes Prop 65 Definition of Nickel (Soluble Compounds)

2019-05-09

On 2 May 2019, California's Office of Environmental Health Hazard Assessment (OEHHA) published a definition of nickel (soluble compounds) for the purposes of Proposition 65 (Prop 65).

On 2 May 2019, California's Office of Environmental Health Hazard Assessment (OEHHA) published a definition of nickel (soluble compounds) for the purposes of Proposition 65 (Prop 65). Under the notice, nickel (soluble compounds) are defined to be compounds of nickel with solubility in water of greater than 0.1 moles per litre (mol/L) at 20°C. OEHHA states that this definition is consistent both with the discussion by the Developmental and Reproductive Toxicant Identification Committee (DARTIC) that led to the listing of nickel (soluble compounds) and OEHHA's prior definition of soluble nickel compounds in the 2012 document, "Nickel Reference Exposure Levels: Nickel and Nickel Compounds. Nickel Oxide. Reference Exposure Levels (RELs)." As reported in the 29 October 2018, memorandum, "California Lists Nickel (Soluble Compounds) on Prop 65 as Known to Cause Reproductive Toxicity," OEHHA added nickel (soluble compounds) to the Prop 65 list of chemicals known to the state to cause reproductive toxicity on October 26, 2018. At that time, it did not define

"soluble." The listing of nickel (soluble compounds) means that warning requirements will apply in one year, or as of 26 October 2019.

Background

OEHHA announced on 27 July 2018, the availability for public review of the hazard identification document entitled "Evidence on the Developmental and Reproductive Toxicity of Nickel and Nickel Compounds." DARTIC considered this document in making its listing decision at its 11 October 2018, meeting. In preparing the hazard identification document, OEHHA issued a request for information relevant to the assessment of the evidence of developmental and male and female reproductive toxicity for nickel and nickel compounds. The data call-in (DCI) period for nickel and nickel compounds opened on 19 February 2016, and closed on 4 April 2016. OEHHA considered information received from the DCI in preparing the hazard identification document. After completing the hazard identification document, OEHHA sent additional studies to DARTIC members. Comments on the hazard identification document that were timely filed were provided to DARTIC in advance of the meeting. The 11 September 2018, comments submitted by NiPERA, Inc. seem to align with OEHHA's decision. According to the comments, "the Prop 65 listing of soluble nickel compounds based on rodent developmental effects is warranted, with the most sensitive effect being perinatal mortality." Soluble nickel compounds reflect the highest bioavailability.

Commentary

Prior to listing nickel (soluble compounds), OEHHA had several distinct listings for nickel: nickel (metallic), nickel acetate, nickel carbonate, nickel carbonyl, nickel compounds, nickel hydroxide, nickelocene, nickel oxide, nickel refinery dust from the pyrometallurgical process, and nickel subsulfide Almost immediately following the listing of nickel (soluble compounds), industry sought guidance from OEHHA as to the exact compounds that would be affected by this new listing, given the ubiquity of nickel in a wide range of products and the variability of solubility. OEHHA's definition does not provide a specific list of compounds or identifiers such as Chemical Abstracts Service Registry Numbers that stakeholders may have preferred. The definition is quite specific, however, and should assist industry in clarifying the scope of the listing.

National Law Review, 7 May 2019

http://www.natlawreview.com

Regulatory Update

NIOSH Issues New Skin Notation Profiles and Invites Public Input

2019-05-09

Earlier this year, the National Institute for Occupational Safety and Health (NIOSH) issued skin notation profiles for five chemicals: atrazine, catechol, chlorinated camphene, pentachlorophenol and sodium fluoroacetate. Chemical skin exposures that cause systemic, direct, and sensitising effects are designated with skin notations. Skin notation profiles summarise the data that support skin notation designation. The herbicide atrazine and sodium fluoroacetate, a chemical that has been used to prevent coyotes from preying on farm animals, have both been assigned the "SK notation ID$^{(SK)}$", indicating that the chemicals have been evaluated, but insufficient data exist to accurately assess the hazards of skin exposure. Catechol, used primarily as an antioxidant in rubber, dye fat and oil industries, and is used in pesticides, pharmaceutical ingredients and aroma chemicals is given "SK: SYS-DIR(IRR)-SEN", indicating acute toxicity, skin irritancy and depigmentation, and skin allergy. The Environmental Protection Agency (EPA) banned chlorinated camphene in 1990, which was used as an insecticide. NIOSH assigned chlorinated camphene "SK: SYS-DIR (IRR)" for systemic effects and skin irritation. One of the most widely used wood preservatives, pentachlorophenol (PCP), has "SK: SYS (FATAL)-DIR (IRR)" allocated for metabolic effects, fever, immunotoxicity and skin irritation and tumour promotion.

Earlier this year, the National Institute for Occupational Safety and Health (NIOSH) issued skin notation profiles for five chemicals: atrazine, catechol, chlorinated camphene, pentachlorophenol and sodium fluoroacetate.

Draft Profiles for Public Comment

In March, NIOSH published a Federal Register notice requesting technical reviews of 10 draft skin notation profile documents. NIOSH would like feedback on whether the documents support the systemic, direct and sensitising effects caused by exposure of skin to the chemicals. The chemicals are:

- Cyclohexanol
- Cyclohexanone
- Cyclonite
- Diacetyl and 2,3-Pentanedione
- Diethylenetriamine
- beta-Chloroprene
- Chlorodiphenyl 42% Chlorine
- Chlorodiphenyl 54% Chlorine

- Dioxane
- 2,4-Toluene diisocyanate, 2,6-Toluene diisocyanate, and the mixture of 2,4- and 2,6-Toluene diisocyanate

Comments are being accepted until 14 May 2019.

Further information is available at: New Skin Notation Profiles https://www.cdc.gov/niosh/topics/skin/skin-notation_profiles.html

Product Supply Chain Intelligence, 7 May 2019

https://psi.ul.com/en/resources/

EUROPE

Bees and pesticides: stakeholders to participate in guidance review

2019-05-09

The European Food Safety Authority (EFSA) is setting up a stakeholder consultative group to support its upcoming review of the guidance on risk assessment of pesticides and bees.

The European Food Safety Authority (EFSA) is setting up a stakeholder consultative group to support its upcoming review of the guidance on risk assessment of pesticides and bees. The group will be consulted at various stages during the review and provide input to the EFSA scientific working group charged with revising the document. Nominations for membership of the stakeholder group will be accepted from registered EFSA stakeholder organisations as well as non-registered bodies with an interest in the area of bee health. More information here. EFSA is revising the guidance, which was published in 2013, on request from the European Commission. A number of Member States have asked for sections of the document to be updated. In addition, new evidence has become available since the original guidance was published. As well as involving stakeholders throughout the process, pesticide experts from Member States will be consulted via EFSA's Pesticides Steering Network. A public consultation and workshop will take place when the document has been drafted. The Commission has asked that the review should focus on:

- Evidence on bee background mortality, taking account of realistic beekeeping management and natural background mortality.
- Exposure routes, particularly through spray application and seed treatment or granular application.
- The list of bee-attractive crops.
- The methodology with regard to higher tier testing.

EFSA will publish an outline of how it plans to address the mandate – including timelines and details of the various consultations – within the next two months. The guidance is expected to be finalised in 2021. Further information is available at: Call to EFSA stakeholder organisations for nominating stakeholder experts to the*ad hoc* EFSA Bee Guidance Stakeholder Consultation Group

EFSA, 8 May 2019

http://www.efsa.europa.eu

Germany Announces Research Project to Establish Criteria for Assessment of the Human Health and Environmental Risks of Novel (Nano) Materials

2019-05-09

On 29 April 2019, the German Federal Institute for Risk Assessment (BfR) announced InnoMat.Life, a joint research project to establish criteria for an efficient assessment of the human health and environmental risks of novel (nano) materials. The Federal Ministry of Education and Research is providing 2.22 million euro to fund the project, which will be coordinated by BfR and includes ten partners from public authorities, academia, and industry. BfR states that until now, nanosafety research focused mainly on first generation nanomaterials, *i.e.*, mainly round particles of pure substances such as nanosilver, titanium oxide, and zinc oxide. In real life, far more materials are used, however. Hybrid materials, consisting of two or more substances, are often applied, and nanoparticles can have many different shapes. Many industrially used materials cover a broad size distribution from nanometres to micrometres. Moreover, according to BfR, many industrial applications are based on material systems that alter their structure during manufacturing or use, such as the layer-by-layer assembly of products manufactured with 3D printers. InnoMat.Life expands the research focus and addresses new material classes, including materials with a broad particle size distribution, such as metals and polymer powders for 3D printing, as well as materials with other shapes and sizes, such as rods, platelets, and fibres. A third focus area comprises hybrid materials made from two or more substances. According to BfR, one of the main goals of InnoMat.Life is to establish criteria catalogues such that novel materials can be grouped together with regard to their hazard potential. This will be done also considering exposure potential

for humans and the environment. The project takes into account the full material life cycle, from synthesis to disposal.

National Law Review, 7 May 2019

http://www.natlawreview.com

INTERNATIONAL

OECD Chemical Safety and Biosafety Progress Report Includes Update on Work Regarding Manufactured Nanomaterials

2019-05-09

The Organisation for Economic Cooperation and Development's (OECD) April 2019 issue of its Chemical Safety and Biosafety Progress Report includes an update on OECD's work to determine the safety of manufactured nanomaterials. The Report notes that the applicability of OECD Test Guidelines for nanomaterials continues to be a major concern of the work of the Working Party on Manufactured Nanomaterials (WPMN). WPMN agreed to work on three new projects related to testing manufactured nanomaterials and addressing:

(1) the determination of concentrations of nanoparticles in biological samples for (eco)toxicity studies;

(2) the determination of dissolution rates of nanomaterials in environmental media (dynamic method); and

(3) supplementary guidance for the use of Test Guidelines 201, 202, and 203 for the determination of the ecotoxicity of manufactured nanomaterials.

Work will continue to complete the compilation of information on biopersistent/biodurable manufactured nanomaterials, as well as on the development of a project proposal to address the toxicokinetics of manufactured nanomaterials. In addition, the WPMN identified a number of issues relevant for the development of all the Test Guidelines for nanomaterials (*i.e.*, updating the *Guidance on Sample Preparation and Dosimetry* and the section on nanomaterials in the *Guidance on Grouping*). The Report states that the objective of WPMN's work on exposure measurement and exposure mitigation is to exchange information on (or

The Organisation for Economic Cooperation and Development's (OECD) April 2019 issue of its Chemical Safety and Biosafety Progress Report includes an update on OECD's work to determine the safety of manufactured nanomaterials.

develop) guidance for exposure measurement and mitigation. WPMN is working on three complementary projects:

(1) assessing the global readiness of regulatory and non-regulatory models for assessing occupational exposure to manufactured nanomaterials;

(2) compilation of available tools and models used for assessing consumer exposure to manufactured nanomaterials; and

(3) compilation of available tools and models used for assessing environmental exposure to manufactured nanomaterials.

These projects aim to evaluate the performance of available exposure models to estimate nanomaterial exposure for three target population groups: workers, consumers, and the environment. To conduct the evaluations of the models, WPMN "is collecting/generating exposure data in a structured format." At WPMN's February 2019 meeting, it discussed ways to structure the exposure data so that they can be collected by existing OECD Harmonised Templates for Reporting Chemical Test Summaries (OHT), as well as potential areas of work to be considered in collaboration with the Working Party on Exposure Assessment. According to the Report, WPMN continues to implement the project "Moving towards a 'Safer Innovation Approach' for more sustainable NMs and nano-enabled products: Overview of existing risk assessment tools and frameworks, and their applicability in industrial settings" led by France, the Netherlands, and Business at OECD (BIAC). The Report states that WPMN expects that the outcomes of this project can further the knowledge to anticipate regulatory challenges posed by innovations, in this case from nanomaterials and nano-enabled products. The Report lists the upcoming following workshops and meetings regarding nanomaterials:

- 10-12 September 2019, Workshop on Advancing Adverse Outcome Pathways Development for Nanomaterial Risk Assessment and Categorisation (NanoAOP);
- 16-18 December 2019, WPMN Roadmap Program of Work (and back-to-back meetings for the projects); and
- 16-19 June 2020, WPMN 20th Meeting.

Further information is available at: Comments

Nano & Other Emerging Technologies Blog, 3 May 2019

REACH Update

Intention to restrict oxo-degradable plastics withdrawn

2019-05-10

On 8 May 2019, the European Chemicals Agency (ECHA) withdrew the intention to investigate the need for a restriction on oxo-degradable plastics. The withdrawal comes after a Commission request following the adoption of the directive on the reduction of the impact of certain plastic products on the environment. The new legislation restricts the placing on the EU market of any product made from oxo-degradable plastics two years after the directive enters into force. Further information is available at: Registry of restriction intentions

ECHA News, 8 May 2019

http://echa.europa.eu

Public consultation on harmonised classification and labelling

2019-05-10

The European Chemicals Agency (ECHA) is seeking comments on 3 new harmonised classification and labelling proposals. The harmonised classification and labelling proposals are for:

- 2-(2-methoxyethoxy)ethanol (EC 203-906-6; CAS 111-77-3);
- pyridine-2-thiol 1-oxide, sodium salt; pyrithione sodium; sodium pyrithione (EC 223-296-5, 240-062-8; CAS 3811-73-2 15922-78-8). It is an active substance mainly used in biocidal products as a preservative and disinfectant; and
- methyl methacrylate methyl 2-methylprop-2-enoate; methyl 2-methylpropenoate (EC 201-297-1, CAS 80-62-6).

The deadline for comments is 5 June 2019.

Information about submitting a comment is available at: Give comments

ECHA News, 8 May 2019

http://echa.europa.eu

On 8 May 2019, the European Chemicals Agency (ECHA) withdrew the intention to investigate the need for a restriction on oxo-degradable plastics.

REACH Update

New proposals and intentions to harmonise classification and labelling

2019-05-10

Four new intentions and 3 proposal to harmonise classification and labelling have been submitted. The proposals have been received for:

- 4,4'-[2,2,2-trifluoro-1-(trifluoromethyl)ethylidene]diphenol (EC 216-036-7, CAS 1478-61-1) by Sweden;
- hydrogen sulphide (EC 231-977-3, CAS 1478-61-1) and benzyl alcohol (EC 202-859-9, CAS 100-51-6) by Germany; and
- 1-phenylethan-1-one (1-phenylethylidene)hydrazone (EC 211-979-0, CAS 729-43-1) by France.

Three proposals to harmonise classification and labelling have been submitted for:

- barium diboron tetraoxide (EC 237-222-4, CAS 13701-59-2) by Sweden;
- cumene (EC 202-704-5, CAS 98-82-8) by Denmark; and
- benfluralin (EC 217-465-2, CAS 1861-40-1) by Norway.

A proposal to harmonise the classification and labelling has been withdrawn for:

- tritosulfuron (ISO) (containing ≤ 0.02 % 2-amino-4-methoxy-6-(trifluormethyl)-1,3,5-triazine); 1-[4-methoxy-6-(trifluoromethyl)-1,3,5-triazin-2-yl]-3-[2-(trifluoromethyl)benzenesulfonyl]urea (containing ≤ 0.02 % 2-amino-4-methoxy-6-(trifluormethyl)-1,3,5-triazine) (EC 604-291-0, CAS 142469-14-5) by Slovenia.

Further information is available at: Registry of CLH intentions

Four new intentions and 3 proposal to harmonise classification and labelling have been submitted.

ECHA News, 8 May 2019

http://echa.europa.eu

Webinar: Using the IUCLID web interface for biocides submissions

2019-05-10

The European Chemicals Agency (ECHA) have announced that it will be holding a webinar on the IUCLID web interface improvements and functionalities for biocides submissions on 15 May 2019 11:00–12:00 Helsinki time. The webinar will, provide information about the latest IUCLID web interface improvements and functionalities for biocides submissions. ECHA will cover features such as the creation and navigation

REACH Update

of a BPR dossier, the comparison tool, and the report generator. To register, go to: Register

ECHA News, 8 May 2019

http://echa.europa.eu

PACT updated with 1 new intention for RMOA

2019-05-09

On 3 May 2019, the European Chemicals Agency's (ECHA) Public Activities Coordination Tool (PACT) was updated with the following new intention for Risk Management Option Analysis (RMOA):

- Chromium trioxide

Yorda's Hive, 3 May 2019

https://www.yordasgroup.com/hive/news

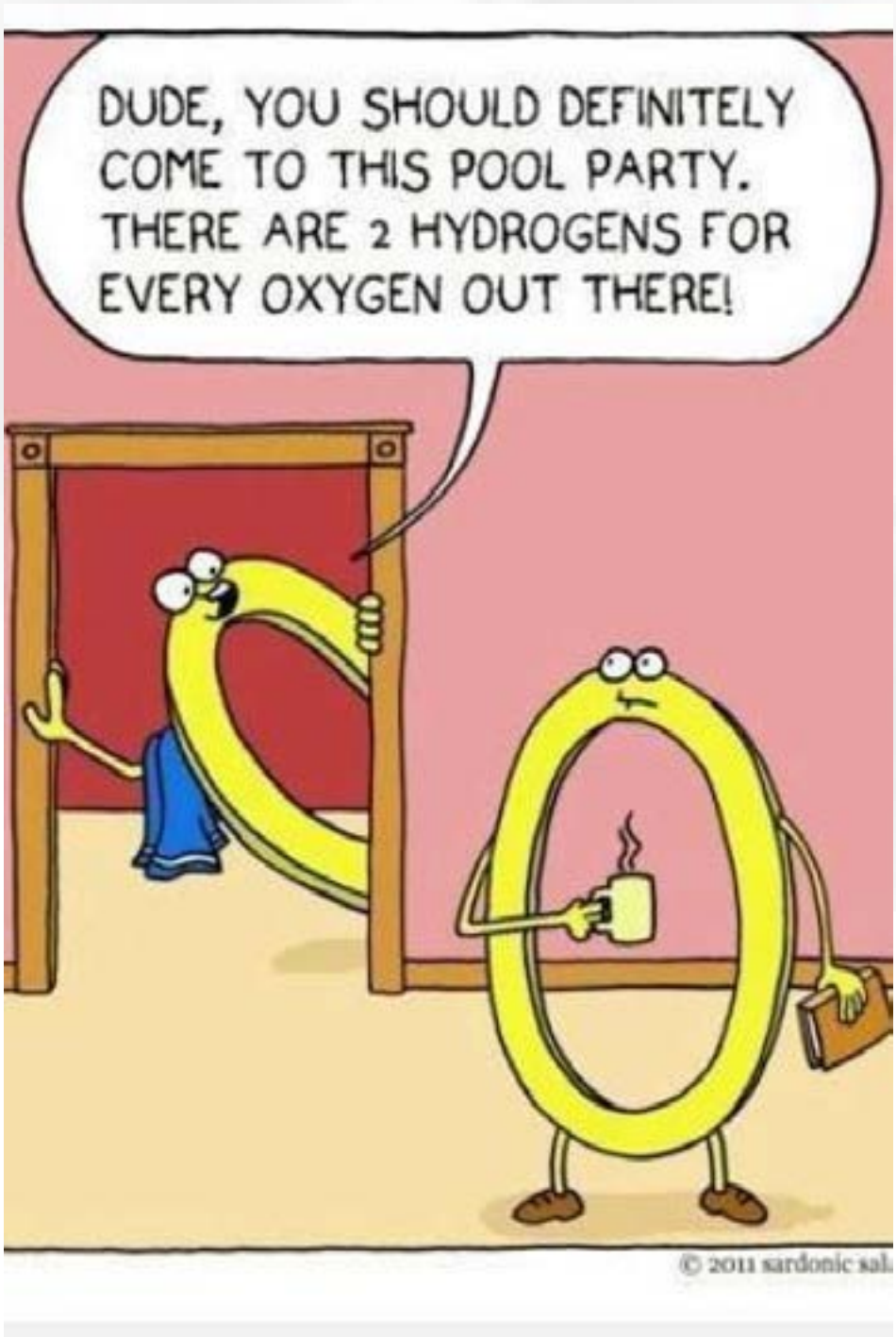
On 3 May 2019, the European Chemicals Agency's (ECHA) Public Activities Coordination Tool (PACT) was updated

Janet's Corner

CHEMWATCH

Pool Party

2019-05-10



Hazard Alert

Chloroform

2019-04-23

Chloroform is an organic compound with formula $CHCl_3$. It is one of the four chloromethanes. The colourless, sweet-smelling, dense liquid is a trihalomethane, and is considered hazardous. [1]

Chloroform is slightly soluble in water. It is miscible with alcohol, benzene, petroleum ether, carbon tetrachloride, carbon disulfide and oils. Chloroform reacts vigorously with strong caustics, strong oxidants, chemically active metals such as aluminium, lithium, magnesium, sodium or potassium, and acetone, causing fire and explosion hazards. It can attack plastic, rubber and coatings. Chloroform decomposes slowly under the influence of light and air. It also decomposes on contact with hot surfaces, flames or fire, forming irritating and toxic fumes, which consist of hydrogen chloride, phosgene and chlorine. [2]

USES [2]

Chloroform is primarily used in the production of refrigerants (e.g. chlorofluorocarbon (CFC)-22, fluorocarbon-22), in the production of plastics (especially vinyl chloride) and in the manufacture of other chemicals. Chloroform is used as an extraction solvent for fats, oils, greases, rubber, waxes, gutta-percha, resins, lacquers, floor polishes, artificial silk manufacture, gums and adhesives. It is utilised as an industrial solvent in the extraction and purification of some antibiotics, alkaloids, vitamins and flavours. It is used as a solvent in organic chemistry, in photography and in making dyes, drugs and pesticides. Other uses are as a dry cleaning agent to remove spots, as a fumigant and in fire extinguishers to lower the freezing temperature of carbon tetrachloride. Chloroform formulated with other ingredients is used to control screw worm in animals. Chloroform is steadily being replaced by less toxic solvents and may no longer be used in some of these applications. Its use as an inhaled anaesthetic during surgery has already been largely discontinued.

Chloroform is an organic compound with formula CHCl3.

SOURCES OF EMISSION & ROUTES OF EXPOSURE

Sources of Emission [2]

- Industry sources: Chloroform may enter the environment from a number of sources, including industrial effluent, municipal waste treatment plant discharges, hazardous waste sites, sanitary landfills and spills.

- Diffuse sources: Chloroform can be formed as a result of the chlorination of naturally occurring organic materials found in raw water supplies. Hence, water treated with chlorine (drinking water, swimming pool) may be contaminated with trace amounts of chloroform.
- Natural sources: There are no natural sources for chloroform.
- Transport sources: There are no mobile sources for chloroform.
- Consumer products: There are no consumer products that contain chloroform.

Routes of Exposure [3]

- Drinking water or beverages made using water containing chloroform.
- Breathing indoor or outdoor air containing it, especially in the workplace.
- Eating food that contains it.
- Skin contact with chloroform or water that contains it, such as in swimming pools.

HEALTH EFFECTS [4]

Acute Effects

- The major effect from acute inhalation exposure to chloroform in humans is central nervous system depression. At very high levels (40,000 ppm), chloroform exposure may result in death, with concentrations in the range of 1,500 to 30,000 ppm producing anaesthesia, and lower concentrations (<1,500 ppm) resulting in dizziness, headache, tiredness, and other effects.
- Effects noted in humans exposed to chloroform via anaesthesia include changes in respiratory rate, cardiac effects, gastrointestinal effects, such as nausea and vomiting, and effects on the liver and kidney. Chloroform is not currently used as a surgical anaesthetic.
- In humans, a fatal oral dose of chloroform may be as low as 10 mL (14.8 g), with death due to respiratory or cardiac arrest.
- Tests involving acute exposure of animals have shown chloroform to have low acute toxicity from inhalation exposure and moderate acute toxicity from oral exposure.

Chronic Effects

- Chronic exposure to chloroform by inhalation in humans is associated with effects on the liver, including hepatitis and jaundice, and central nervous system effects, such as depression and irritability.
- Inhalation exposures of animals have also resulted in effects on the kidney.
- Chronic oral exposure to chloroform in humans has resulted in effects on the blood, liver, and kidney.
- EPA has not established a Reference Concentration (RfC) for chloroform.
- The California Environmental Protection Agency (CalEPA) has established a chronic reference exposure level of 0.3 milligrams per cubic metre (mg/m3) for chloroform based on exposures resulting in kidney and liver effects in rats.
- ATSDR has established an acute inhalation minimal risk level (MRL) of 0.5 mg/m3 (0.1 ppm) based on exposures resulting in liver effects in mice, an intermediate inhalation MRL of 0.2 mg/m3 (0.05 ppm) based on worker exposures resulting in liver effects in humans, and a chronic inhalation MRL of 0.1 mg/m3 (0.02 ppm) also based on liver effects in humans.
- The Reference Dose (RfD) for chloroform is 0.01 milligrams per kilogram per day (mg/kg/d) based on exposures resulting in fatty cyst formation in the livers of dogs.

Reproductive/Developmental Effects

- Little information is available on the reproductive or developmental effects of chloroform in humans, via any route of exposure. A possible association between certain birth outcomes (e.g., low birth weight, cleft palate) and consumption of contaminated drinking water was reported. However, because multiple contaminants were present, the role of chloroform is unclear.
- Animal studies have demonstrated developmental effects, such as decreased foetal body weight, foetal resorptions, and malformations in the offspring of animals exposed to chloroform via inhalation.
- Reproductive effects, such as decreased conception rates, decreased ability to maintain pregnancy, and an increase in the percentage of abnormal sperm were observed in animals exposed to chloroform through inhalation.

- Animal studies have noted decreased foetal weight, increased foetal resorptions, but no evidence of birth defects, in animals orally exposed to chloroform.

Cancer Risk

- No information is available regarding cancer in humans or animals after inhalation exposure to chloroform.
- Epidemiologic studies suggest an association between cancer of the large intestine, rectum, and/or bladder and the constituents of chlorinated drinking water, including chloroform. However, there are no epidemiologic studies of water containing only chloroform.
- Chloroform has been shown to be carcinogenic in animals after oral exposure, resulting in an increase in kidney and liver tumours.
- EPA considers chloroform to be a probable human carcinogen and has ranked it in EPA's Group B2.
- EPA has determined that although chloroform is likely to be carcinogenic to humans by all routes of exposure under high-exposure conditions that lead to cell death and regrowth in susceptible tissues, chloroform is not likely to cause cancer in humans by any route of exposure under exposure conditions that do not cause cell death and regrowth. Therefore, EPA has not derived either an oral carcinogenic potency slope or an inhalation unit risk for chloroform.

SAFETY [5]

First Aid Measures

- 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. WARM water MUST 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. 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 physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Exposure Controls & Personal Protection

Engineering Controls

- Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the workstation location.

Personal Protective Equipment

The following personal protective equipment is recommended when handling chloroform:

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

Personal Protection in Case of a Large Spill:

- Splash goggles;
- Full suit;
- Vapour respirator;
- Boots;
- Gloves;
- A self-contained breathing apparatus should be used to avoid inhalation of the product.

*Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

REGULATION

United States [6]

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

- General Industry: 29 CFR 1910.1000 Table Z-1 - 50 ppm, 240 mg/m3 Ceiling;
- Construction Industry: 29 CFR 1926.55 Appendix A - 50 ppm, 240 mg/m3 Ceiling;
- Maritime: 29 CFR 1915.1000 Table Z-Shipyards - 50 ppm, 240 mg/m3 TWA

ACGIH: The American Conference of Governmental Industrial Hygienists (ACGIH) has set a Threshold Limit Value (TLV) for chloroform of 10 ppm, 49mg/m3 TWA; Appendix A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans

NIOSH: The National Institute for Occupational Safety and Health (NIOSH) has set a Recommended Exposure Limit (REL)for chloroform of 2 ppm, 9.78mg/m3 STEL (60 Minutes); Appendix A - NIOSH Potential Occupational Carcinogens

Australia [7]

Safe Work Australia: Safe Work Australia has established a time weighted average (TWA) concentration of chloroform of 2ppm or 10mg/m3 for a 40 hour work-week.

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Gossip

Harnessing microorganisms for smart microsystems

2019-04-24

A research team at the Department of Mechanical Engineering at Toyohashi University of Technology has developed a method to construct a biohybrid system that incorporates Vorticella microorganisms. The method allows movable structures to be formed in a microchannel and combined with Vorticella. In addition, the biohybrid system demonstrates the conversion of motion from linear motion to rotation. The results of their research was published in the IEEE/ASME Journal of Microelectromechanical Systems. Complex control systems are required for the operation of smart microsystems, and their sizes should be reduced. Cells are expected to be applicable as alternatives to these complex control systems. Because a cell integrates many functions in its body and responds to its surrounding environment, cells are intelligent and can be used in smart micromechanical systems. In particular, Vorticella convallaria has a stalk (approximately 100 μm in length) that contracts and relaxes, and it works as an autonomous linear actuator. The combination of stalks and movable structures will form an autonomous microsystem. However, the construction of biohybrid systems in a microchannel is difficult, as it is necessary to establish a cell patterning method and a biocompatible assembly process for the structure and cell. The research group has developed a method to construct a biohybrid system that incorporates Vorticella. "Harnessing microorganisms requires that a batch assembly method be applied to the movable components in a microchannel. It is necessary to pattern a water-soluble sacrificial layer and confine the movable components in a microchannel," says Moeto Nagai, a lecturer at Toyohashi University of Technology and the leader of the research team. Vorticella cells were placed around blocks in the channel by applying magnetic force. These processes were applied to demonstrate how Vorticella converts the motion of a movable component. "The concept of harnessing a component to a microorganism seems simple, but it is difficult for even a microfabrication expert to make harnesses that can follow the motions of microorganisms. Hazardous chemicals should be avoided, and a multidisciplinary approach should be taken," says Nagai. His group is familiar with microfabrication and has conducted considerable research in the field of microbiology. They found a biocompatible approach for making and releasing harnesses in a microchannel. After permeabilised treatment, Vorticella stalks respond to changes in calcium ion concentration, and they can operate as calcium ion-responsive valves. The research team believes that calcium ion-sensitive motors of Vorticella will facilitate the realisation of autonomous fluidic valves, regulators, and

Vorticella autonomously converts its linear motion to rotation

mixers, as well as wearable smart microsystems, such as an automated insulin infusion pump for diabetes.

EurekAlert, 12 April 2019

http://www.eurekalert.org

New smart material works better under pressure

2019-04-24

Advanced robotics sensitive touch or next-generation wearable devices with sophisticated sensing capabilities could soon be possible following the development of a rubber that combines flexibility with high electrical conductivity. The new smart composite material, developed by researchers at the University of Wollongong's (UOW) Faculty of Engineering and Information Sciences, shows properties that have not previously been observed: it increases in electrical conductivity as it is deformed, especially when elongated. Elastic materials, such as rubbers, are sought after in robotics and wearable technology because they are inherently flexible, and can be easily modified to suit a particular need. To make them electrically conductive, a conductive filler, such as iron particles, is added to form a composite material. The challenge for researchers has been finding a combination of materials to produce a composite that overcomes the competing functions of flexibility and conductivity. Typically, as a composite material is stretched, its ability to conduct electricity decreases as the conductive filler particles separate. Yet, for the emerging sphere of robotics and wearable devices, being able to be bent, compressed, stretched or twisted while retaining conductivity is a vital requirement. Led by Senior Professor Weihua Li and Vice-Chancellor's Postdoctoral Fellow Dr. Shiyang Tang, the UOW researchers have developed a material that throws out the rule book on the relationship between mechanical strain and electrical conductivity. Using liquid metal and metallic microparticles as a conductive filler, they discovered a composite that increases its conductivity the more strain placed on it – a discovery that not only opens up new possibilities in applications, it also came about in an unexpected way. Dr. Tang said the first step was a mixture of liquid metal, iron microparticles, and elastomer that, by a fortuitous accident, had been cured in an oven for much longer than normal. The over-cured material had reduced electrical resistance when subjected to a magnetic field, but it took dozens more samples to find that the reason for the phenomena was an extended curing time of several hours longer than it would normally take. "When we accidentally stretched a sample while we were measuring its resistance, we surprisingly found

Advanced robotics sensitive touch or next-generation wearable devices with sophisticated sensing capabilities could soon be possible following the development of a rubber that combines flexibility with high electrical conductivity.

that the resistance reduced dramatically," Dr. Tang said. "Our thorough testing showed the resistivity of this new composite could drop by seven orders of magnitude when stretched or compressed, even by a small amount. "The increase in conductivity when the material is deformed or a magnetic field is applied are properties, we believe are unprecedented." The results were published recently in the journal Nature Communications. Lead author and Ph.D. student Guolin Yun said the researchers demonstrated several interesting applications such as exploiting the composite's superior thermal conductivity to build a portable heater that warms where pressure is applied. "The heat increases to the area where pressure is applied and reduces when it's removed. This feature could be used for flexible or wearable heating devices, such as heated insoles," he said. The research group has been studying materials that can change their physical state, such as shape or hardness, in response to mechanical pressure. With the addition of electrical conductivity, the materials become 'smart' by being able to convert mechanical forces into electronic signals. Professor Li said the discovery had not only overcome the key challenge of finding a flexible and highly conductive composite material, its unprecedented electrical properties could lead to innovative applications, such as stretchable sensors or flexible wearable devices that can recognise human motion. "When using conventional conductive composites in flexible electronics, the decrease in conductivity upon stretching is undesirable because it can significantly affect the performance of these devices and compromise battery life. "In this sense, we had to develop a composite material with properties that have never been observed before: a material that can retain its conductivity, or increases in conductivity, as it is elongated. "We know that many scientific advances have come from unusual ideas. The exploration of unconventional fields and a lab culture that encourages innovation is more likely to bring unexpected discoveries."

Phys.org, 12 April 2019

http://phys.org

Chemical engineers have devised an alternative approach to synthesising epoxides, a type of chemical that is found in many products, including plastics, pharmaceuticals and textiles.

Shrinking the carbon footprint of a chemical in everyday objects

2019-04-24

The biggest source of global energy consumption is the industrial manufacturing of products such as plastics, iron, and steel. Not only does manufacturing these materials require huge amounts of energy, but many of the reactions also directly emit carbon dioxide as a by-product. In an effort to help reduce this energy use and the related

emissions, MIT chemical engineers have devised an alternative approach to synthesising epoxides, a type of chemical that is used to manufacture diverse products, including plastics, pharmaceuticals, and textiles. Their new approach, which uses electricity to run the reaction, can be done at room temperature and atmospheric pressure while eliminating carbon dioxide as a by-product. "What isn't often realised is that industrial energy usage is far greater than transportation or residential usage. This is the elephant in the room, and there has been very little technical progress in terms of being able to reduce industrial energy consumption," says Karthish Manthiram, an assistant professor chemical engineering and the senior author of the new study. The researchers have filed for a patent on their technique, and they are now working on improving the efficiency of the synthesis so that it could be adapted for large-scale, industrial use. MIT postdoc Kyoungsuk Jin is the lead author of the paper, which appears online April 9 in the Journal of the American Chemical Society. Other authors include graduate students Joseph Maalouf, Nikifar Lazouski, and Nathan Corbin, and postdoc Dengtao Yang.

Ubiquitous chemicals

Epoxides, whose key chemical feature is a three-member ring consisting of an oxygen atom bound to two carbon atoms, are used to manufacture products as varied as antifreeze, detergents, and polyester. "It's impossible to go for even a short period of one's life without touching or feeling or wearing something that has at some point in its history involved an epoxide. They're ubiquitous," Manthiram says. "They're in so many different places, but we tend not to think about the embedded energy and carbon dioxide footprint." Several epoxides are among the chemicals with the top carbon footprints. The production of one common epoxide, ethylene oxide, generates the fifth-largest carbon dioxide emissions of any chemical product. Manufacturing epoxides requires many chemical steps, and most of them are very energy-intensive. For example, the reaction used to attach an atom of oxygen to ethylene, producing ethylene oxide, must be done at nearly 300 degrees Celsius and under pressures 20 times greater than atmospheric pressure. Furthermore, most of the energy used to power this kind of manufacturing comes from fossil fuels. Adding to the carbon footprint, the reaction used to produce ethylene oxide also generates carbon dioxide as a side product, which is released into the atmosphere. Other epoxides are made using a more complicated approach involving hazardous peroxides, which can be explosive, and calcium hydroxide, which can cause skin irritation. To come up with a more sustainable approach, the MIT team took inspiration

from a reaction known as water oxidation, which uses electricity to split water into oxygen, protons, and electrons. They decided to try performing the water oxidation and then attaching the oxygen atom to an organic compound called an olefin, which is a precursor to epoxides. This was a counterintuitive approach, Manthiram says, because olefins and water normally cannot react with each other. However, they can react with each other when an electric voltage is applied. To take advantage of this, the MIT team designed a reactor with an anode where water is broken down into oxygen, hydrogen ions (protons), and electrons. Manganese oxide nanoparticles act as a catalyst to help this reaction along, and to incorporate the oxygen into an olefin to make an epoxide. Protons and electrons flow to the cathode, where they are converted into hydrogen gas. Thermodynamically, this reaction only requires about 1 volt of electricity, less than the voltage of a standard AA battery. The reaction does not generate any carbon dioxide, and the researchers anticipate that they could further reduce the carbon footprint by using electricity from renewable sources such as solar or wind to power the epoxide conversion.

Scaling up

So far, the researchers have shown that they can use this process to create an epoxide called cyclooctene oxide, and they are now working on adapting it to other epoxides. They are also trying to make the conversion of olefins into epoxides more efficient -- in this study, about 30 percent of the electrical current went into the conversion reaction, but they hope to double that. They estimate that their process, if scaled up, could produce ethylene oxide at a cost of $900 per ton, compared to $1,500 per ton using current methods. That cost could be lowered further as the process becomes more efficient. Another factor that could contribute to the economic viability of this approach is that it also generates hydrogen as a by-product, which is valuable in its own right to power fuel cells. The researchers plan to continue developing the technology in hopes of eventually commercialising it for industrial use, and they are also working on using electricity to synthesise other kinds of chemicals. "There are many processes that have enormous carbon dioxide footprints, and decarbonisation can be driven by electrification," Manthiram says. "One can eliminate temperature, eliminate pressure, and use voltage instead." The research was funded by MIT's Department of Chemical Engineering and a National Science Foundation Graduate Research Fellowship.

Science Daily, 9 April 2019

http://www.sciencedaily.com

Gossip

Important aspects easier to understand and enthuse more people to study chemistry?

2019-04-24

This question is posed in an article published in Nature Chemistry by chemists and psychologists at the University of Nottingham and Manchester and Liverpool universities. 2019 marks the 150th anniversary of the first publication of Mendeleev's periodic table, which has become the accepted way of arranging the elements and of predicting new ones – but is there a better way of presenting this information for a new and in particular a young audience?

Doing a 180 degree turn

Nottingham chemists Sir Martyn Poliakoff and Dr. Sam Tang suggest that by turning the periodic table through 180 degrees on a horizontal axis would make the Table more like a traditional graph so that values increase from bottom to top. Putting the lighter elements at the bottom and heavy ones at the top would mean most of the properties also increase from bottom to top, including; atomic number, atomic mass, atomic radius, maximum oxidation state and reactivity. Sir Martyn says: "Think of the periodic table from the viewpoint of children looking for the first time at Mendeleev's table hanging on the classroom wall. The teacher rarely mentions any of the elements that are typically closest to the children's eye-level and talks mostly about those high up near the top of the table. The current layout also makes it harder to understand one of the key concepts underlying the structure of the periodic table, namely the order of the filling of electron shells. In Mendeleev's table, these fill from the top to the bottom while most everyday objects like beakers, baths and waste bins fill from the bottom up." Martyn and Sam suggest that turning the periodic table upside-down will be making the filling of the electron shells easier to understand. Surprisingly, no one appears to have tried doing this before, in the past 150 years.

Comparing the view

But how would people view upside-down periodic tables compared to the traditional one? To investigate this, Martyn enlisted the help of two experimental Psychologists – his daughter Dr. Ellen Poliakoff from the University of Manchester and her collaborator Dr. Alexis Makin from the University of Liverpool. Ellen and Alexis asked participants to rate silhouettes of periodic tables and at the same time recorded where the participants looked using eye-tracking. To avoid any preconceptions all the

lettering was removed so participants were looking at blank squares. Their results showed that participants had a slight preference for the traditional orientation and, in both orientations, people spent the most time looking in the centre. However, their eyes were drawn upwards with the traditional orientation and downwards for the upside-down version. Ellen explains; "In both views people were drawn to look at the distinct part of the shape—the 'legs' of the table or the lighter elements. Our study used naïve participants who were not studying chemistry, so we still need to find out whether the effects are similar for those with expertise in chemistry. It's also likely that more experience with the inverted table could overcome the slight preference that people showed for the upright version." Alexis adds: "The findings also tell us something about the psychology of visual preferences. People preferred the traditional, upright periodic tables, even without recognising them. Such unconscious 'mere exposure' effects have been known since the 1960s. We suggest that they are driven by familiar sequences of images and eye movements, not just familiar images. This tells us something about the aesthetic appeal of art and design. People might say they like a painting, but what they really like is the way their eyes interact with it." Sir Martyn concludes: "It has been really fun working with psychologists. We've had a surprisingly positive response to inverting the periodic table so far and whilst we are not claiming our version is in any way 'more correct' we feel it has some clear advantages. Looking at something from a new viewpoint gives rise to new ideas, so this new perspective may create some new thinking. Also, using the periodic table in this way demonstrates that the table is constantly evolving and can meet new challenges. We hope people will take a serious look at our suggestion and see what they think of this new perspective."

Phys.org, 9 April 2019

http://phys.org

Scientists from Wageningen University & Research have developed an injectable adhesive able to bond to many surfaces underwater.

New bioinspired glue bonds any surface underwater

2019-04-24

Underwater adhesion is technically challenging because of the presence of water, the worst enemy for any glue. Now, scientists from Wageningen University & Research have developed an injectable adhesive able to bond to many surfaces underwater. Water drastically weakens the mechanical properties of an adhesive and prevents good contact with the surface. This strongly limits the development of injectable adhesives for wet environments, such as the human body—soft tissue repair and wound closure would have much to gain from the development of glues to

replace patient and surgeon-unfriendly techniques such as suturing and stapling.

Inspired by nature

Pressure-sensitive adhesives work effectively on almost any dry surface. But as soon as the surface gets wet, its performance is greatly undermined. However, this challenge was solved a long time ago by many natural organisms such as mussels and sandcastle worms. These underwater creatures are able to release a fluid phase underwater. This substance successively hardens due to a change in the environmental conditions (pH, ionic strength), enabling the organisms to attach to surfaces. The natural glue is mainly composed of oppositely charged protein domains and stored in the form of complex coacervate, a fluid and water-immiscible phase. Researchers from the Wageningen Physical Chemistry and Soft Matter group have used these creatures as a source of inspiration for the development of a new glue that solves most of the challenges associated with underwater adhesion. The adhesive is prepared by mixing aqueous solutions of oppositely charged polymers modified with thermosensitive units. The material, which is liquid-like at room temperature, turns immediately into a solid when the temperature rises above 32 degrees C, when the thermoresponsive chains get together and collapse, making the adhesive much tougher. When tested underwater, the material shows impressive adhesive properties, sticking strongly to surfaces like glass, teflon or charged surfaces. The developed glue is therefore an ideal candidate for gluing tissues inside the human body, where the temperature of the environment would trigger an immediate setting without the insertion of any additional chemical species. In addition to that, the material is easy to inject, given its low viscosity at room temperature, and does not disperse in the environment since it is water-immiscible. The researchers are now working on the optimisation of the material properties in order to obtain an even better performance which would allow them to start testing the adhesive properties on real biological tissues.

Phys.org, 5 April 2019

http://phys.org

Gossip

Colour-Changing Materials Go From Solid To See-Through

2019-04-24

Researchers have created materials that quickly change colour from completely clear to a range of vibrant hues—and back again. The work could have applications in everything from skyscraper windows that control the amount of light and heat coming in and out of a building, to switchable camouflage and visors for military applications, and even colour-changing cosmetics and clothing. It also helps fill a knowledge gap in a key area of materials science and chemistry. Electrochromic materials change colour upon the application of a small electrical potential or voltage. For the last 20 years John R. Reynolds, a professor with joint appointments in the School of Chemistry and Biochemistry and the School of Materials Science and Engineering at Georgia Tech, has been studying and developing electrochromic materials that can switch from a wide range of vibrant colours to clear. But these materials, known as cathodically colouring polymers, have a drawback. Their transmissive, or clear, state is not completely clear. Rather, in this state the material has a light blue tint. "That's fine for many applications—including rear-view mirrors that cut the glare from oncoming cars by turning dark—but not for all potential uses," says Reynolds. For example, the Air Force is working toward visors for its pilots that would automatically switch from dark to clear when a plane flies from bright sunlight into clouds. "And when they say clear, they want it crystal clear, not a light blue," Reynolds says. "We'd like to get rid of that tint."

Researchers have created materials that quickly change colour from completely clear to a range of vibrant hues—and back again.

Handy Aces

There is another family of electrochromic materials that can change colour when exposed to an oxidising voltage. These materials, known as anodically colouring electrochromes (ACEs), are colourless materials that turn coloured upon oxidation. But there has been a knowledge gap in the science behind the coloured oxidised states, known as radical cations. Researchers have not understood the absorption mechanism of these cations, and so they could not controllably tune the colours. That's where Dylan T. Christiansen, a graduate student in the Reynolds group, came in. While tinkering with some ACE molecules, he experimented with a new approach to controlling colour in radical cations. Specifically, he created four different ACE molecules by making tiny changes to the ACEs' molecular structures that have little effect on the neutral, clear state, but significantly change the absorption of the coloured or radical cation state. The results were spectacular. "I expected some colour differences between

the four molecules, but thought they'd be very minor," Christiansen says. Instead, upon the application of an oxidising voltage, the four molecules produced four very different colours: two vibrant greens, a yellow, and a red. And unlike their cathodic counterparts, they are crystal clear in the neutral state, with no tint. Finally, just like mixing inks, the researchers found that a blend of the molecules that switch to green and red made a mixture that is clear and switches to an opaque black. Suddenly those Air Force visors that switch from crystal clear to black looked more attainable. "The beauty of this is it's so simple. These minor chemical changes—literally the difference of a few atoms—have such a huge impact on colour," says co-author Aimée L. Tomlinson, a professor in the chemistry and biochemistry department at the University of North Georgia.

'Better Than Expected'

How could such tiny changes have such an effect? For the last five years Tomlinson, a computational chemist, has been analysing Reynolds' electrochromic materials with computational models that provide insights into what's happening at the sub-molecular level. Using those models, coupled with Christiansen's data for the new ACE molecules, she was able to show how the small chemical changes that researchers made could drastically alter the electronic structure of the molecules' radical cation states, and ultimately control the colour. The work continues to generate insights into new ACE molecules thanks to continuous feedback between Tomlinson's models and the experimental data. The models help guide efforts in the lab to create new ACE molecules, while the experimental data from those molecules makes the models ever stronger. Tomlinson notes that because the work is also helping to illuminate how radical cations work—researchers still don't understand them well—it could help others manipulate them for future use in fields beyond electrochromism. "I think what makes science really interesting is that [sometimes] you see something you really did not expect, you pursue it, and you end up with something that is better than you expected when you started," Reynolds says. The research appears in the Journal of the American Chemical Society. The Air Force Office of Scientific Research funded the research. Tomlinson also acknowledges the support of her university, while Reynolds acknowledges support for his electrochromic polymer research program from NXN Licensing. Any opinions or conclusions are those of

the authors and do not necessarily represent the views of the sponsoring organisations.

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Scientists Dig Into Hard Questions About The Fluorinated Pollutants Known As PFAS

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Scientists are ramping up research on the possible health effects of a large group of common but little-understood chemicals used in water-resistant clothing, stain-resistant furniture, non-stick cookware and many other consumer products. Per- and polyfluoroalkyl substances are generally referred to by their plural acronym, PFAS. PFAS are resistant to water, oil and heat, and their use has expanded rapidly since they were developed by companies in the mid-20th century. Today, PFAS' non-stick qualities make them useful in products as diverse as food wrappers, umbrellas, tents, carpets and firefighting foam. The chemicals are also used in the manufacture of plastic and rubber and in insulation for wiring. In short, they are all around us. And as a result, they've found their way into the soil and, especially in some regions, into our drinking water. "We're finding them contaminating many rivers, many lakes, many drinking water supplies," says Linda Birnbaum, director of the National Institute of Environmental Health Sciences and the National Toxicology Program. "And we're finding them not only in the environment, but we're finding them in people." "Essentially everyone has these compounds in our blood," she explains. That's in part because PFAS don't break down easily — a quality that has earned them the nickname "forever chemicals." Some varieties have been found to stick around in the human body for years, if not decades. Others accumulate in soil or water, creating a continuous source of exposure. Despite their ubiquity, however, scientists know relatively little about the health effects of most types of PFAS.

Scientists are ramping up research on the possible health effects of a large group of common but little-understood chemicals used in water-resistant clothing, stain-resistant furniture, non-stick cookware and many other consumer products.

No PFAS legal safety limit yet

"Despite their everyday use, the body of science necessary to fully understand and regulate these chemicals is not yet as robust as it needs to be," acknowledged the assistant administrator of the Environmental Protection Agency's Office of Water, David Ross, at a congressional hearing on PFAS in March. This year, the EPA signalled that it is considering setting a legal safety limit for some PFAS in drinking water, but it hasn't

acted yet. Meanwhile, public spending on research of the chemicals has gone up. The National Institutes of Health, the Environmental Protection Agency, the Centres for Disease Control and Prevention and multiple state university systems have all increased their funding for PFAS studies in recent years. "We have more and more of our grantees who are looking at PFAS in their studies — both mechanistic studies and animal studies," as well as epidemiological studies that analyse large populations, explains Birnbaum. But the work is slow going. "These are a very broad class of chemicals — probably 5,000 or more — and it seems like new ones are being produced all the time," she says. In most cases, U.S. chemical regulations do not require that companies prove a chemical is safe before they start selling it. It's up to the EPA to determine whether a substance is unacceptably dangerous and under what circumstances, and typically such analyses begin only after public health concerns are raised. As a result, "we really don't know much about the great majority of these chemicals," says Birnbaum. One approach that scientists supported by the National Institutes of Health are taking is to analyse hundreds of PFAS varieties at once. The goal is to identify subgroups of PFAS with similar characteristics, so scientists won't have to do a battery of toxicity tests on each individual chemical. "There's no way that we'll ever be able to test 5,000 or more PFAS," Birnbaum explains.

Early studies suggest some health risks

Some of the most large-scale PFAS epidemiology research in the U.S. was conducted by a science panel starting in 2005 as part of a class action lawsuit against the chemical company DuPont. The case alleged that thousands of people in West Virginia and Ohio were hurt by industrial releases of a PFAS chemical called PFOA. The panel — made up of three career epidemiologists whom both sides of the court case agreed to have evaluate the scientific evidence — found a "probable link" between long-term exposure to the chemical and certain medical conditions, such as kidney cancer and thyroid disease. Additional studies of both humans and rodents have found similar associations.

Decades-Old Chemicals, New Angst Over Drinking Water

"I think we have growing information that at least some members of this class can be problematic," says Birnbaum. Those findings have raised a host of new questions, first about mechanism: How do PFAS chemicals act in the body? It's one thing to see an association between exposure to a substance and disease. It's much more difficult to determine a likely path from chemical exposure to disease symptoms. "We still don't know

the precise molecular ways that they produce toxicity," explains Jamie DeWitt, a toxicologist who studies PFAS at East Carolina University. For example, DeWitt and others have published studies of both humans and rodents that suggest exposure to one PFAS chemical — PFOA — can suppress the body's response to vaccines. "I'm pretty sure that a type of immune cell called a B cell is involved" in that suppression, says DeWitt. "But I don't know why the B cell doesn't produce enough antibody. Is it signalling molecules that say, 'Hey, B cell, make antibody?' Is it something wrong inside the B cell itself? Is it the amount of energy that the B cell has? These are these molecular mechanisms that we're still trying to figure out." Knowing those mechanisms for PFOA might help scientists estimate the potential risks of other PFAS that have a similar structure, she says. "Honestly, I think we're still at the very beginning." At the current rate of research, Birnbaum says, it will take about two years to get a basic handle on the toxicity of the whole PFAS group. But there will still be many questions for both scientists and regulators. "Realising that these chemicals have escaped into the environment, how are we going to remediate those problems? How are we going to get rid of these chemicals?" she says. "A question that we all need to be asking is: What's essential?" she says. "Do we really need it? Are there some places where we need to have this class of chemicals to be safe? But if that's the case, we would like them used in closed systems so they don't escape and end up contaminating the whole world." Asked to comment on how essential PFAS are, a spokesperson for the FluoroCouncil, part of the main trade group representing chemical companies in the U.S., defended their widespread use in consumer products. "PFAS are an essential enabling technology that play a vital role in products ranging from lifesaving applications in pacemakers and defibrillators, to the design of lower-emissions automobiles with improved auto safety, to the manufacturing of semiconductors, solar panels and high-performance electronics," a spokesperson for the FluoroCouncil wrote in an emailed statement to NPR. "The vast differences within the PFAS family of chemistry are not immediately obvious to many people," the statement continues. "While some of the names sound the same, PFAS have differing characteristics, formulations, intended uses, and environmental and health profiles." While two years is not very long in the world of basic scientific research, it can feel like an eternity to people who are worried about their health. In response to public concern, some states already are taking action on their own, both to regulate PFAS emissions and exposure and to gather public health information in communities where the water is known to be contaminated. "For people who live in areas where one of their drinking water sources has a level [of PFAS] that was high enough to raise concern,

there's a really strong demand for information," says Alissa Cordner, a sociologist at Whitman College and one of the organisers of a nationwide PFAS contamination list. "There's so much uncertainty around what the scale and the consequences of contamination are," she explains, and that uncertainty makes people afraid. "In terms of individuals wanting to know 'What's in my drinking water?' the testing is still prohibitively expensive." And even when scientists or officials test water in a community, the lack of scientific evidence gathered, so far, about PFAS and health makes it difficult for people to know how to react. Most in-home water filters don't remove the chemicals effectively, according to the CDC. "I think it's confusing, because you have so many chemicals about which we know so little, other than they're a member of this large class," says Birnbaum. "I think that is confusing, but it's also frustrating. So, we're trying to address those problems right now." Regulators, scientists and citizens all agree: Research results can't come soon enough.

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Tracking the spread of mercury across the planet

2019-04-24

A team led by researchers at University of Massachusetts Lowell is seeking to more deeply understand the process through which mercury is disseminated across the planet.

Many of us are aware that mercury, a naturally occurring metal, is found in much of the fish we consume. We also know it's not all that great for our health. But how does the chemical element make its way onto our dinner plate in the first place? A team led by researchers at University of Massachusetts Lowell is seeking to more deeply understand the process through which mercury is disseminated across the planet. They are studying how much of the toxic substance accumulates in forests, with the goal of reducing the pollutant worldwide. "It has always been a natural element. It has always been in fish," said Daniel Obrist (ab0ve), lead researcher. "But what we've done as a society is we've increased mercury deposition to between three and five times what it was before 1750, before large-scale industrialisation." Mercury can be found in rocks in the Earth's crust, such as coal. It is a global pollutant, meaning it can be emitted in one area but affect others. As humans mine and burn coal, the gaseous form of mercury is released into the atmosphere. Plants uptake the gas into their leaves, much like they do with carbon dioxide. When the plants shed the leaves or die, the mercury makes its way into the soil. Water runoff carries the pollutant into rivers and streams, finally sweeping it out into the ocean. "We can see that, near the coast, the fish have more mercury that originates from solids, from the forest runoff," Obrist said. "If

you go out deeper into the ocean, these fish have more mercury content that comes from rain." Fish with the highest mercury contamination are those that eat other smaller fish, live longer, and grow bigger. Mercury is a neurotoxin. Overexposure in humans can lead to cardiovascular and neurological problems. It is especially dangerous for pregnant women and their unborn children. The research team will study two very different forests in mercury hotspots — Harvard Forest in Petersham and a rainforest in central Costa Rica. The team will use sensors to measure the forests' uptake of mercury in the atmosphere at various heights, allowing for daily tracking of mercury levels over time and space. Obrist hypothesises that the Massachusetts forest will show high mercury uptake in the spring and summer months and low uptake in the winter and fall (when there are no active leaves to absorb the gaseous mercury). He expects the rainforest, which is green all year, to show a more consistent mercury uptake. Obrist sees the need for increased renewable energy sources to combat the spread of the pollutant. He does not recommend people stop eating fish altogether, but that they research which ones are lowest in the chemical. He also encourages citizens to push for change on a larger scale. "Force your energy company to move to renewable energy. Get informed, apply pressure, call your energy company about their energy mix," Obrist said. "Say you want to move to cleaner fuels and avoid fossil fuels."

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Synthetic Peptides Could Block Toxic Alzheimer's Build-Up

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Researchers have developed synthetic peptides that can target and inhibit small, toxic aggregates related to Alzheimer's disease.

Researchers have developed synthetic peptides that can target and inhibit small, toxic aggregates related to Alzheimer's disease. Alzheimer's is a disease of aggregation. Neurons in the human brain make a protein called amyloid beta. Such proteins on their own, called monomers of amyloid beta, perform important tasks for neurons. But in the brains of people with Alzheimer's disease, amyloid beta monomers have abandoned their jobs and joined together. First, they form oligomers—small clumps of up to a dozen proteins—then longer strands and finally large deposits called plaques. For years, scientists believed that the plaques triggered the cognitive impairments characteristic of Alzheimer's disease. But newer research implicates the smaller aggregates of amyloid beta as the toxic elements of this disease. The new synthetic peptides—which

researchers designed to fold into a structure known as an alpha sheet—can block amyloid beta aggregation at the early and most toxic stage when oligomers form. The team showed that the synthetic alpha sheet's blocking activity reduced amyloid beta-triggered toxicity in human neural cells grown in culture, and inhibited amyloid beta oligomers in two laboratory animal models for Alzheimer's.

Amyloid Beta to Blame?

These findings add evidence to the growing consensus that amyloid beta oligomers—not plaques—are the toxic agents behind Alzheimer's disease. The results also indicate that synthetic alpha sheets could form the basis of therapeutics to clear toxic oligomers in people, according to corresponding author Valerie Daggett, a professor of bioengineering and faculty member in the University of Washington Molecular Engineering & Sciences Institute. "This is about targeting a specific structure of amyloid beta formed by the toxic oligomers," says Daggett. "What we've shown here is that we can design and build synthetic alpha sheets with complementary structures to inhibit aggregation and toxicity of amyloid beta, while leaving the biologically active monomers intact." Cellular proteins assume many different 3D structures, usually by first folding into certain types of basic shapes. The alpha sheet is a nonstandard protein structure, which Daggett's group discovered using computational simulations. The research team has previously shown that alpha sheets are associated with aggregation of amyloid beta. These and related findings indicate that, in nature, alpha sheets likely occur in only rare instances when proteins fold incorrectly and interact in ways that disrupt cellular function, leading to so-called "protein misfolding" diseases like Alzheimer's. In this new paper, Daggett and her team provide evidence that amyloid beta oligomers form an alpha sheet structure as they aggregate into longer strands and plaques. Critically, the team's synthetic alpha sheets can actually block this aggregation by specifically binding and neutralising the toxic oligomers. Using both novel and conventional spectroscopic techniques, Daggett's team observed the individual stages of development of amyloid beta clusters, from monomers to six- and 12-protein oligomers all the way up to plaques, in human neural cell lines. The researchers confirmed that the oligomer stages were most toxic to the neurons, which agrees with clinical reports of amyloid beta plaques in the brains of people who don't have Alzheimer's. "Amyloid beta definitely plays a lead role in Alzheimer's disease, but while historically attention has been on the plaques, more and more research instead indicates that

amyloid beta oligomers are the toxic agents that disrupt neurons," says Daggett.

Blocking Aggregation

In addition, the researchers designed and built small, synthetic alpha sheet peptides, each made up of just 23 amino acids, the building blocks of proteins. The synthetic peptides folded into a hairpin-like structure and are not toxic to cells. But the synthetic alpha sheets neutralized the amyloid beta oligomers in human neural cell cultures, inhibiting further aggregation by blocking parts of the oligomers involved in the formation of larger clumps. The peptides also protected laboratory animals from toxic oligomer damage. In brain tissue samples from mice, the team observed an up to 82 percent drop in amyloid beta oligomer levels after treatment with a synthetic alpha sheet peptide. Administering a synthetic alpha sheet to living mice triggered a 40 percent drop in amyloid beta oligomer levels after 24 hours. In the common laboratory worm Caenorhabditis elegans, another model for Alzheimer's disease, treatment with synthetic alpha sheets delayed the onset of amyloid beta-induced paralysis. In addition, C. elegans worms showed signs of intestinal damage when they were fed bacteria that express amyloid beta. That damage was inhibited when the scientists first treated the bacteria with their synthetic alpha sheets. Daggett's team is continuing experiments with synthetic alpha sheets to engineer compounds that are even better at clearing amyloid beta oligomers. For the current study, the researchers also created a novel laboratory assay that uses a synthetic alpha sheet to measure levels of amyloid beta oligomers. They believe this assay could form the basis of a clinical test to detect toxic oligomers in people before the onset of Alzheimer's symptoms. "What we're really after are potential therapeutics against amyloid beta and diagnostic measures to detect toxic oligomers in people," says Daggett. "Those are the next steps." The paper appears in the Proceedings of the National Academy of Sciences. Additional co-authors are from the University of Washington, the University of Colorado Boulder, Redshift BioAnalytics, the Roskamp Institute. The National Institutes of Health, the University of Washington, the American Microscopy Society, the National Science Foundation, and the Roskamp Institute provided funding for the research.

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Gossip

Some Water Disinfection Misses Drug-Resistant Genes

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Current water and wastewater disinfecting methods work well to deter bacterial growth, but have varied success in fighting an antibiotic resistance gene, according to new research. Each year, antibiotic-resistant bacteria infect at least 2 million Americans, and at least 23,000 of these people die, according to the Centres for Disease Control. These bacteria can end up in our water, which is why we use disinfectants to kill or stop them from growing to treat both waste and drinking water. But so far, few researchers have looked at whether these treatments are effective in removing the genes that encode for the traits that make these bacteria resistant to antibiotics. Some researchers are concerned that, even after treatment, non-resistant bacteria could still become resistant by picking up intact genes left over from damaged antibiotic resistant bacteria. Although it's not clear if this is currently happening, researchers want to be prepared for this scenario. So, the research team tested how well current water and wastewater disinfecting methods affect antibiotic resistance genes in bacterial DNA. The researchers report their results in the journal Environmental Science & Technology, and they are also developing a model for proper treatment of any antibiotic resistance gene.

Current water and wastewater disinfecting methods work well to deter bacterial growth, but have varied success in fighting an antibiotic resistance gene, according to new research.

DNA in the Environment

"DNA is not in itself particularly toxic or harmful. But it's important to consider its fate once it's in the environment because it can potentially spread undesirable traits into bacterial communities," says corresponding author Michael Dodd, an associate professor in the civil and environmental engineering department at the University of Washington. "We have been finding more and more medically relevant antibiotic resistance genes in the environment. The recognition that these genes are present in the environment isn't new—other groups have already provided a great deal of information on their behaviour as environmental contaminants. "What's unique about our work is that we're focusing on really unravelling and characterising how a variety of disinfection processes influence the fate of such genes, so we can better understand how these different treatments affect antibiotic resistant bacteria and their DNA in our water," Dodd says. Current water treatment plants use a variety of disinfecting methods. Most involve exposing water to UV light or to chlorine- or oxygen-containing compounds, such as chlorine by itself or ozone. To determine how these methods affect both bacteria and antibiotic resistance genes, Dodd and his team used a model system: a harmless soil bacterium called Bacillus subtilis. The team worked with a strain of B. subtilis that overproduced

a gene, called blt, which makes a protein that lets B. subtilis pump antibiotics out—making the bacterium resistant to a variety of common antibiotics.

Two Disinfectants Fall Short

The researchers exposed the bacteria to different disinfecting methods and then monitored two things: how well treated bacteria grew when after exposure to antibiotics and whether the methods damaged the gene inside the bacteria. "As we expected, all of the treatments we looked at were successful in disrupting bacterial viability," says first author Huan He, a civil and environmental engineering doctoral student. "But we saw mixed results for DNA damage." At typical exposures used for water treatment, three methods showed greater than 90 percent degradation or deactivation of the gene: UV light, ozone, and chlorine. The team determined that these three methods are largely successful in preventing the spread of antibiotic resistance by both deactivating the bacteria and damaging the resistance gene. But two other disinfectants called chlorine dioxide and monochloramine showed barely any damage to the gene. "We found that these two methods degrade DNA so slowly that almost nothing has happened during the amount of time water is exposed under typical treatment conditions," says He. "In fact, we found that DNA from bacteria treated with chlorine dioxide and monochloramine retains the ability to transfer antibiotic resistance traits to non-resistant bacteria long after the original bacteria are killed." Currently the team knows how quickly these disinfecting methods affect the gene they used in the study. Now the researchers are developing a model that would allow them to estimate how quickly they would damage any gene. "If we can predict how effectively each disinfectant method would deactivate or degrade a specific gene, then we can better evaluate effective treatment strategies for degrading any antibiotic resistance gene that presents a concern," Dodd says. "Disinfection processes are very important tools for preventing the spread of antibiotic resistance. We're trying to better understand them so we can more effectively design and operate them in the future." Additional co-authors came from the University of Washington; Corona Environmental Consulting; Stanford University; and the Gwangju Institute of Science and Technology in South Korea. The National Science Foundation funded the research.

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Gossip

New automated biological-sample analysis systems to accelerate disease detection

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Professor Thomas Gervais of Polytechnique Montréal and his students Pierre-Alexandre Goyette and Étienne Boulais, in partnership with the team led by Professor David Juncker of McGill University, have developed a new microfluidic process aimed at automating protein detection by antibodies. This work, the topic of an article in Nature Communications, points to the arrival of new portable instruments to accelerate the screening process and molecule analysis in biological laboratories to accelerate research in cancer biology. Microfluidics refers to the manipulation of fluids in microscale devices. Commonly called "labs on a chip," microfluidic systems are used to study and analyse very small-scale chemical or biological samples, replacing the extremely expensive and cumbersome instruments used for traditional biological analyses. Listed in 2001 among the "10 Emerging Technologies That Will Change the World" by the MIT Technology Review, microfluidics is considered just as revolutionary for biology and chemistry as microprocessors have been to electronics and IT, and it applies to a huge market. Today, this young discipline, which began to take off in the 2000s with closed systems made up of microchannel networks, is itself being radically transformed by the discovery made by the group of researchers from Polytechnique and McGill University, which reinforces the theoretical and experimental foundations of open-space microfluidics. This technology, which eliminates channels, competes favourably with conventional microfluidics for certain types of analyses. Indeed, the classical configuration of closed-channel microfluidic devices provides several disadvantages: the scale of the channel cross-sections increases the stress that cells undergo when they are culture; and they are not compatible with the cell-culture standard, the Petri dish, which makes it hard for the industry to adopt it. The new approach explored by Polytechnique and McGill University researchers is based on microfluidic multipoles (MFMs), a system of simultaneous fluid suction and aspiration through opposing micro-openings on a very small surface placed in a confined space that is less than 0.1 mm thick. "When they come into contact with one another, these jets of fluid form patterns that can be seen by dyeing them with chemical reagents," says Professor Gervais. "We wanted to understand these patterns while developing a reliable method for modelling MFMs." To understand these patterns, Professor Gervais's team had to develop a new mathematical model for open multipolar flows. This model is based on a classical branch of mathematics known as conformal mapping

Microfluidics systems are used to study and analyse very small-scale chemical or biological samples, replacing the extremely expensive and cumbersome instruments used for traditional biological analyses.

that solves a problem related to a complex geometry by reducing it to a simpler geometry (and vice-versa). PhD student Étienne Boulais first developed a model to study microjet collisions in a multifluidic dipole (an MFM with only two openings), and then, relying on this mathematical theory, extrapolated the model to MFMs with multiple openings. "We can make an analogy with a game of chess in which there is a version with four players, then six or eight, applying a spatial deformation while maintaining the same rules of the game," he explains. "When subjected to conformal mapping, the patterns created by fluid jet collisions form symmetrical images reminiscent of the paintings of Dutch artist M.C. Escher," adds the young researcher, who has a passion for visual arts. "But far beyond its aesthetic appeal, our model allows us to describe the speed with which molecules move through fluids as well as their concentration. We have defined valid rules for all possible systems configurations of up to 12 poles in order to generate a wide variety of flow and diffusion patterns." The method is therefore a complete toolbox that will not only make it possible to model and explain the phenomena occurring in MFMs, but also explore new configurations. Thanks to this method, it is now possible to automate open-space microfluidic tests, which up until now have only ever been explored through trial and error.

Fabrication of the Device Using 3D Printing

The design and manufacture of the MFM device was accomplished by Pierre-Alexandre Goyette. This device is a small probe made out of resin using a low-cost 3D printing process and connected to a system of pumps and injectors. "The expertise of Professor Juncker's team in the detection of proteins by antibodies immobilised on a surface has been invaluable in managing the biological aspects of this project," says the PhD student in biomedical engineering. "The results obtained with assays validated the accuracy of the models developed by my colleague Étienne." The device allows for the simultaneous use of several reagents to detect various molecules in the same sample, which saves biologists valuable time. For certain types of tests, the analysis time could be reduced from several days to a few hours, or even a matter of minutes. In addition, the versatility of this technology should make it usable for various analytical processes, including immunological and DNA tests.

Towards A Micfrofluidic Display?

Professor Gervais's team is already considering a next step in his project: the development of a screen displaying a chemical image. "It would be a sort of chemical equivalent of the liquid-crystal display," Professor Gervais

explains. "In the same way that we move electrons across a screen, we would send jets of fluid at various concentrations that would react with a surface. Together, they would form an image. We are very excited to move forward with this project, for which we have obtained a provisional patent."

Reinvention of Diagnostic Procedures and Medical Treatment Follow-Up

For now, the technology developed by this research team is aimed at the fundamental research market. "Our processes make it possible to expose cells to many reagents simultaneously," Professor Gervais says. "They can help biologists study the interactions between proteins and reagents on a large scale, increasing the amount and quality of information obtained during assays." He explains that subsequently, the pharmaceutical market will also be able to benefit from new methods of screening-system automation resulting from the discovery. Lastly, it opens up a new avenue for drug discovery by facilitating patient cell culture and exposure to various drug agents to determine which ones they respond to best.

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Need more energy storage? Just hit 'print'

2019-04-24

Researchers from Drexel University and Trinity College in Ireland, have created ink for an inkjet printer from a highly conductive type of two-dimensional material called MXene. Recent findings, published in Nature Communications, suggest that the ink can be used to print flexible energy storage components, such as supercapacitors, in any size or shape. Conductive inks have been around for nearly a decade and they represent a multi-hundred million-dollar market that is expected to grow rapidly into the next decade. It's already being used to make the radiofrequency identification tags used in highway toll transponders, circuit boards in portable electronics and it lines car windows as embedded radio antennas and to aid defrosting. But for the technology to see broader use, conductive inks need to become more conductive and more easily applied to a range of surfaces. Yury Gogotsi, PhD, Distinguished University and Bach professor in Drexel's College of Engineering, Department of Materials Science and Engineering, who studies the applications of new materials in technology, suggests that the ink created in Drexel's Nanomaterials Institute is a significant advancement on both of these fronts. "So far only limited success has been achieved with conductive inks in both fine-

Researchers have developed a conductive ink made from a special type of material they discovered, called MXene, that was used by the researchers to print components for electronic devices.

resolution printing and high charge storage devices," Gogotsi said. "But our findings show that all-MXene printed micro-supercapacitors, made with an advanced inkjet printer, are an order of magnitude greater than existing energy storage devices made from other conductive inks." While researchers are steadily figuring out ways to make inks from new, more conductive materials, like nanoparticle silver, graphene and gallium, the challenge remains incorporating them seamlessly into manufacturing processes. Most of these inks can't be used in a one-step process, according to Babak Anasori, PhD, a research assistant professor in Drexel's department of Materials Science and Engineering and co-author of the MXene ink research. "For most other nano inks, an additive is required to hold the particles together and allow for high-quality printing. Because of this, after printing, an additional step is required -- usually a thermal or chemical treatment -- to remove that additive," Anasori said. "For MXene printing, we only use MXene in water or MXene in an organic solution to make the ink. This means it can dry without any additional steps." MXenes are a type of carbon-based, two-dimensional layered materials, created at Drexel in 2011, that have the unique ability to mix with liquids, like water and other organic solvents, while retaining their conductive properties. Because of this, Drexel researchers have produced and tested it in a variety of forms, from conductive clay to a coating for electromagnetic interference shielding to a near-invisible wireless antenna. Adjusting the concentration to create ink for use in a commercial printer was a matter of time and iteration. The solvent and MXene concentration in the ink can be adjusted to suit different kinds of printers. "If we really want to take advantage of any technology at a large scale and have it ready for public use, it has to become very simple and done in one step," Anasori said. "An inkjet printer can be found in just about every house, so we knew if we could make the proper ink, it would be feasible that anyone could make future electronics and devices." As part of the study, the Drexel team, working with researchers at Trinity College, who are experts in printing, put the MXene ink to the test in a series of printouts, including a simple circuit, a mirco-supercapacitor and some text, on substrates ranging from paper to plastic to glass. In doing so, they found that they could print lines of consistent thickness and that the ink's ability to pass an electric current varied with its thickness -- both important factors in manufacturing electronics components. And the printouts maintained their superior electric conductivity, which is the highest among all carbon-based conductive inks, including carbon nanotubes and graphene. This all amounts to a very versatile product for making the tiny components that perform important, but often overlooked functions in our electronics devices -- jobs like keeping the power on when the

battery dies, preventing damaging electrical surges, or speeding the charging process. Providing a higher-performing material and a new way to build things with it could lead not only to improvements to our current devices, but also the creation of entirely new technologies. "Compared to conventional manufacturing protocols, direct ink printing techniques, such as inkjet printing and extrusion printing, allow digital and additive patterning, customisation, reduction in material waste, scalability and rapid production," Anasori said. "Now that we have produced a MXene ink that can be applied via this technique, we're looking at a world of new opportunities to use it."

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Defying the laws of physics? Columbia engineers demonstrate bubbles of sand

2019-04-24

New study is first to show how two types of sand can behave like light and heavy liquids, shedding light on geological processes from mudslides to volcanos and potentially enabling new technologies from pharmaceutical production to carbon capture. The flow of granular materials, such as sand and catalytic particles used in chemical reactors, and enables a wide range of natural phenomena, from mudslides to volcanos, as well as a broad array of industrial processes, from pharmaceutical production to carbon capture. While the motion and mixing of granular matter often display striking similarities to liquids, as in moving sand dunes, avalanches, and quicksand, the physics underlying granular flows is not as well-understood as liquid flows. Now, a recent discovery by Chris Boyce, assistant professor of chemical engineering at Columbia Engineering, explains a new family of gravitational instabilities in granular particles of different densities that are driven by a gas-channelling mechanism not seen in fluids. In collaboration with Energy and Engineering Science Professor Christoph Müller's group at ETH Zurich, Boyce's team observed an unexpected Rayleigh-Taylor (R-T)-like instability in which lighter grains rise through heavier grains in the form of "fingers" and "granular bubbles." R-T instabilities, which are produced by the interactions of two fluids of different densities that do not mix--oil and water, for example--because the lighter fluid pushes aside the heavier one, have not been seen between two dry granular materials. The study, published in the Proceedings of the National Academy of Sciences, is the first to demonstrate that "bubbles" of lighter sand form and rise through heavier sand when the two types of sand are subject to

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vertical vibration and upward gas flow, similar to the bubbles that form and rise in lava lamps. The team found that, just as air and oil bubbles rise in water because they are lighter than water and do not want to mix with it, bubbles of light sand rise through heavier sand even though two types of sand like to mix. "We think our discovery is transformational," says Boyce "We have found a granular analogue of one of the last major fluid mechanical instabilities. While analogues of the other major instabilities have been discovered in granular flows in recent decades, the R-T instability has eluded direct comparison. Our findings could not only explain geological formations and processes that underlie mineral deposits, but could also be used in powder-processing technologies in the energy, construction, and pharmaceuticals industries." Boyce's group used experimental and computational modelling to show that gas channelling through lighter particles triggers the formation of finger and bubble patterns. The gas channelling occurs because the clusters of lighter, larger particles have a higher permeability to gas flow than do the heavier, smaller grains. The R-T-like instability in granular materials arises from a competition between upward drag force increased locally by gas channelling and downward contact forces, a physical mechanism entirely different from that found in liquids. They found that this gas-channelling mechanism also generates other gravitational instabilities, including the cascading branching of a descending granular droplet. They also demonstrated that the R-T-like instability can occur under a wide variety of gas flow and vibration conditions, forming different structures under different excitation conditions. "These instabilities, which can be applied to a variety of systems, shed new light on granular dynamics and suggest new opportunities for patterning within granular mixtures to form new products in the pharmaceutical industry, for example," Boyce adds. "We are especially excited about the potential impact of our findings on the geological sciences--these instabilities can help us understand how structures have formed over the long history of the Earth and predict how others may form in the future." Boyce is now investigating other liquid-like and structured phenomena in sand particles and quantifying their behaviour. He is also in conversations with geologists and volcanologists to explore more about how this process and similar ones occur in the natural world.

EurekAlert, 22 April 2019

http://www.eurekalert.org

Gossip

Modified 'white graphene' for eco-friendly energy

2019-04-24

Scientists from TPU, Germany, and the United States have found a new way to functionalise a dielectric, otherwise known as 'white graphene', i.e. hexagonal boron nitride (hBN), without destroying it or changing its properties. Thanks to the new method, the researchers synthesised a 'polymer nano carpet' with strong covalent bond on the samples. Prof Raul Rodriguez from the TPU Research School of Chemistry & Applied Biomedical Sciences explains: 'For the first time, we have managed to covalently functionalize hexagonal boron nitride without strong chemical compositions and the introduction of new defects into the material. In fact, earlier approaches had resulted in a different material with altered properties, i.e. hydrolysed boron nitride. In our turn, we used nanodefects existing in the material without increasing their number, and eco-friendly photopolymerisation.' One of the promising options for using the new material, according to researchers, is catalysts for splitting water in hydrogen and oxygen. With this in view, 'polymer carpets' functioned as carriers of active substances, i.e. matrices. Nickel nanoparticles were integrated into the matrix. Catalysts obtained were used for electrocatalysis. Studies showed that they could be successfully used as an alternative to expensive platinum or gold. 'One of the important challenges in catalysis is forcing the starting material to reach active centres of the catalyst. 'Polymer carpets' form a 3D structure that helps to increase the area of contact of the active centres of the catalyst with water and makes hydrogen acquisition more efficient. It is very promising for the production of environmentally friendly hydrogen fuel,' - says the scientist. Boron nitride is a binary compound of boron and nitrogen. While, hexagonal boron nitride or 'white graphene' is a white talc-like powder with hexagonal, graphene-like lattice. It is resistant to high temperatures and chemical substances, nontoxic, has a very low coefficient of friction, and functions both as a perfect dielectric and as a good heat conductor. Boron-nitride materials are widely used in the reactions of industrial organic synthesis, in the cracking of oil, for the manufacturing of products of high-temperature technology, the production of semiconductors, means for extinguishing fires, and so on. Previously, a number of studies were devoted to functionalisation of hexagonal boron nitride. Typically, this process uses strong chemical oxidants that not only destroy the material but also significantly change its properties. The method, which TPU scientists and their foreign colleagues use, allows them to avoid this. 'Studies have shown that we obtained homogenous and durable 'polymer carpets' which can be removed from the supporting substrate and used

Scientists found a way how to use 2D material for hydrogen energy

separately. What is more, this is a fairly universal technology since for functionalisation we used different monomers which allow obtaining materials with properties optimal for use in various devices,' - says Prof Raul Rodriguez.

EurekAlert, 22 April 2019

http://www.eurekalert.org

Curiosities

Researchers say eggs for breakfast benefits those with diabetes

2019-04-25

While some cereals may be the breakfast of champions, a UBC professor suggests people with Type 2 Diabetes (T2D) should be reaching for something else. Associate Professor Jonathan Little, who teaches in UBC Okanagan's School of Health and Exercise Sciences, published a study this week demonstrating that a high-fat, low-carb breakfast (LCBF) can help those with T2D control blood sugar levels throughout the day. "The large blood sugar spike that follows breakfast is due to the combination of pronounced insulin resistance in the morning in people with T2D and because typical Western breakfast foods—cereal, oatmeal, toast and fruit—are high in carbohydrates," says Little. Breakfast, he says, is consistently the "problem" meal that leads to the largest blood sugar spikes for people with T2D. His research shows that by eating a low-carb and high-fat meal first thing in the morning is a simple way to prevent this large spike, improve glycaemic control throughout the day, and perhaps also reduce other diabetes complications. Study participants, with well-controlled T2D, completed two experimental feeding days. On one day, they ate an omelette for breakfast and on another day, they ate oatmeal and some fruit. An identical lunch and dinner were provided on both days. A continuous glucose monitor—a small device that attaches to your abdomen and measures glucose every five minutes—was used to measure blood sugar spikes across the entire day. Participants also reported ratings of hunger, fullness and a desire to eat something sweet or savory. Little's study determined that consuming a very low-carbohydrate high-fat breakfast completely prevented the blood sugar spike after breakfast and this had enough of an effect to lower overall glucose exposure and improve the stability of glucose readings for the next 24 hours. "We expected that limiting carbohydrates to less than 10 per cent at breakfast would help prevent the spike after this meal," he says. "But we were a bit surprised that this had enough of an effect and that the overall glucose control and stability were improved. We know that large swings in blood sugar are damaging to our blood vessels, eyes, and kidneys. The inclusion of a very low-carbohydrate high-fat breakfast meal in T2D patients may be a practical and easy way to target the large morning glucose spike and reduce associated complications." He does note that there was no difference in blood sugar levels in both groups later in the day, suggesting that the effect for reducing overall post-meal glucose spikes can be attributed to the breakfast responses with no evidence that a low-carb breakfast worsened glucose response to lunch or dinner. "The

UBC Associate Professor Jonathan Little says a high-fat, low-carb breakfast can help control blood sugar levels throughout the day.

results of our study suggest potential benefits of altering macronutrient distribution throughout the day so that carbohydrates are restricted at breakfast with a balanced lunch and dinner rather than consuming an even distribution and moderate amount of carbohydrates throughout the day." As another interesting aspect of the research, participants noted that pre-meal hunger and their cravings for sweet foods later in the day tended to be lower if they ate the low-carb breakfast. Little suggests this change in diet maybe a healthy step for anybody, even those who are not living with diabetes.

Medical Xpress, 11 April 2019

http://medicalxpress.com

B cells gone bad could be the culprit in rheumatoid arthritis

2019-04-25

Biomolecular researcher Navin Varadarajan has published in Arthritis & Rheumatology journal a first-of-its-kind study—a comprehensive profile of B cells in rheumatoid arthritis (RA). B cells are lymphocytes, or white blood cells, that make protein antibodies that attack a patient's healthy proteins in patients with RA. "To the best of our knowledge, this is the first study to conduct whole transcriptome profiling of antigen-specific B cells in any human autoimmune disorder," said Varadarajan, whose results portray B cells not merely as autoantibody producers, but also as a source of diverse molecules that can influence proliferation, differentiation and activation of other pathogenic cell types. "We anticipate that these data will serve as a foundational data set for investigating multiple hypotheses on the roles of B cells in RA and other autoimmune disorders, and will enable drug discovery," said Varadarajan.

Biomolecular researcher Navin Varadarajan anticipates that his data will serve as a foundation for investigating multiple hypotheses on the roles of B cells in RA and other autoimmune disorders, and will enable drug discovery.

B Cells, good and bad

For every new pathogen encountered, a small subset of B cells activates to make an antibody that specifically recognises that particular pathogenic protein. Every person has between 10-100 million unique B cells, each capable of making its own antibody. While antibodies are the natural way the body fights infections, in the autoimmune RA, these antibodies—that are supposed to fight foreign invaders—attack the body's own proteins and are thus called autoantibodies. "We wanted to understand if there's anything special about this class of white bloods cells, the autoreactive B cells that make autoantibodies, that would make them

fight against healthy proteins," said Varadarajan. Fewer than one in 1,000 B cells are autoreactive, so to find which one is the culprit, Varadarajan's postdoctoral researcher Ankit Mahendra designed a method to reliably identify and isolate the population, then used RNA sequencing to study all of the RNA being made by each cell. A number of pathways associated with inflammation and protein modification, known to be amplified in rheumatoid arthritis, were found. At the molecular level, the team found two specific differences in the B cells of RA patients—the inclusion of the protein interleukin 15 receptor subunit alpha (IL-15Rα) and a high amount of the amphiregulin molecule, which can signal adjacent cells. Each was validated at the protein level in independent cohorts of RA patients and prioritised for further studies. Autoreactive B cells, and they alone, have the protein IL-15Rα. "We think that protein allows them to become bad actors," said Varadarajan. "People have been targeting this pathway for quite some time. This now sheds new light on these bad guys in the progression of this disease and how to target it." The team is the first to show that B cells make amphiregulin. Amphiregulin sits in a well-studied pathway, the epidermal growth factor receptor pathway (EGFR), and so the next step will be to determine if inhibiting the pathway impacts the B cells. Varadarajan's team also published a list of FDA-approved drugs, such as Xeljanz (tofacitinib), that target various pathways of the B cells, though they aren't specifically approved for that purpose. The team includes Chandra Mohan, Hugh Roy and Lillie Cranz Cullen Endowed Professor of biomedical engineering at UH; S. Louis Bridges, Anna Lois Waters Endowed Chair of clinical immunology and rheumatology at the University of Alabama School of Medicine; Sandeep Agarwal, associate professor and section chief of Medicine—Immunology, Allergy & Rheumatology at Baylor College of Medicine; Amita Aggarwal, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, India.

Medical Xpress, 11 April 2019

http://medicalxpress.com

Consistent approaches to working hours and shift breaks needed, sleep inquiry finds

2019-04-25

Just five bad nights of sleep can put your body in a pre-diabetic state, and if you are a man it can lead to a dramatic reduction in testosterone, according to a recent report commissioned by the Federal Government. "Politicians and even the medical professions ourselves have been guilty of working long hours, restricting sleep times and feeling that this is

Just five bad nights of sleep can put your body in a pre-diabetic state, and if you are a man it can lead to a dramatic reduction in testosterone, according to a recent report commissioned by the Federal Government.

something that toughens you up. But in actual fact, it's the opposite." Associate Professor Young is just one of the experts who contributed to a 170-page inquiry report into sleep health awareness in Australia, commissioned by Health Minister Greg Hunt, which was published last week. The inquiry spells out the health problems associated with bad sleep, including a 20 to 40 per cent increase in the likelihood of developing chronic health issues, a higher risk of obesity, and a close link between sleep health and mental health. Evidence provided to the inquiry by the Adelaide Institute of Sleep Health suggested that after five nights of bad sleep, a 20-year-old man suffers a temporary reduction in testosterone, "as though he has aged a decade".

Sleep must be treated like fitness and nutrition

Concerns about these effects led the inquiry to recommend the Government should make sleep a priority, treating it with the same importance as fitness and nutrition when it comes to the health of Australians.

Some of the key recommendations:

- Prioritise sleep health as a national priority and recognise its importance to health and wellbeing alongside fitness and nutrition.
- Safe Work Australia and the Alertness CRC provide updated guidelines for industries using shift work.
- The Australian Government work with states and territories to develop a nationally consistent approach to working hours and rest breaks for shift workers.
- The Department of Health undertake a review of the Medicare Benefits Schedule as it relates to sleep health services in Australia.
- The Australian Government, in partnership with the states, territories and key stakeholder groups, work to develop and implement a national sleep health awareness campaign.
- The Committee recommends that the Australian Government in consultation with the Royal Australian College of General Practitioners and other key stakeholders assess the current knowledge of healthcare providers regarding sleep, and develop education to improve this knowledge.

The Australian Government fund research focussed on: sleep disorders in under-researched populations; rare and not well-understood conditions; further analysis of broad population studies; the impact of long-term shift work on sleep health; and the effects of digital devices and electronic

media on sleep health. University of South Australia psychology professor Siobhan Banks said the inquiry represented the first time a government had acknowledged sleep as a national priority. "It often doesn't seem to get that same attention from a research or funding perspective," she said, adding that the toll of bad sleep could fly under the radar. "Sleep is also something where if people do have a problem with it, they often suffer in silence and don't really talk about it."

Damage from lack of sleep among shift workers evident

Recommendations from the inquiry include the creation of nationally consistent approaches to working hours and rest breaks for shift workers. Peter Biagini, branch secretary for the transport union of Queensland, said the damage from lack of sleep among shift workers was evident in the airport, waste management and general transportation sectors. "You just have to actually go down to these workplaces and meet and talk to the people who do these different shifts, and they always look sickly and tired," he said. "After a certain period of time, chronic fatigue sets in." The inquiry also recommended national education strategies to increase community awareness about healthy sleep, with specific attention paid to educating people on how the use of digital devices before bed can disrupt sleep. The committee was "particularly concerned to hear about the impact that smartphones and other forms of electronic and digital devices may be having on the sleep health of children". Professor Young welcomed the recommendation that sleep should be treated with a new significance by policymakers. "Everyone in society will recognise the importance of a healthy diet and exercise, but really sleep should be that third pillar of good health," he said.

ABC News, 10 April 2019

http://www.abc.net.au/news/

Courts Would Likely Uphold FDA's Menthol Cigarette Ban

2019-04-25

Courts will likely uphold the US Food and Drug Administration's proposed ban on menthol combustible tobacco products, though it may be a lengthy legal process, according to a new study. The 2009 Family Smoking Prevention and Tobacco Control Act provided the FDA with broad authority to regulate the manufacturing, marketing, and distribution of tobacco products, including banning flavoured cigarettes, to protect

Courts will likely uphold the US Food and Drug Administration's proposed ban on menthol combustible tobacco products, though it may be a lengthy legal process, according to a new study.

public health. However, the act didn't ban menthol cigarettes, which adolescents, women, LGBT populations, and racial/ethnic minority groups, particularly African Americans, disproportionately use. Researchers anticipated arguments the tobacco industry is likely to use in a lawsuit challenging the FDA's authority to ban menthol cigarettes, weighed the strength of the scientific evidence justifying a menthol ban, and considered the potential for illicit trade to undermine the effectiveness of a menthol ban. After considering those factors, researchers conclude that the FDA rule banning menthol cigarettes is likely to survive a lawsuit. The FDA has sought public comments on menthol two previous times this decade without following through. In late 2018, then FDA Commissioner Scott Gottlieb showed commitment to a menthol ban that the FDA had not displayed previously. There is no indication that his resignation in March 2019 will alter the FDA's course or priorities. "All cigarettes are deadly. Menthol cigarettes are particularly nefarious because the tobacco industry designed them as 'starter products' that mask the harshness of smoking, leading to more smokers overall," says lead author Kevin Schroth, a member of the Rutgers Centre for Tobacco Studies and a faculty member at the Rutgers School of Public Health. "Additionally, menthol cigarettes are even harder to quit than nonmenthol cigarettes. This paper shows that right now the FDA has the scientific evidence and legal power to pull these deadly products from the market, saving thousands of lives, especially in communities that have been targeted historically by menthol marketing." Even if the FDA proceeds expeditiously, the rule-making process may take at least two years without including potential litigation delays. In the meanwhile, local jurisdictions like San Francisco have banned the sale of menthol and other flavoured tobacco products.

Futurity, 15 April 2019

http://www.futurity.org

Shops that minimise the environmental impact of our consumer habits are springing up across Britain. Could they help us avert catastrophe?

The zero-waste revolution: how a new wave of shops could end excess packaging

2019-04-25

The smell in Natural Weigh, a zero-waste shop that opened a year ago in Crickhowell in mid-Wales, is lovely. The shop – filled with pasta, grains, seeds and dried fruit served from hoppers to avoid plastic packaging; washing-up liquid and laundry products that customers pump into their battered old squeezy bottles; fair-trade coffee and chocolate, plus an array of environmentally friendly products, such as bamboo toothbrush holders, plastic-free dental floss and vegan leather snack pouches – looks lovely.

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The little town itself, which prides itself on having the best high street in Britain, is lovely, too. I am captivated. Natural Weigh is part of a quiet revolution. Over the past two years, well over 100 of these stores have sprung up across the UK. Precise numbers are hard to come by, but some in the business say there are almost 200, many in environmental hotspots such as Brighton, Bath, Bristol and north-east London, but also in plenty of other less obviously fertile areas. Zero-wasters are in touch with each other on Facebook, and have their own bible in Bea Johnson's book Zero Waste Home. Chloe and Robin Masefield started Natural Weigh, which they say is Wales's first zero-waste shop, in March 2018. "We got the idea in August 2017," says Robin. "We saw a shop down in Totnes" – Earth.Food. Love, which opened in March 2017 and presents itself as Britain's first zero-waste shop – "and thought we should go for it." Chloe and Robin worked in the environmental sector – Chloe for the Woodland Trust, Robin in the fishing industry – and saw a plastic-free shop as a natural extension of their environmental concerns. The shop is part of what used to be a pub. When it closed, it was earmarked for redevelopment as a supermarket, but local people bought it instead – raising a cool £500,000 – and the site houses an antique shop and a cafe as well as Natural Weigh. Crickhowell is fiercely protective of its independence and taste for non-supermarket shopping. The high street also includes two high-quality butchers and two greengrocers – one reason the Masefields don't sell organic veg alongside their dried goods, as many zero-waste shops do. They don't want to undermine their neighbours. It cost the Masefields more than £40,000 to set up the store, and Robin says it is on track financially, although he has carried on working part-time to supplement his income. There is a steady stream of shoppers on the Monday morning I visit. Ann Williams is a regular. "I liked the concept," she says. "We have far too much waste these days." She buys all her washing and cleaning materials here, as well as lots of dried goods. She says she has always been careful to recycle, and sees zero-waste shops as a return to the days of grocers decanting products from large containers. "I don't know why we ever moved away from that," she adds. "Supermarkets are the problem. I do hardly anything in supermarkets now." Pip Mumford says she buys into everything Natural Weigh represents – healthy eating, local shopping, ethical sourcing, zero waste. She is trying out the shop's eco cleaning products for the first time, filling up a bottle from the pile that the shop keeps for customers to use, and also stocking up on ingredients for her homemade muesli. "It tastes much nicer," she says. Hugo Tewson is running around the shop, grabbing nuts and cereals, and using the nut grinder to make peanut butter. "It's great fun to shop here," he says. "The washing-up liquid is great. I'll be back tomorrow with my own bottles to fill up. That's very satisfying. I

need turmeric for my arthritis and it's great to be able to buy it in proper quantities. The nut butter is wonderful. I hate shopping, but this is a different experience." The performative aspects of zero-waste shopping, which children and middle-aged men with an aversion to conventional shops particularly enjoy, are not to be underestimated. This part of Wales has quite a few second homeowners and a degree of affluence that makes it possible to raise half a million quid to see off a supermarket. Some view zero-waste shops as inherently middle class in their combination of healthy eating and social concern, but Masefield hopes his shop can reach a broader demographic. Liz Maglaras, another regular at the shop, believes it can. "Most people think it costs more to shop here," she says, "but that's not true. Sometimes it's the same and sometimes it can be cheaper. Occasionally, it costs more, but that's because I've got an addiction to those really nice chocolates over there. I'm not on a high income, and I don't think it's only for the rich. It doesn't have to be anyway, and I know all sorts of people who shop here."

The Clean Kilo opened in Digbeth in central Birmingham last June. The location is significant: Digbeth is the Shoreditch of Birmingham – a rundown area that now has a millennial buzz and a taste for social entrepreneurship. The two social entrepreneurs who set up the shop, using their own savings plus money from crowdfunding, are Tom Pell, a 32-year-old chemist who got the zero-waste bug in Australia (which is at least a decade ahead of the UK in environmentalism), and a 28-year-old fashion designer, Jeanette Wong. The shop styles itself as a zero-waste supermarket, selling not just the nuts, pulses, pastas and dried fruits you find in all these stores, but fruit and veg, bread, eggs, cheese, butter, ice-cream – in cones only, no plastic tubs – and vegan chocolate. No meat, of course: a no-no in all zero-waste shops because meat is inherently planet-destroying. When I applaud Morrisons' decision to allow customers to use their own containers to take home raw meat, Sarah Lewis – who runs the Zero Waster website – looks at me askance. The packaging, she points out, is the lesser problem. Only when we move away from meat, which demands that more and more forest land be cleared for grazing, will we start to confront the climate crisis. I like the Clean Kilo's one-stop-shop approach. It makes the store less austere and clinical than some zero-waste shops. It reminds me a lot of Bulk Market in Hackney, east London, which has a similar energy and range. Here I pick up an organic eco Easter egg with minimal cardboard packaging and none of those layers of plastic designed to make the egg look bigger. What you see is what you get. The Clean Kilo is also busy on the day I visit. Andrew Wall and Kerry Hughes have come over from Wolverhampton, which they say they often do on a

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Saturday. "We treat it as our Clean Kilo day," says Wall. They say they have always recycled as much as possible, but they are trying to cut the amount they recycle, too. As Masefield points out, recycling alone is not the answer because it uses a lot of energy, and the recycled packaging that emerges is of lesser quality. "Calling it recycling is disingenuous," he says. "It should really be called downcycling because you can't retain the same quality of plastic unless you introduce virgin materials to retain that quality." Joanna Fursman has cycled across to Digbeth from the suburb of Edgbaston in south-west Birmingham and is busy refilling a bottle with additive-free shampoo. "I've been trying to reduce the amount of waste I produce for quite a few years," she says. "I come from a family who grow their own vegetables, and supermarket shopping has always felt a bit odd." Natural Weigh and the Clean Kilo both get their cleaning products from SESI (Sustainable Ethical Supplies Initiative), a fast-growing social enterprise based in Oxford that was set up more than a decade ago by Rina Melendez and Paul Godden. It originally supplied ethical wholefoods to schools and farmers' markets, but started campaigning on plastic packaging and in 2013 developed a range of biodegradable vegan detergents. "At the time there was a niche interest in having properly refillable zero-waste household detergents," says Godden. "The main issue for retailers was that it was a bit messy, so we went away and developed our own manual pump-based dispensing system." They now supply 70 zero-waste shops and have another 40 on their waiting list. "We have really only pushed this hard in the last year, and we're finding it's an open door," he says. "Demand is huge now." The commercial opportunities have not passed others by. A franchise called the Source Bulk Foods, which has more than 50 shops across Australia, is setting up in the UK. There are already two stores in London owned by Patrick Cermak and Makayla Drummond, who have the master franchise for the brand in the UK and Ireland, and are looking for partners to develop a chain of shops here. "I walked into one of the Source Bulk Foods stores in Australia and I fell in love with it," says Drummond, an Australian-born accountant based in the UK. "I knew that they had nailed the concept of it – of bringing an old-school idea and modernising it to make it appealing to this generation. I was really excited and thought: 'We need this in London. I must bring this to London.'" Supermarkets, too, are waking up to consumers' growing awareness of the environmental impact of plastic packaging. Blue Planet II and other programmes demonstrating the dangers of plastics to marine life have had a huge impact – many of the customers I talk to mention the Attenborough effect – and recent stories such as the dead whale washed up in the Philippines with 40kg of plastic in its stomach are keeping the crisis at the forefront of the public's mind.

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Iceland Frozen Foods, which tops Greenpeace's league table ranking supermarkets' efforts to take on the scourge of plastic, has vowed to eliminate plastic packaging on its own-brand products by 2023. Richard Walker, Iceland's managing director, says the fact he is a surfer – and so all too aware of the rubbish floating in the sea – has made the issue a personal crusade. "I've seen the problem of plastic get worse," he says, "but I also knew I was part of the problem. Supermarkets are leading contributors to plastic waste, and I was keen to stand up and do something about it." Rival chains are also making the right noises. Morrisons, which is trialling a move from plastic bags to paper, says that by 2025 at the latest all its own-brand plastic packaging "will be reusable, recyclable or compostable". Marks & Spencer is running a trial at its large food store in Tolworth, south London, to see to what degree it can "remove packaging without affecting food quality and freshness". And even Sainsbury's, the butt of a Greenpeace April fool lambasting its poor performance on plastic, points out that it has reduced its own-brand packaging by 35% since 2005, and that nearly 40% of its packaging uses recycled content. Hopeless, says Greenpeace, which puts Sainsbury's at the bottom of its plastics league table, but a start. The dilemma for the new breed of zero-waste shops is that they want the supermarkets to see the light, but they don't want them to get so good at it that they drive the little shops out of business. "It's a double-edged sword because it will mean more competition," says Masefield, "but my principles mean I still want supermarkets to do it. In any case I don't think they will do it to the same level as us, or offer the personal touch or the same shopping experience." Jeanette Wong at the Clean Kilo reckons shoppers will spot shopkeepers who are jumping on the zero-waste bandwagon or engaging in "greenwashing" – paying lip service to environmental concerns – a mile off. "If it's a generic shop and the owners don't really know about zero waste, you get that feeling," she says. "Customers will know very quickly." At Hetu, a small zero-waste vegan shop in Wandsworth, south-west London, I discover a test for whether shopkeepers really are activists, too. When I hand my business card to Laura Boyes, who started the shop in December 2017, she takes a photograph of it and hands it back to me. "Zero waste!" she says triumphantly. If you truly buy into zero waste, it affects your whole attitude and lifestyle. Like many zero-wasters, Boyes sees herself as an agent of social change as well as a business person. This is social entrepreneurship in its purest form. Some zero-waste shops use plastic hoppers for their products, but she insists on glass. She also makes her customers aware that paper and cardboard have their own environmental downsides, and will suggest they reuse their paper bags rather than chuck them in the recycling. Every alternative to plastic has disadvantages, and

bioplastics are far from being the easy answer they are cracked up to be because many don't easily compost, so reuse beats recycling every time. "Our motto is: planet and purpose over profit," she says without a hint of smugness. And if supermarkets get really good at it, she says she will happily give up and do something else because the battle will have been won. On my mini-odyssey, something significant strikes me. I get the first inkling of it when I talk to Helen Bird, a strategic engagement specialist with the waste reduction charity Wrap, which oversees the UK Plastics Pact that most supermarkets have now signed up to – it commits them to eliminating "unnecessary single-use plastics" by 2025. Bird is fascinating on many points, not least in her assertion that plastic should not be seen as inherently the enemy – without it, food waste would be enormous. It simply needs to be used with discrimination. But the real insight she gives me is that the war on waste should be seen in the round. Fast fashion is also wasteful, and we discuss the irony that some people who deplore the use of plastic are also fond of online shopping for clothes that may be worn just once or twice before being discarded. The new generation of zero-waste stores are a delight and have the potential to change the way we shop and help revive the high street, but Bird makes me realise that the charity shops that many people see as disfiguring town centres and spelling decline for high streets are themselves performing a zero-waste function, ensuring that clothes and other goods are reused rather than sent to landfill. This sends me on a fresh line of inquiry – talking to co-ops such as the True Food Co-op in Reading, FareShares Food Co-op in south London and the Shrub Co-op in Edinburgh, none of which is strictly speaking zero waste or plastic-free, but all of which try to minimise waste packaging and, more importantly, have an ethos that puts the use of local products, the empowerment of local communities and social justice at the heart of what they do. They are crucial in understanding the nexus of social action and environmental concern, whether supporting local charities and running environmental workshops for schoolchildren in Reading, repairing bikes next to the community store in Elephant and Castle in London, or running a swap shop and food-sharing hub in Edinburgh. Discovering Nottingham Fixers, which is run by Sarah Maloy, who also has a zero-waste shop called Shop Zero in the city, was important, too. It's a simple point, but if you repair something it does not go to landfill. Ugo Vallauri, an Italian who cofounded the Brixton-based social enterprise the Restart Project, which had a hand in getting Nottingham Fixers off the ground, makes a strong case for the "right to repair" being essentially political. Manufacturers don't want consumers to repair things, he says. They want us to buy them all over again, so they make parts hard to get, don't supply proper instructions on how

products work and encourage us to see them as black boxes that have to be chucked away if they go wrong. Vallauri would like to see products "that are designed to be fully repairable, reusable, longer-lasting and not turning into unnecessary electrical waste after a few months".

I finish my journey in Brighton, where environmental concern is deeply embedded, every other person is a social entrepreneur, cafes have "no-laptop tables" to encourage proper mindfulness and hairdressers advertise themselves as "eco salons". Here, I find Infinity Foods, a co-operative established in 1971 that runs a vegetarian supermarket, a bakery and a cafe. It is not completely plastic-free, although it is doing what it can to minimise packaging, and plans to return to the hoppers for rice and pasta that it originally had in the 1970s. Ironically, those were removed because customers didn't like spending time queueing while other shoppers filled their containers. Convenience was king, and the supermarket ethos had taken over, even among the cognoscenti of Brighton. Now, tastes have come full circle. Infinity, which is also one of the country's leading wholesalers of organic and natural foods, stocks magazines that bring home just how large and well-organised this movement is: Ethical Consumer; Positive News (the cover story of which proclaims "The Joy of Fix: Claiming the Right to Repair"); Permaculture; Stir: the Magazine for the New Economy; and PlantBased (a magazine specialising in vegan recipes). What we eat and how we shop have never been more political, and the growth of the new generation of zero-waste shops should be seen as part of a 50-year struggle to change (and, the consumer revolutionaries would say, save) the world. Then it's lunch at Silo, widely acclaimed as Britain's first zero-waste restaurant, where bins are banned, the food is locally sourced (I especially appreciate the garnish of wild alexanders foraged from the beach) and anything left on the plate goes to a local farmer to turn into fertiliser. But my most telling meeting was an accidental one – with Siobhan Wilson, who runs a store called the Fair Shop. "The implications of climate change call for consumer change," declares the sign outside the shop, while a poster inside asks: "Who made my clothes?" Wilson has been running the store for 10 years, and its longevity is a little surprising given that she encourages customers not to buy too much. This is the opposite of fast fashion: slow, ethically sourced fashion; clothes built to last. Leather jackets made from end-of-line leather that typically would have been thrown away; T-shirts made from organic cotton, the growing of which involves no pesticides and uses only 10% of the water used in conventional cotton production; and tights made from recycled polyester. Wilson is wearing an intriguing-looking necklace, and when I ask her about it, she says it was made from bullets collected in farmers' fields

in Ethiopia, produced by a women's collective, bought from a market in Addis Ababa and marketed here by Cred jewellery. Now that really is zero waste.

The Guardian, 21 April 2019

http://www.guardian.com

Noise pollution: What you need to know about the carbon footprint of streaming music

2019-04-25

If you love sipping an herbal tea and munching an organic snack while you stream Spotify or Apple Music on a sleek device in your pocket, don't expect a sticker for being virtuous just yet. It turns out your mother may have been right about your music after all: it's just a bunch of noise pollution. Researchers at the University of Oslo and the University of Glasgow, in a joint study titled The Cost of Music, have determined that streaming music is worse for the environment than vinyl or CDs. Musicologists Kyle Devine and Matt Brennan studied the consumption of music through the decades, choosing key years based on U.S. record sales. They chose 1977 as the peak of vinyl sales, 1988 as the peak of cassettes, 2000 as the top-selling year for compact discs, and 2016 to focus on the downloading and streaming of music. They analysed the amount of plastics used to make each format, with levels averaging between 56 million kilograms to 61 million kilograms in the earliest years.

Researchers at the University of Glasgow and the University of Oslo have found that while we spend less on physical music these days, we are using more energy to listen to it.

As expected, with consumers ditching physical music for streaming music, the level of plastics used has dropped dramatically in recent years — 8 million kilograms in 2016. But when they measured the greenhouse gases it took to make the music of each year, the results surprised them. "The carbon footprint of listening to recorded music might actually be higher today than ever before," says Devine. Greenhouse gas emissions for streaming and downloading in 2016 were between 200 million and 350 million kilograms — over 50 million kilograms more than the peak year of CDs. Devine says a significant amount of that comes from the way streaming services power their servers, which often use coal, nuclear energy and gas as their major power sources. But he also notes the history of music recording has a harsh past.

The shellac era

His research looked into the ecology of music, comparing the materials used to make recording like gramophone discs, vinyl LPs, cassettes and

compact discs. In what was known as the shellac era, from 1900 to 1950, most recordings were made with bug-based resin mostly from India. The material was harvested and processed largely by women and children, according to a 1946 report by the Indian government on the working conditions in the shellac industry. "The report didn't mince words. It called it sweated labour, and this material is present in every record that was ever released during that period," said Devine. Then came plastics, with recordings made with oil-based products. Compact discs are made of a highly processed plastic that takes over a million years to decompose and contains Bisphenol A, or BPA, a chemical found to affect brain and behaviour in children. CDs can be recycled, but there is currently no consumer recycling program in Newfoundland and Labrador.

CDs are a triple-plastic challenge

Greentec International, an e-waste company based in Cambridge, Ont., recycles electronics and data for large companies, including CDs. The company's president and CEO, Tony Perrotta, says it can be time-consuming to recycle the materials used to make CDs for reuse. "You have the jewel case, which is made up of a polystyrene type of material. And then you'd have the actual insert, made of some type of paper stock or fibre. And then you have the actual disc, which is made of polycarbonate." Perrotta says it's important we all put in an effort for the environment. "The municipalities and the blue box programs need to evolve to allow consumers to add these product streams to their recycling streams," he said. Devine says his work isn't to make others feel guilty, but to start a conversation. "I think for a lot of people (we're thinking about this) for the first time. Certainly, for me it was the first time," he said. "So, there's a positive message — by the very fact that we're already discussing it, we've already started to do something about it."

CBC, 21 April 2019

http://www.cbc.ca/story/science

Triclosan has been phased out of many consumer products as scientists continue to study health risks

What happened to triclosan? A lingering legacy of the hyper-hygiene era

2019-04-25

Whatever happened to triclosan? A few years ago, we were brushing our teeth with it, rinsing our mouths with it, sanitizing our hands with it and sending a lot of it down the drain and into rivers and lakes. Hundreds of cosmetic and cleaning products contained triclosan, including, at

one point, almost all of the antibacterial liquid soap that was sold to consumers. Recently, the U.S. Food and Drug Administration (FDA) announced it was finalising the latest in a series of rules that would require companies to prove that triclosan was more effective than ordinary soap.

Legacy of the hygiene craze

Government health agencies began questioning the safety of triclosan almost a decade ago, at the height of a hygiene craze after antibacterial soaps and cleansers had already swept the consumer marketplace. Back in the 1970s, triclosan was a specialised compound primarily used in hospital surgical wards. But by the end of the '90s, household "antibacterial" soaps and cleansers with triclosan were everywhere. "The companies were not putting it in for nefarious reasons; they were putting it in for health reasons," said Julie Gosse, a scientist at the University of Maine who studies triclosan. "But there hadn't been a whole lot of actual toxicology studies done on it." Over the last two decades, the population has been so widely exposed to triclosan that it has shown up in human urine tests all over the world.

Still, key questions remain. Is triclosan safe? The FDA wasn't sure, stating in 2013 that "there are unresolved safety considerations regarding long-term daily use," mainly because important human health studies had not been done. Is triclosan effective? Was there any health advantage to exposing everyone to this chemical? The FDA decided to put that question to the companies relying on the agent, asking them to provide evidence to support the use of triclosan. Instead, major manufacturers have gradually stopped using it.

The rise and fall of triclosan

By 2015, Johnson & Johnson had removed triclosan from all of its products "in response to feedback from our consumers and customers," a company spokesperson told CBC News in an email. Both Unilever and Colgate-Palmolive told CBC News they have also taken triclosan out of their products. Colgate Total toothpaste was reformulated to eliminate triclosan late last year, a company spokesperson said. And by the end of last year, triclosan was gone from Loblaws' and Shoppers Drug Mart's President's Choice and Life Brand household and cosmetic products. A Loblaws spokesperson told CBC News in an email that feedback from the company's scientific advisers and customers "suggested a move away from this ingredient was necessary, so we took the proactive approach to remove triclosan." Even though triclosan is vanishing from the marketplace, the chemical is still deemed safe for human use by Health

Canada. Health Canada allows triclosan in some cosmetic products, if the concentration is below a specified level. Products with higher levels must be approved through a formal drug application process, where the products are assigned a Drug Identification Number (DIN). "Health Canada has approved 64 marketed drug products with a DIN that contain triclosan. These are not all hand sanitisers —some are soaps, hand washes and toothpastes," a Health Canada spokesperson said in an email.

New research on triclosan and human health

Meanwhile, scientists are still investigating the human health effects of triclosan — and new evidence is starting to emerge. Julie Gosse, biomedical scientist discovered that triclosan can affect human mast cells, an important part of the immune system. "We found that triclosan inhibits mast cell function quite acutely and quite strongly at concentrations that are completely relevant to what people would be exposed to when they're washing their hands with this stuff or using the toothpaste." She's also shown that triclosan can affect the mitochondria of human skin cells. "In real time, with super resolution microscopy, we've seen the mitochondria become deformed within a matter of minutes. And these are the energy powerhouses of the cell," she said. Mitochondrial testing is now done routinely on new chemicals, but Gosse said that wasn't the case when triclosan first came on the market. Many other human health tests were also not done. "What's missing is there was not a lot of studies on neurodevelopment — and there still aren't to this date," said Joseph Braun, an environmental epidemiologist at Brown University in Providence, Rhode Island. "We have filled some of that gap in and found at certain times during pregnancy, particularly around delivery, [triclosan exposures] are associated with decreases in IQ, in one of our studies," he said. "And then we've also found that triclosan exposures across pregnancy are associated with behavioural disorders in children, particularly ADHD-related behaviours, and those associations may be stronger in boys." Braun is following a cohort of teenagers to monitor those cognitive and behavioural effects over time. Other research has suggested triclosan could be associated with lower thyroid levels and lower birth weight. "The evidence has increased that triclosan is potentially harmful," said Braun.

'Highly toxic' to fish

Although Canada's federal Health and Environment ministries have concluded that triclosan is safe for humans, the compound has been deemed "highly toxic" to fish and other aquatic organisms, affecting "growth, reproduction and survival," according to a federal environmental

assessment. Last year, Canada added triclosan to its official list of toxic chemicals under the Environmental Protection Act and the federal government is currently working on a triclosan pollution prevention program that would require companies to reduce their triclosan by 30 per cent by May 2020. Environment and Climate Change Canada already reports that triclosan is "continuously present" in the Canadian environment. Other studies have detected triclosan in rivers and lakes all over the world, after years of the agent being flushed down household drains.

CBC, 20 April 2019

http://www.cbc.ca/story/science

Landmark discovery as Aberdeen researchers find air pollution can stunt babies' growth

2019-04-25

A landmark discovery by north-east researchers has linked air pollution with harm to babies during pregnancy.

Scientists at Aberdeen University have found that infants' growth can be stunted if they are exposed to nitrogen dioxide while in the womb. And in turn, this can lead to a higher chance of them developing heart disease, asthma and diabetes. Nitrogen dioxide is primarily generated by vehicle traffic but can also come from cigarette smoke and kerosene heaters and the researchers are calling for "urgent" measures to minimise pregnant mothers' exposure to the gas. The group studied more than a decade's worth of research evidence from around the globe to come to their conclusion, finding that foetal growth was particularly affected by pollution in the final three months of pregnancy. Professor Steve Turner, who led the investigation, said: "In our research we looked at all the studies that measured the effects of mothers' exposures to everyday substances including air pollutants, alcohol, and diet on the size of the unborn baby, measured through ultrasound from halfway through the pregnancy and onwards. "The seven studies where air pollution was measured and linked to foetal size were from different geographical areas of the world, including Australia, the USA and several countries in Europe. "However, in all of the studies the evidence was clear that, in the third trimester in particular, exposure to nitrogen dioxide reduced foetal growth." Some of Scotland's streets are regularly shamed for having high levels of air pollution. In January, Friends of the Earth Scotland revealed that streets in Glasgow, Edinburgh, Dundee and Aberdeen had all either breached the legal limits or come "perilously close" to doing so. Prof Turner added: "Our research has shown that the link between exposure and foetal growth is apparent well before birth, so any potential interventions need to happen

in the early stages of pregnancy. "Furthermore, the findings also suggest that public health measures are urgently required to minimise pregnant mothers' exposures to nitrogen dioxide."

Time to act

Environmental campaigners say councils and the Scottish Government need to act soon to reduce air pollution and its associated health risks. Friends of the Earth has called for the widespread introduction of park and ride networks and low emission zones (LEZ) in city centres. LEZs ban traffic which do not meet emission standards by using number plate recognition cameras to send fines to the vehicles' owners. They have been set up in Greenwich, Oxford and London and the first in Scotland came into effect in Glasgow in December. Councils in Aberdeen, Dundee and Edinburgh are currently carrying out assessments for how LEZs could be established in their cities. Friends of the Earth Aberdeen co-ordinator Gregor McAbery said: "Almost every week now we see new research confirming the direct impact of air pollution, largely from diesel vehicles on our roads. "Air pollution from traffic is a public health crisis, affecting us before we are even born, and shortening the lifespans of many adults who work in or live in or even visit busy traffic corridors." "We also need to ensure the public is kept informed so that they know why changes are coming for the sake of their health, what they should think of when buying a vehicle, and why walking, cycling and using public transport are good for them and others."

The Press & Journal, 19 April 2019

https://www.pressandjournal.co.uk

Some bottled water contains arsenic levels that researchers and regulators deem potentially unsafe.

Arsenic in Some Bottled Water Brands at Unsafe Levels, Consumer Reports Says

2019-04-25

Natural foods grocery chain Whole Foods introduced its new brand of bottled water at a 2015 investor event, where company executives heralded the product's purity and healthfulness. "It naturally flows out of the ground," chief operating officer A.C. Gallo said about the company's spring in Council, Idaho, according to a published transcript on its website. "We built, actually, a spring house over it so we can let the water go down to the bottling plant. It's amazingly pristine water." Yet from late 2016 to early 2017, Starkey Water—the name of Whole Foods' brand—recalled more than 2,000 cases of water after tests by regulators showed an impermissible level of arsenic beyond the federally mandated

threshold of 10 parts per billion. A year later, Whole Foods' internal testing showed results that were just under the federal limit but still at levels that pose risks if regularly consumed, according to growing research and independent experts, including Consumer Reports' scientists. Over the past few years, as consumers have worried more about the quality of municipal tap water, bottled water has surged in popularity. It's now the nation's best-selling bottled beverage, according to the International Bottled Water Association. But a CR investigation has found that in some cases bottled water on store shelves contains more potentially harmful arsenic than tap water flowing into some homes. "It makes no sense that consumers can purchase bottled water that is less safe than tap water," says James Dickerson, Ph.D., chief scientific officer at Consumer Reports. "If anything, bottled water—a product for which people pay a premium, often because they assume it's safer—should be regulated at least as strictly as tap water." For this report, CR tracked down and reviewed hundreds of public records and test reports from bottled water brands, and from various federal and state regulators. We found that several popular brands sell bottled water with arsenic levels at or above 3 ppb; current research suggests that amounts above that level are potentially dangerous to drink over extended periods of time. CR believes the federal limit for bottled water should be revised to 3 ppb from the current federal standard of 10 ppb. In total, CR identified 11 brands out of more than 130 that either self-reported or, based on tests we commissioned, had detectable amounts of arsenic. Of those, six had levels of 3 ppb or higher. These brands are Starkey (owned by Whole Foods), Peñafiel (owned by Keurig Dr Pepper), Crystal Geyser Alpine Spring Water, Volvic (owned by Danone), and two regional brands, Crystal Creamery and EartH_2O.
As part of our investigation, CR also was able to purchase two brands of imported water—Jermuk from Armenia and Peñafiel from Mexico—that are on an import alert issued by the federal government for previously having arsenic levels above the federal limit of 10 ppb. Such an alert is meant to "prevent potentially violative products from being distributed in the United States," according to the Food and Drug Administration. Even so, CR easily purchased the two brands in retail stores in two states and on Amazon. A spokesperson for the FDA, which regulates bottled water, wouldn't comment directly on the availability of the products but said that the agency takes the issue of heavy metals "seriously" and that if a product on the market is deemed "adulterated," the agency will take "appropriate action." Beverage giant Keurig Dr Pepper provided CR in March with Peñafiel's bottled water quality report for 2018, which stated that the water had nondetectable amounts of arsenic. But the company said this week that it had conducted new testing, because of CR's questions, and

confirmed levels above the federal limit, at an average of 17 ppb. Keurig Dr Pepper said that it had suspended bottled water production for two weeks at its Mexico facility that makes Peñafiel for export to the U.S. It plans to improve filtration at the plant to lower arsenic levels, the company told CR. For its latest internal testing, the company said it used a different protocol and consulted the FDA. A recall isn't planned, Peñafiel said, but CR believes one should be issued. "An arsenic level of 17 ppb is a clear violation of the federal bottled water standard of 10 ppb," says Jean Halloran, director of food policy initiatives at CR. "Keurig Dr Pepper should recall all Peñafiel water currently on the market that may contain these violative levels. If they do not act, the FDA should mandate a recall."

Companies Can Remove Arsenic

Arsenic is a naturally occurring heavy metal that can cause disease and also affect child development. It can be found in natural water supplies, depending on the geology of the area. There are also water sources that don't contain the heavy metal. Companies can test for it and also use certain treatment processes to remove it from water. "With bottled water, why should you have arsenic in the water?" says Ana Navas-Acien, M.D., Ph.D., professor of environmental health sciences at the Mailman School of Public Health at Columbia University in New York City. "There should be plenty of opportunities for treatment and remediation." Bottled water manufacturers promote their product as a pure, healthy alternative to sugar-loaded sodas, and the industry's sales have been on a continuous climb for years, thanks in part to skittish consumers uneasy about the quality of water from their taps after a highly publicised water quality scandal in Flint, Mich., in 2015. To be sure, CR also found dozens of bottled water brands that reported nondetectable levels of arsenic. And drinking a single glass of water with 3 ppb of arsenic probably will not harm you, says Dickerson at CR. But regular consumption over extended periods increases the risk of cardiovascular disease, can lower IQ scores in children, and can cause certain cancers and other health problems, he says. CR's investigation—which focused only on arsenic levels—shows that, unlike tap water, bottled water is regulated in a hodgepodge fashion. Moreover, some states have inconsistent arsenic guidelines in place for tap and bottled water, with stricter thresholds in place for tap than for bottled water. And public records on bottled water quality are also difficult to access, CR found, with some states destroying company testing reports after a year and other states not collecting them at all. The FDA set the federal threshold for arsenic in drinking water at 10 ppb in 2006, in line with the standard for drinking water set by the Environmental Protection

Agency, which regulates tap water. But New Jersey says the level for tap water should be half that. New Jersey's Department of Environmental Protection says that water with arsenic above 5 ppb shouldn't be used for "drinking, cooking, mixing baby formula, or in other consumptive ways." However, the state's bottled water arsenic limit is still 10 ppb, in keeping with the federal standard. New Hampshire is considering a similar standard, but also for tap water only. CR says the limit for arsenic in bottled water should be revised from 10 ppb to 3 ppb, the same threshold CR recently proposed for apple, grape, and other juices. Recent CR testing detected the heavy metal in some juices at levels posing potential health risks.

Spot Testing 3 Brands

For this report, CR decided to commission its own independent spot tests for three brands that the FDA had previously flagged for elevated arsenic levels—the Starkey Whole Foods brand, and also Peñafiel (owned by Keurig Dr Pepper) and Jermuk. The test results show that Whole Foods' bottled water still has levels of arsenic that approach or exceed the legal federal limit: Three samples tested this month ranged from 9.48 to 9.86 ppb of arsenic; a fourth registered 10.1 ppb, just above the federal limit of 10 ppb. The tested bottles of water were purchased in March at retail locations. In a statement, Whole Foods said it had recently conducted an analysis on Starkey samples from the same lot used in the tests that CR commissioned. The company said the tests "show these products are fully compliant with FDA standards for heavy metals." The company also said it tests "every production run of water before it is sold." "We would never sell products that do not meet FDA requirements," the company's statement said. At the same time, the Jermuk samples we tested revealed dramatically lower arsenic levels than a government test result indicated in 2009. The result of that earlier test prompted the import alert that remains in effect. CR's recent test of Jermuk water shows three tested samples averaging about 1.31 ppb, well below the federal threshold and down from the more than 450 ppb the government found in 2009. (The company bottles water at a single plant in Armenia, according to its website. Jermuk didn't respond to requests for comment.) All three Peñafiel samples CR tested, however, found arsenic levels well above the 10-ppb limit, registering an average of 18.1 ppb. Katie Gilroy, spokesperson for Keurig Dr Pepper, says the new internal tests of Peñafiel were conducted after CR's inquiries, revealing "somewhat elevated levels" consistent with our testing results at about 17 ppb. "Because the health and safety of our consumers is our top priority, as soon as we received

the test results, we took immediate action by stopping production at the Mexico facility in question, working with outside experts, and consulting with the FDA, which is supportive of our action plan," Gilroy says. (An FDA spokesperson didn't respond to a request for comment on this subject in time for publication.) "The independent experts with whom we are working have indicated that there is no health or safety risk to consumers at the current levels, and we have begun remedying the situation by enhancing the filtration system in the plant, which we expect to take two weeks," Gilroy said. "At that point, we will resume production." Gilroy says tests were conducted on products for sale in the U.S. market, "which come from one production location in Mexico." The International Bottled Water Association says that any product that doesn't meet the FDA's 10 ppb standard for arsenic "should not be allowed to be sold." "As with other food products, bottled water that does not meet all applicable laws and regulations is subject to FDA enforcement actions, including recalls, warning letters, and product seizures," the IBWA says. "This helps ensure that adulterated or mislabelled products do not reach consumers."

America's Favourite Bottled Drink

The popularity of bottled water can't be overstated: Consumers nowadays have hundreds of brands to choose from—some carrying celebrity endorsements; others touting big, sometimes vague, health claims. But even as water has become the nation's most popular bottled beverage, CR's investigation also found that the regulatory regime meant to protect consumers is inadequate. The federal government's safety inspections of water bottling facilities hit a 15-year low in 2017, according to documents CR obtained through a public records request. In 2010, the FDA conducted 371 inspections; by 2017, that number fell to 209. These inspections include verifying that companies have test results on file for their products. But records show that some companies have been issued violations by the FDA and state agencies for lacking legally required test data. The companies were required to correct the violations by a later date, records show. The FDA doesn't conduct tests on individualised finished bottled water during these inspections, a spokesperson said, and relies on companies to produce their own results. (Imported water could be tested during routine border testing at ports of entry, however, the spokesperson said.) That could be an unsettling reality for some consumers, especially those in cities that have turned to bottled water because of unsafe tap water, such as Flint, Mich., which continues to deal with the effects of a lead-in-water scandal that began in 2015. "This is a huge, multibillion-dollar industry selling a product that is viewed by many consumers as

safer than tap water," says Erik Olson, senior director of health and food at the Natural Resources Defence Council (NRDC), which published a four-year bottled water study in 1999. He says that "meaningful oversight of this extremely profitable business" is needed and that consumers should be able to easily get test results online. Years after Flint's lead contamination first became known, donations of bottled water continue to flow into the city. At the same time, perhaps in response to quality concerns that Flint's crisis sparked elsewhere, sales of bottled water nationally have risen 19 percent, to $18.5 billion in 2018, according to the IBWA. "These companies make a mint on basically something that's a free resource," says David Carpenter, Ph.D., director of the Institute for Health and the Environment at the State University of New York at Albany. "So, there's no reason that they can't find a water source that is either very, very low in arsenic, or do the treatment themselves."

Looking for Arsenic Answers

A key problem, CR found, is that the industry and the government haven't made it easy for the public to obtain information on bottled water quality. For one thing, a public repository of bottled water quality information currently doesn't exist. Few states regularly conduct independent tests on bottled water for contaminants, as municipalities must for tap water. Many states, however, require bottled water companies to submit the results of their own testing to sell products. But CR found that information can be hard to come by. In California, for example, CR filed a public records request for all test reports submitted to the state by bottled water manufacturers, as required under a 2009 state law. Because the state discards these records once a company is deemed in compliance, the best it could do was to provide CR with a list of companies licensed to bottle water. The state recommended that we contact the companies for their reports. So, we did. Ultimately, using the California list and other sources, we obtained reports representing more than 130 bottled water brands across the country, either through company websites or in response to queries sent to them. We also reviewed public records and independent studies that have analysed bottled water. Overall, beyond our tests that revealed Peñafiel, owned by Keurig Dr Pepper, had levels of arsenic in excess of the federal standard, five companies self-reported levels at or above CR's recommended cut-off of 3 ppb. In addition to Starkey (8 ppb), that included two other national brands—Crystal Geyser (3.8 ppb for water bottled at its facility in Olancha, Calif.) and Volvic (4 ppb). EartH_2O (3 ppb), a firm based in Oregon, reported 3 ppb. Crystal Creamery, based in California, reported in 2017 that its water contained 5 ppb of arsenic.

Curiosities

The California Department of Health says the company's license to sell bottled water expired in June 2018. Some consumers, however, may still have the product on their shelves. Two more brands, Aguavida, a regional brand in California, and Badoit, a mineral water owned by Danone, fell shy of CR's cut-off, reporting 2 ppb, a level researcher say is associated with health issues such as high blood pressure and circulatory problems. Two leading national brands—Fiji and Niagara Bottling (for its spring water)—reported 1 ppb of arsenic on average in their most recently available reports. Another, Poland Spring, reported nondetectable levels below 2 ppb. CR contacted the companies that reported detectable amounts, and of those that responded, most said that they adhered to government standards and that arsenic can be naturally occurring. Crystal Creamery and Crystal Geyser did not respond to a CR request for comment. "Volvic Natural Spring Water is naturally filtered as it slowly trickles down through hundreds of layers or porous puzzolana sand, basalt, and lava stone," said Alessandra Simkin, senior manager of external communications at Danone, which owns Volvic, in a statement. "As the water filters through these different volcanic layers, it absorbs natural minerals, where arsenic naturally occurs. The level in Volvic is 4 ppb, well below the FDA arsenic maximum level. Volvic is safe and in full compliance with all applicable federal, state, and industry bottled water standards." Austin Bouck, plant manager at EartH_2O, said in an email, "As a responsible producer of bottled water, we continue to listen to the public health experts at the FDA and EPA to help us ensure we produce a safe, wholesome product, just as we did in 2000 when the arsenic limits were last evaluated." "We always encourage those agencies to make decisions that are in the best interest of public health and consumer choice, and will continue to re-evaluate our water source as new benchmarks and standards are established," Bouck said. Separately, independent studies have tested other brands and found arsenic: A 2011 study conducted by the Los Angeles County Agricultural Commissioner/Weights & Measures found that grocery chain Trader Joe's bottled water had 3.48 ppb of arsenic. Trader Joe's didn't respond to repeated requests for comment on the study's findings.

How Much Arsenic Is Too Much?

Arsenic—found naturally in soil, minerals, air, and plants—enters water by way of eroding rocks and minerals, urban runoff, pesticides, and municipal waste disposal. Because it's ubiquitous, it can also get into the foods and drinks we consume. In fact, CR has recently found worrisome levels of arsenic in juices and baby foods. For many years, the upper limit for arsenic in drinking water was set at 50 ppb. But in 2001, the EPA responded to

rising concerns about the heavy metal's health risks by lowering that level, initially suggesting 3 ppb as a "feasible" cut-off. The agency eventually settled on 10 ppb because it "maximizes health risk reduction benefits at a cost that is justified by the benefits." Growing research, however, suggests that the health risks of arsenic exposure emerge at levels below 10 ppb, especially in children, says Joseph Graziano, Ph.D., a professor of environmental health sciences at Columbia University's Mailman School of Public Health and professor of pharmacology at Columbia's medical school. For example, a 2014 study he co-authored found that an arsenic level of 5 ppb or greater in a child's household water supply was associated with a 5- to 6-point reduction in IQ compared with those whose exposure to arsenic levels was below 5 ppb. Regular exposure to small amounts of arsenic can also harm adults. A 2017 study published in the journal Environmental Research found a relationship between exposure to arsenic levels starting around 2 ppb and prostate cancer among men in Iowa, prompting the authors to suggest that the 10-ppb arsenic limit may "not be protective for human health." And public health officials in New Hampshire, in explaining their pending proposal to lower the state's cut-off for arsenic in tap water, cited research that potentially identified health problems that appear at levels below 10 ppb, including "lung, bladder and skin cancer; cardiovascular disease; adverse birth outcomes; illnesses in infants; and reduced IQ." In fact, the EPA itself sets its "maximum contaminant level goal" for arsenic in water—the level below which there is no known or expected risk to health—at zero. Experts acknowledge that reaching that goal may not be practical, especially for municipal water supplies, because the cost of purification could be prohibitive. But Navas-Acien at Columbia says that consumers often purchase bottled water because they believe it's a safe product. "The standard [for arsenic] needs to be stronger for bottled water, as compared to just regular old tap water," she says. And the FDA does have a history of enforcing stricter standards: The agency requires bottled water companies to keep lead levels below 5 ppb, but the EPA allows tap water to contain up to 15 ppb of that heavy metal.

Consumer Reports, 18 April 2019

https://www.consumerreports.org

Measles Epidemic: As an Adult, Do You Need a Vaccination to Protect Yourself?

2019-04-25

As the measles outbreaks spread, many people are growing concerned. New York City declared a public health emergency and mandated vaccinations in four ZIP codes where vaccination rates have been low. An Israeli flight attendant is in a coma from being infected with the highly contagious disease. As a professor who teaches courses in immunology, microbiology and vaccine public policy, I research the fundamental processes of how our bodies respond to infections and vaccines to generate protective immunity. In my teaching, I work with students to develop an understanding of the complexity of these issues and encourage them to engage in the public discourse on these topics from balanced and informed perspective. Given all the attention around measles, here's what people who believe they have been vaccinated should know.

I received my vaccines more than 30 years ago. Am I still protected?

Yes, according to the Centres for Disease Control and Prevention (CDC), the measles component of the MMR vaccine provides lifelong protection. The mumps and rubella portions are not as long-lived. One dose of the MMR vaccine protects against measles at 93 percent efficacy (that is, 93 percent of individuals will receive the protective benefit of the vaccine), two doses of the vaccine provides 96-97 percent efficacy. The Advisory Committee on Immunisation Practices at the CDC began recommending two doses of the MMR vaccine in 1989 in response to a measles outbreak in children who had been vaccinated by only a single dose.

I'm not sure that I received two doses of the MMR. Do I need another shot?

Concerned individuals should contact their physician for recommendations on how best to proceed. The CDC recommends the following are considered "evidence of immunity" that would make vaccination considered unnecessary: written documentation of vaccination; one or more doses of a vaccine containing measles administered on or after the first birthday for preschool-age children and adults not at high risk; two doses of measles-containing vaccine for school-age children and adults at high risk, including college students, health care personnel, and international travellers; laboratory evidence of immunity; laboratory confirmation of measles; or birth before 1957.

Curiosities

Surveys suggest that 95-98 percent of individuals born before 1957 were exposed to measles as children, giving them lifelong natural protection.

I don't have my vaccination records, and I'm not sure I even received one dose. What should I do?

Talk to your provider; you may need a shot. The CDC recommends that all individuals born after 1957 receive a vaccine for the measles. Measles is not strictly a childhood disease and adults and teenagers should be up-to-date on their vaccination. If you do not know your vaccine status, best practices would suggest you speak with your physician about receiving the vaccine. Of particular emphasis are international travellers, health care professionals, women of childbearing age, close contacts of immunocompromised individuals, and people with human immunodeficiency virus (HIV).

Should some people not be vaccinated?

Yes. The CDC recommends that you tell your vaccine provider if the person getting the vaccine:

- has any severe, life-threatening allergies to any part of this vaccine
- is pregnant, or thinks she might be pregnant
- has a weakened immune system due to disease (such as cancer or HIV/AIDS) or medical treatments, such as radiation, immunotherapy, steroids or chemotherapy
- has a family member with a history of immune system problems
- has ever had a condition that makes them bruise or bleed easily
- has recently had a blood transfusion or received other blood products
- has tuberculosis
- has gotten any other vaccines in the past four weeks
- is not feeling well.

Other than being vaccinated, is there anything else I can do to stay safe?

Vaccination is the single best preventative strategy in avoiding the measles. As is the case for all contagious infections, proper hygiene practices, self-isolation while sick and avoiding contact with sick individuals are also useful practices in limiting the contraction and spread of disease.

Science Alert, 23 April 2019

http://www.sciencealert.com.au

Technical Notes

CHEMWATCH

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

ENVIRONMENTAL RESEARCH

Behavioural profile alterations in zebrafish larvae exposed to environmentally relevant concentrations of eight priority pharmaceuticals

Occurrence and spatial distribution of phthalate esters in sediments of the Bohai and Yellow seas

Species turnover reveals hidden effects of decreasing nitrogen deposition in mountain hay meadows

Application of essential oils as a natural and alternate method for inhibiting and inducing the sprouting of potato tubers

A comparison of transgenic rodent mutation and in vivo comet assay responses for 91 chemicals

MEDICAL RESEARCH

In vitro evaluation of organic extractable matter from ambient PM2.5 using human bronchial epithelial BEAS-2B cells: Cytotoxicity, oxidative stress, pro-inflammatory response, genotoxicity, and cell cycle deregulation

The impact of a quality improvement project to standardize pain, agitation, and withdrawal assessments on the use of morphine and midazolam in the Paediatric Intensive Care Unit

Optical, electrochemical and catalytic methods for in-vitro diagnosis using carbonaceous nanoparticles: a review

Quality of INR control and switching to non-Vitamin K oral anticoagulants between women and men with atrial fibrillation treated with Vitamin K Antagonists in Spain. A population-based, real-world study

Effects of intravenous oxycodone alone or in combination with naltrexone on measures of respiratory depression: a randomised placebo-controlled study

OCCUPATIONAL RESEARCH

Probabilistic risk assessment of occupational exposure to volatile organic compounds in the rendering plant of a poultry slaughterhouse

Technical Notes

Innovations in Worksite Diagnosis of Urinary Tract Infections and the Occupational Health Nurse

Urinary trimethyl tin reflects blood trimethyl tin in workers recycling organotins

The quantitative and qualitative parameters of rhynthytocograms in methanol and formaldehyde impact in production environment

Health Risks of Polybrominated Diphenyl Ethers (PBDEs) and Metals at Informal Electronic Waste Recycling Sites

PUBLIC HEALTH RESEARCH

Lactational exposure to phthalates impaired the neurodevelopmental function of infants at 9 months in a pilot prospective study

Mercury levels in blood, urine and hair in a nation-wide sample of Spanish adults

Potential Health Risks of Chemicals in Car Colorant Products

Changing prevalence of current asthma and inhaled corticosteroid treatment in the UK: population-based cohort 2006-2016

Assessment of human oestrogen receptor agonistic/antagonistic effects of veterinary drugs used for livestock and farmed fish by OECD in vitro stably transfected transcriptional activation assays