Bulletin Board
FEB. 15, 2019

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CHEMWATCH

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CHEMWATCH

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TECHNICAL NOTES

ASIA PACIFIC

Draft secondary notification assessment on Irgalube 232 for public comment

2019-02-08

The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) has conducted a secondary notification assessment on Irgalube 232 under the Industrial Chemicals (Notification and Assessment) Act 1989 (ICNA Act). In the April 2018 Chemical Gazette, the chemical was declared as requiring secondary notification.

Why the chemical needed a secondary notification

The chemical required secondary notification and reassessment because:

- it is now being used as a collector in the sulphide flotation process in mining operations;
- introduction volumes significantly exceed those previously assessed;
- new toxicity data are available, which warrant a review of the hazard classification of the chemical.

Draft report for public comment

The draft assessment report has been released for public comment. The secondary notification assessment report is an evaluation of the relevant new information on the potential human health and environmental risks that may be associated with exposure to the chemical.

Assessment findings — report recommendations

Based on the assessment findings, the chemical is classified according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) as below:

- Toxic to Reproduction (Category 2): H361D – suspected of damaging the unborn child;
- Chronic aquatic toxicity (Category 4): H413 – may cause long-lasting harmful effects to aquatic life;

It is recommended that importers revise the SDS and labels to reflect the amended classification. It is also recommended that users of the chemical should:

- avoid contact during pregnancy/while nursing
- avoid contact with skin and eyes

The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) has conducted a secondary notification assessment on Irgalube 232 under the Industrial Chemicals (Notification and Assessment) Act 1989 (ICNA Act).

- not directly dispose of it to surface waters or soils

Request for variation applications

You can request a variation to the report. When requesting the variation, you:

- Should outline any amendment or change(s) requested.
- Must identify the exact words, sentences or paragraphs in the report to be varied. You must also provide any replacement words, sentences or paragraphs.
- Must explain the rationale behind the request and include any relevant references.

Variation requests must be submitted by 5 March 2019.

Further information is available at:

Download the draft report on Irgalube 232 [PDF 1.5MB]

Download the application for Variation (Form 4a) [Word 69 KB]

NICNAS, 22 January 2019

http://www.nicnas.gov.au

Heat and work injury prevention – a shared responsibility

2019-02-08

An experienced panel of work health and safety experts explore key issues on heat and work injury, including: the importance of developing and adhering to preventative strategies for working in heat, identifying hazards, implementing risk-management strategies, and the need for training and awareness across all levels of management. Heat is a hazard that can cause heat-related illness and increase the risk of work-related injury. Preventative strategies are needed for both indoor and outdoor work environments to address the risks working in heat poses for workers, as well as potential losses in productivity. Safe Work Australia and SafeWork SA have been working with researchers at the University of Adelaide, Monash University, University of Western Australia, Queensland University of Technology and SA Health, on a national project focused on preventing work-related injury in hot conditions. Researcher and educator Professor Dino Pisaniello opened the panel discussion with key insights from this research which sets the scene for industry experts to discuss the work-related injury in hot conditions. The panel agree that elimination

An experienced panel of work health and safety experts explore key issues on heat and work injury, including: the importance of developing and adhering to preventative strategies for working in heat, identifying hazards, implementing risk-management strategies, and the need for training and awareness across all levels of management.

and safe design should be a priority for decision and policy makers. They also discuss the importance of evidence, strong safety culture, awareness of regulatory policy, and good leadership and engagement from all levels of management. The seminar was aimed at policy makers, influencers, subject matter experts, business owners, managers, supervisors, regulators and WHS professionals and representatives.

Safe Work Australia, 24 January 2019

http://www.safeworkaustralia.gov.au

Taiwan Pec registration delayed until 2020

2019-02-08

Taiwan's Toxic and Chemical Substance Bureau (TCSB) plans to delay the start of standard registration for 106 priority existing chemicals (Pecs) until 1 January 2020, according to a TCSB official. It was previously scheduled for 1 July this year. The delay is a consequence of the long-awaited draft revisions to the Regulation of New and Existing Chemical Substance Registration, which has also been held up. The Regulation creates the Pec registration rules. "We must give manufacturers and importers a buffer period of at least six months, so we decided that the most convenient date to begin Pecs registration would be 1 January 2020," said Hsu Chung-hao, section chief in the TCSB's evaluation management division. Mr Hsu told Chemical Watch that these revisions "may be enacted as soon as the end of February or by the end of March at the latest". Last November, the TCSB anticipated the revised regulation would be promulgated by the end of the year. But this was delayed by the resignation of Democratic Progressive Party (DPP) premier Lai Ching-te and his cabinet, after major setbacks in last November's local elections. In line with Article 17 of the rules, companies manufacturing or importing any substance from the Pecs list will be required to complete standard registrations:

Change in government means process will begin six months later than expected

- for annual volumes of 100 tonnes or above, by the end of 2022; or
- for annual volumes of 1-100 tonnes, by the end of 2023.

Chemical Watch, 31 January 2019

http://chemicalwatch.com

Regulatory Update

New Standard on Major Hazard Installations for Hazardous Chemicals to Take Effect in March 2019

2019-02-08

On 19 November 2018, Chinese State Administration for Market Regulation and Standardisation Administration announced the release of the revised *Identification of Major Hazard Installations for Hazardous Chemicals* (GB 18218-2018). It will come into mandatory effect on 1 March 2019. Compared to the previous version GB 18218-2009, the key changes to GB 18218-2018 are presented as follows:

- **Scope of the standard:** It is specified in GB 18218-2018 that the standard does not apply to offsite transport of hazardous chemicals.
- **Definition of "hazardous chemicals" and "major hazard installations":** In line with *Regulations on the Control over Safety of Hazardous Chemicals* (State Council Decree No. 591), hazardous chemicals in GB 18218-2018 refer to highly toxic chemicals and other chemicals which are toxic, corrosive, explosive, flammable or combustion-supporting and can do harm to the human body, facilities and the environment. The new document defines major hazard installations for hazardous chemicals as units which engage in long-term or temporary production, storage, use or operations of hazardous chemicals and where the quantity of hazardous chemicals is equal or greater than the threshold quantity.
- **Major hazard installation unit:** In GB 18218-2009, a major hazard installation unit refers to a (a set of) production device, facility or site, or several (sets of) production devices, facilities or sites, in one production and business operation entity, which are within a distance of 500 meters of each other; while in GB 18218-2018, the 500m threshold is removed and the document divides major hazard installations into two types of unit, namely production unit and storage unit.
- **Classification criteria of hazardous chemicals:** GB 18218-2018 employs the classification criteria of hazardous chemicals stipulated in the GB 30000-2013 series on China GHS classification and labelling of chemicals.
- **Content in tables:** The Table 1 ("Names and threshold quantities of hazardous chemicals") in GB 18218-2018 contains 85 hazardous chemicals, 7 more than those in the previous version, and both Table 1 and 2 ("Categories and threshold quantities of hazardous chemicals which are not included in Table 1") involve several modifications and

On 19 November 2018, Chinese State Administration for Market Regulation and Standardisation Administration announced the release of the revised Identification of Major Hazard Installations for Hazardous Chemicals (GB 18218-2018).

improvements to classification of hazardous chemicals. For details, see table below.

- **Identification index of major hazard installations:** GB 18218-2018 provides further clarifications on the actual quantity of hazardous chemicals (which is determined based on their maximum design quantity), how to treat mixtures of hazardous chemicals, and the procedure of identification of major hazard installations for hazardous chemicals.
- **Grading index of major hazard installations:** GB 18218-2018 stipulates the grading index and methodology of major hazard installations, which is absent in GB 18218-2009, referencing the *Interim Provisions on the Supervision and Management of Major Hazard Installations for Hazardous Chemicals* (revised 2015).

	GB 18218-2009	GB 18218-2018
Scope of the standard	The standard does not apply to **transport of hazardous chemicals**.	It is further specified in GB 18218-2018 that the standard does not apply to **offsite transport of hazardous chemicals.**
Normative references	**GB 12268** List of dangerous goods **GB 20592** Safety rules for classification, precautionary labelling and precautionary statements of chemicals – Acute toxicity	**GB 30000-2013** series on China GHS classification and labelling of chemicals (2-5, 7-16, 18)

Regulatory Update

	GB 18218-2009	GB 18218-2018
Definitions	**Hazardous chemicals**: Chemicals which are flammable, explosive, toxic, and harmful and can do harm to the human body, facilities and the environment. **Major hazard installations**: Units which engage in long-term or temporary production, processing, use or storage of hazardous chemicals and where the quantity of hazardous chemicals is equal or greater than the threshold quantity.	**Hazardous chemicals**: Highly toxic chemicals and other chemicals which are toxic, corrosive, explosive, flammable or combustion-supporting and can do harm to the human body, facilities and the environment. **Major hazard installations**: Units which engage in long-term or temporary production, storage, use or operations of hazardous chemicals and where the quantity of hazardous chemicals is equal or greater than the threshold quantity.
Major hazard installation unit	A major hazard installation unit refers to a (a set of) production device, facility or site, or several (sets of) production devices, facilities or sites, in one production and business operation entity, which are within a distance of 500 meters of each other.	The 500m threshold is removed, and major hazard installations are divided into two types of unit, namely **production unit** and **storage unit**.

Regulatory Update

<table>
<tr><th></th><th colspan="2">GB 18218-2009</th><th>GB 18218-2018</th></tr>
<tr><td rowspan="5">Content in tables</td><td rowspan="3">Table 1</td><td colspan="2">General differences</td></tr>
<tr><td>* 78 hazardous chemicals
* Three columns</td><td>* 85 hazardous chemicals
* Four columns</td></tr>
<tr><td colspan="2">Specific differences</td></tr>
<tr><td colspan="3">*New additions like potassium nitrate, nitrocellulose solution, etc.
*Deletions like fuming Sulphuric acid, etc.
*Modifications to specifications of some chemicals -e.g. Ammonium nitrate fertilizer →Ammonium nitrate fertilizer (with content of combustible materials≤0.2%)
*Modifications to threshold quantities of some chemicals -e.g. Ammonium nitrate fertilizer: 1,000t →200t
* Refined classification of nitrocellulose -five categories of nitrocellulose</td></tr>
<tr><td rowspan="3">Table 2</td><td colspan="2">General difference</td></tr>
<tr><td>9 categories of hazardous chemicals</td><td>14 categories of hazardous chemicals</td></tr>
<tr><td colspan="2">Specific differences</td></tr>
<tr><td colspan="3">* New additions like unstable explosives, aerosols, self-reactive substances and mixtures, etc.
*Modifications to threshold quantities of explosives, pyrophoric liquids and solids, etc. -e.g. explosives, except division 1.1: 50t →explosives divisions 1.2, 1,3 1.5 and 1.6: 10t
* Refined classification of flammable liquids and organic peroxides
* Modifications to specifications of toxic substances</td></tr>
</table>

	GB 18218-2009	GB 18218-2018
Identification index of major hazard installations	*Ambiguity on the actual quantity of hazardous chemicals *No mention of how to treat mixtures of hazardous chemicals	*The actual quantity of hazardous chemicals is determined based on their maximum design quantity *Treatment of mixtures of hazardous chemicals *Annex A: Procedure of identification of major hazard installations for hazardous chemicals
Grading of major hazard installations	N/A	Clarifications on grading index, methodology, and standards of major hazard installations

Further information is available at: GB18218-2018

Chemlinked, 31 January 2019

http://chemlinked.com/en/news

China Revises Regulations on the Lithium-ion Battery Industry

2019-02-08

On 16 January, the Chinese Ministry of Industry and Information Technology issued the *Regulatory Standards for the Lithium-ion Battery Industry (2018)*and the *Interim Administrative Measures for the Regulatory Circular of the Lithium Ion Battery Industry (2018)* after consulting on revisions to previous versions. The revised regulations, effective from 15 February, 2019, aim to further enhance the administration of the lithium-ion battery industry and facilitate its transformation and upgrading.

More Stringent Environmental Protection Requirements

China MIIT issued the revised Regulatory Standards for the Lithium-ion Battery Industry and the Interim Administrative Measures for the Regulatory Circular of the Lithium-ion Battery Industry.

Regulatory Update

The Regulatory Standards explicitly provides that it should be prohibited to construct lithium-ion battery projects or any supporting facilities in natural reserves, reserves for drinking water sources or ecological reserves determined by national laws and regulations or approved by governments at the provincial level or above, on the designated permanent basic croplands, or in areas where the construction of industrial enterprises is prohibited by the law. Lithium-ion battery enterprises which are currently located in the areas described above should be shut down and removed, or control their sizes and gradually move out of such areas. In addition, enterprises are encouraged to build up a "green supply chain" as well as implementing resource conservation and construction of an environmentally friendly system which involves all links in the supply chain.

Higher Standards for Capacity and Quality Control

According to the Regulatory Standards, new lithium-ion battery projects and their supporting facilities which feature larger capacities yet little technological advancement must be put under strict control. Industry regulators and authorities shall, in line with relevant regulations, conduct discussions on and assessments of new projects or expanded projects which can promote technological innovations and improve product quality. Enterprises whose production in the previous year came in below 50% of its capacity are not qualified to apply for expanding capacity. This is set to help improve the capacity utilization rates across the sector. The Regulatory Standards requires that lithium-ion battery enterprises and associated businesses should be capable of product quality inspections. It also encourages enterprises to establish a robust product traceability system based on third-party certification.

Greater Emphasis on Technological Innovations

The Regulatory Standards provides that lithium-ion battery enterprises are required to spend no less than 3% of its operating revenue on research and development. Enterprises are encouraged to obtain the qualification of new high-tech enterprises or R&D institutes or technology centres at or above the provincial level. Such quantitative requirements are expected to prompt enterprises to improve their core competitiveness by pursuing technological advances and optimising their capacity structure.

Better-regulated Procedure of Industry Administration

The Interim Administrative Measures details how eligible enterprises should apply to relevant authorities so as to be included in the regulatory

circular which lists all enterprises compliant with regulatory standards. Moreover, in order to ensure the continued compliance of certified enterprises, such enterprises are required to submit their annual self-examination report for the previous year through the MIIT public service platform for the lithium-ion battery industry (www.ldchy.cn) before 31 March each year, report their operations data semi-annually, and file the paper versions of their self-examination report to MIIT. Moreover, MIIT would organise or commission third-party inspection institutes to conduct random testing of products produced by enterprises listed in the regulatory circular, and those failing to pass the testing will be subject to corresponding punishments. Further information is available at: MIIT Notice

Chemlinked, 31 January 2019

http://chemlinked.com/en/news

AMERICA

Florida city bans sunscreens containing oxybenzone, octinoxate

2019-02-08

The City Commission of Key West, Florida, has voted to ban the sale of sunscreen products containing oxybenzone or octinoxate.

The City Commission of Key West, Florida, has voted to ban the sale of sunscreen products containing oxybenzone or octinoxate. The ban, which will come into effect on 1 January 2021, is intended to protect the coral reefs off the coast of the beach destination, which has a population of 25,000. It follows similar actions in Hawaii and Palau in recent months. The ordinance says its intention is to preserve the marine ecosystem, amid concern that the substances have "significant harmful impacts on the marine environment and residing ecosystems around the water of Key West, including coral reefs that protect the shoreline". The Consumer Healthcare Products Association (CHPA) and Personal Care Products Council (PCPC) both filed letters in opposition, citing a lack of scientific evidence that the ingredients are bleaching coral reefs. "We fear this legislation will create confusion, put consumers' health at risk and potentially discourage the use of sunscreens – an important part of a safe sun regimen," the PCPC wrote. But support came from a variety of residents, NGOs, academics and manufacturers of sunscreens with alternative ingredients, many of whom said other products are available

to the consumer. The ordinance was agreed by a 6-1 margin. Further information is available at: Ordinance

Chemical Watch, 7 February 2019

http://chemicalwatch.com

US chemical plant antiterrorism law extended

2019-02-08

The day before a US antiterrorism statute affecting chemical companies was to expire on 19 January, President Donald J. Trump signed a 15-month extension of that law. The 11-year-old Chemical Facility Anti-Terrorism Standards (CFATS) requires industrial facilities that make, use, or store specified quantities of any of more than 300 hazardous chemicals to assess their risks and submit site-security plans to the Department of Homeland Security for review and approval. The facilities must then implement protective measures based on their level of risk. Approximately 3,500 of these facilities are considered high risk under CFATS. They must devise and implement department-approved, site-specific security plans. Legislation to extend CFATS stalled last year in debate between Democrats in the House of Representatives and Republicans in the Senate. Led by Sen. Ron Johnson (R-WI), some senators want to make industry-backed changes to CFATS before they endorse a multiyear reauthorisation of the law. House Democrats oppose that idea. For now, lawmakers settled on a 15-month reauthorisation extending the current law. This effectively sets a deadline early in 2020 for them to reach a compromise.

CFATS remains in effect until early 2020

Chemical & Engineering News, 24 January 2019

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

U.S. Department of Labor Publishes New Frequently Asked Questions on Controlling Silica in General Industry

2019-02-08

The United States Department of Labor's Occupational Safety and Health Administration (OSHA) has posted new frequently asked questions (FAQs) on the agency's standard for respirable crystalline silica in general industry. OSHA developed the FAQs in consultation with industry and union stakeholders to provide guidance to employers and employees on the standard's requirements, such as exposure assessments, regulated areas, methods of compliance, and communicating silica hazards to employees.

The questions and answers are organised by topic, and include an introductory paragraph that provides background information about the regulatory requirements. Visit OSHA's silica standard for general industry webpage for more information and resources on complying with the standard.

U.S OSHA, 23 January 2019

http://www.osha.gov

EUROPE

Sweden sets strategic priorities for non-toxic goals

2019-02-08

The Swedish chemicals agency has identified priorities needed to help the country meet its goals for a non-toxic environment. Last year Kemi said the 2020 national target will not be achieved "by the measures and instruments already in place". Now, in a just released report submitted to the country's EPA as part of its evaluation of environmental goals every four years, the agency has set three strategic development areas. The first is on better knowledge and information. It says that information should be more accessible on the chemical content of goods, especially concerning low-volume substances and nanomaterials in the EU. Here and on the international stage requirements "must be strengthened", the agency said. Additionally, decisions need to be taken based on the precautionary principle to prevent damage of hazardous substances. Another priority is eliminating substances of concern from the beginning of the product cycle. Research is needed, Kemi said, on innovative approaches to substances, materials and goods that can be included in non-toxic and resource efficient cycles. Existing material flows need to be "detoxified", it added. "The use of particularly hazardous substances needs to cease and globally binding agreements are needed" to phase them out – notably for perfluoroalkyl and polyfluoroalkyl substances (PFASs) and endocrine disruptors. The third priority is effective legislation and supervision to ensure a high level of protection. Legislation in the EU needs to be applied and developed "more quickly" to identify and address potential chemical threats, Kemi said. The EU should provide a high level of protection based on the needs of children and other sensitive groups, take into account combination effects and as far as possible regulate chemicals in groups. The EU should also bolster its supervision of rapidly increasing imports from countries with less developed chemicals policies, Kemi said.

The Swedish chemicals agency has identified priorities needed to help the country meet its goals for a non-toxic environment.

Pre-requisites

Sweden had originally established six prerequisites for reducing toxins from the environment by 2020. In its report, Kemi explains the reasons why they have not been met:

- total exposure to chemical substances: although basic legislation has been introduced to reduce exposure to hazardous substances, "important components" are still missing. A major stumbling block for controlling chemicals is growing e-commerce and increased production from more lax regimes outside the EU that feeds demand;
- use of particularly hazardous substances: measures to curb this, such as REACH authorisation, face "limitations" and "extensive" measures are needed to achieve sufficient protection for human health in the long term;
- knowledge of chemical and environmental properties: for many substances' knowledge on distribution, exposure and effects is "still lacking". This is "especially true" for low-volume substances, nanomaterials and combination effects;
- information on hazardous substances in articles: this is "still very much inadequate". Many goods are manufactured outside the EU, which makes the information flow "more difficult";
- polluted areas: contaminated sites must be addressed sooner, requiring more effective supervisory work, government support and the development of innovative technologies;
- post-2020 development: it is "not possible" to make a clear forecast for a non-toxic environment after 2020 because of the vast number of substances and missing information about their use and exposure. "Current instruments provide the conditions for managing chemical production within the EU, but more efforts are needed to tackle issues generated by growing globalised production."

The EU's non-toxic environment strategy, which was due by the end of 2018, has been postponed until the new European Commission takes office in late October. Under the 7th Environment Action Programme, which steers the bloc's policies until 2020, the Commission is legally obliged to release its strategy this year on how it will eliminate toxic substances from the environment. A copy of the report is available at: Report

Chemical Watch, 31 January 2019

http://chemicalwatch.com

Regulatory Update

EU committee lists persistent mobile substances as emerging issue

2019-02-08

An EU science committee has identified persistent, mobile and toxic substances (PMTs) as one of 14 emerging issues that could impact on human health or the environment in the future. The list of emerging issues comes in a statement from the Scientific Committee on Health, Environmental and Emerging Risks (Scheer) on 11 January. The foreword says that this will be used when discussing potential mandates from the European Commission. Germany's Federal Environment Agency (UBA) has proposed the PMT substances should be identified as substances of very high concern (SVHCs) under REACH. The topic was discussed last year at a two-day workshop run by UBA and the Norwegian Geotechnical Institute (NGI). The aim of the UBA proposal is to protect humans and the environment from substances that have the potential to circulate very widely in water systems and contaminate, in particular, drinking water. Industry is opposed to it, warning of a rush to regrettable regulation. In the statement, Scheer says that EU legislation on persistent, bioaccumulative and toxic substances (PBTs) – such as REACH – "pays insufficient attention to the drinking water function of our surface waters and groundwater. After all, there are substances that do not accumulate very much but that are very difficult to remove from water." The Scheer member who acted as "initiator" for the entry on PMTs was Pim de Voogt, professor of environmental chemistry at the University of Amsterdam. Also identified as emerging issues are:

- chemicals in recycled materials – an issue for a circular economy;
- drinking water treatment interactions with compounds and potential health effects;
- per- and polyfluorinated organic substances;
- micro and nano-plastic in the environment; and
- nanoparticles released from building materials and construction waste to the environment.

Further information is available at: Scheer statement

Chemical Watch, 4 February 2019

http://chemicalwatch.com

An EU science committee has identified persistent, mobile and toxic substances (PMTs) as one of 14 emerging issues that could impact on human health or the environment in the future.

Regulatory Update

Silicic acid, aluminium magnesium sodium salt under evaluation as a new active substance under the BPR

2019-02-08

The following active substance is under evaluation as a new active substance under the Biocidal Products Regulation (BPR):

- Silicic acid, aluminium magnesium sodium salt: Product type 18 (insecticides, acaricides and products to control other arthropods)

Yorda's Hive, 7 February 2019

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

Plant protection products Regulation list of approved active substances updated

2019-02-08

The following substances have been added to the list of approved active substances under the Plant protection products Regulation (EC) No. 1107/2009 as per Commission Implementing Regulation (EU) 2019/139 of 29 January 2019 and Commission Implementing Regulation (EU) 2019/147 of 30 January 2019:

New substances have been added to the list of approved active substances under the Plant Protection Products Regulation.

- Beauveria bassiana strain IMI389521
- Beauveria bassiana strain PPRI 5339

The specific provisions relating to conditions of approval of the following active substance under the Plant protection products Regulation (EC) No. 1107/2009 have been updated as per Commission Implementing Regulation (EU) 2019/149 of 30 January 2019:

- Vinegar

The approval of the following active substances under the Plant protection products Regulation (EC) No. 1107/2009 has been renewed as per Commission Implementing Regulation (EU) 2019/151 of 30 January 2019 and Commission Implementing Regulation (EU) 2019/158 of 31 January 2019:

- Clonostachys rosea strain J1446
- Methoxyfenozide

As a result, these substances have now been updated in the list of approved active substances (the Annex to Commission Implementing Regulation (EU) No. 540/2011).

Yorda's Hive, 6 February 2019

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

INTERNATIONAL

Global trends are major cause for concern, says UN chemicals report

2019-02-08

Summary issues call to action ahead of major international environment meeting

Global trends are a "major cause for concern" in achieving sound chemicals management and actions to address the adverse effects of substances that are not properly managed are "urgently needed", according to a major UN report. Ahead of releasing the second Global Chemicals Outlook (GCO-II) report in March, UN Environment has published a summary of its findings for policy makers. It includes ten actions aimed at progressing the sound management of chemicals globally. The summary report highlights megatrends, such as global economic and population growth, as areas that are affecting market demand for chemicals, creating both risks and opportunities. And, it says, the expected doubling of the global chemicals market between 2017 and 2030 will "increase exposures, concentrations and adverse health and environmental impacts", if the sound management of chemicals and waste is not achieved worldwide. "Many manufactured chemicals have helped improve human health, food security, productivity and quality of life throughout the world," the summary says. However, many with hazardous properties "continue to cause significant adverse impacts on human health and the environment because they are not properly managed". Some of the challenges it highlights are hazardous chemicals used in products, complex supply chains, polluting manufacturing operations and a lack of capacity in developing countries to effectively implement basic chemicals and waste management systems. "Business as usual is therefore not an option," it says. Solutions exist, the report adds, but "more ambitious, urgent and worldwide action is needed by all stakeholders."

Global framework

The summary says findings of the GCO-II "indicate that the sound management of chemicals and waste will not be achieved by 2020,

despite global agreement reached at several high-level UN conferences, and significant action already taken". The 2020 goal was set out in 2006 under the UN's global voluntary chemicals programme, the Strategic Approach to International Chemicals Management (Saicm). And with Saicm's mandate coming to an end next year, programme stakeholders are finalising discussions – known as the intersessional process – on whether it should continue beyond its 2020 mandate, or be replaced with an alternative framework. An "aspirational and comprehensive" global framework is required, the summary says, and must "create incentives to foster commitment and engagement by all relevant actors in the value chain". Several ideas for a post-2020 framework have been put forward. Last year, ministers and vice ministers from eight countries formed an alliance, which supports the adoption of something similar to the Paris Agreement on climate change for chemicals. The GCO-II was mandated by the second UN Environment Assembly (Unea-2) in 2015, with a particular emphasis on areas where data was found to be lacking, or inadequate, and to assess progress towards Saicm's 2020 goal. The report summary will be officially launched at Unea-4, which is taking place in March in Nairobi. The full report will be made available at the meeting of the Saicm Open Ended Working Group, which is taking place in Uruguay 2-4 April. Achim Halpaap, senior adviser of UN Environment's chemicals and health branch, told Chemical Watch the summary seeks to inform delegates participating in the upcoming Unea-4 session and in other relevant processes, such as the beyond 2020 discussion. It aims to help them "consider progress made in implementing the [Saicm] 2020 goal, as well as the identified options on the implementation of further action to achieve the sound management of chemicals and waste worldwide," he said. The first report, published in 2013, examined trends in worldwide chemicals production, use, disposal, and provided policy options.

<u>Ten actions identified to achieve the sound management of chemicals globally</u>

1. Develop effective management systems: Address prevailing capacity gaps across countries, strengthen national and regional legislation using a lifecycle approach, and further strengthen institutions and programmes
2. Mobilise resources: Scale up adequate resources and innovative financing for effective legislation, implementation and enforcement, particularly in developing countries and economies in transition

Regulatory Update

3. Assess and communicate hazards: Fill global data and knowledge gaps, and enhance international collaboration to advance chemical hazard assessments, classifications and communication
4. Assess and manage risks: Refine and share chemical risk assessment and risk management approaches globally to promote safe and sustainable use of chemicals throughout their lifecycle
5. Use lifecycle approaches: Advance widespread implementation of sustainable supply chain management, full material disclosure, transparency and sustainable product design
6. Strengthen corporate governance: Enable and strengthen chemicals and waste management aspects of corporate sustainability policies, sustainable business models, and reporting
7. Educate and innovate: Integrate green and sustainable chemistry in education, research and innovation policies and programmes
8. Foster transparency: Empower workers, consumers and citizens to protect themselves and the environment
9. Bring knowledge to decision makers: Strengthen the science-policy interface and use of science in monitoring progress, priority setting and policy making throughout the lifecycle of chemicals and waste
10. Enhance global commitment: Establish an ambitious and comprehensive global framework for chemicals and waste beyond 2020, scale up collaborative action and track progress

Further details are available in the Summary report.

Chemical Watch, 30 January 2019

http://chemicalwatch.com

REACH Update

ECHA proposes to restrict intentionally added microplastics

2019-02-08

The European Chemical Agency (ECHA) has submitted a restriction proposal for microplastic particles that are intentionally added to mixtures used by consumers or professionals. If adopted, the restriction could reduce the amount of microplastics released to the environment in the EU by about 400 thousand tonnes over 20 years. ECHA has assessed the health and environmental risks posed by intentionally added microplastics and has concluded that an EU-wide restriction would be justified. If adopted, the restriction could result in a reduction in emissions of microplastics of about 400 thousand tonnes over 20 years. ECHA's assessment found that intentionally added microplastics are most likely to accumulate in terrestrial environments, as the particles concentrate in sewage sludge that is frequently applied as fertiliser. A much smaller proportion of these microplastics is released directly to the aquatic environment. The persistence and the potential for adverse effects or bioaccumulation of microplastics is a cause for concern. Once released, they can be extremely persistent in the environment, lasting thousands of years, and practically impossible to remove. Currently it is not possible to determine the impact of such long-term exposure on the environment. Data available on effects is limited, particularly for the terrestrial environment, which makes risk assessment difficult. Due to their small size, microplastics and nanoplastics – even smaller particles that are created from the further degradation of microplastics – may be readily ingested and thereby enter the food chain. The potential effects on human health are though still not well understood. Overall, the use of microplastics in products that result in release to the environment are not adequately controlled. ECHA's proposed restriction targets intentionally added microplastics in products from which they will inevitably be released to the environment. The definition of microplastic is wide, covering small, typically microscopic (less than 5mm), synthetic polymer particles that resist (bio)degradation. The scope covers a wide range of uses in consumer and professional products in multiple sectors, including cosmetic products, detergents and maintenance products, paints and coatings, construction materials and medicinal products, as well as various products used in agriculture and horticulture and in the oil and gas sectors. ECHA has assessed the socio-economic impact of the proposed restriction and is aware that the restriction is likely to result in different costs depending on the type of product affected. However, implementing the restriction is expected to be cost-effective in all sectors, including

The European Chemical Agency (ECHA) has submitted a restriction proposal for microplastic particles that are intentionally added to mixtures used by consumers or professionals.

the agricultural sector, identified in the proposal as the biggest source of intentionally added microplastics. Several EU Member States have already introduced bans on the use of microplastics in certain types of products, largely concerning wash-off cosmetic products. ECHA has published the restriction proposal on microplastics at the same time as its restriction proposals for formaldehyde and for siloxanes D4, D5 and D6. Further information is available at: Microplastics restriction proposal

ECHA, 30 January 2019

http://echa.europa.eu

Provide feedback on the EU nanomaterials observatory

2019-02-08

The European Observatory for Nanomaterials (EUON) provides information on nanomaterials to a wide audience on subjects ranging from safety to innovation. It also covers the existing EU legislation on nanomaterials and the presence and uses of specific substances on the EU market. Feedback is being sought on how the EUON is performing and how it could be developed to better meet your needs. Have your say by completing our short questionnaire: Participate

ECHA News, 30 January 2019

http://echa.europa.eu

The European Observatory for Nanomaterials (EUON) provides information on nanomaterials to a wide audience on subjects ranging from safety to innovation.

Restriction reports published

2019-02-08

On 30 January 2019, the European Chemicals Agency (ECHA) published the restriction reports on:

- formaldehyde and formaldehyde releasers (EC -);
- octamethylcyclotetrasiloxane (D4) (EC 209-136-7), decamethylcyclopentasiloxane (D5) (EC 208-764-9) and dodecamethylcyclohexasiloxane (D6) (EC 208-762-8), details; and intentionally added microplastics.

Further information on the restrictions is available at: Registry of restriction intentions

ECHA News, 30 January 2019

http://echa.europa.eu

REACH Update

Need to report legal personality changes?

2019-02-08

A new practical guide on how to report changes in identity under REACH and CLP has been published. The guide replaces 'Practical guide 8: How to report changes in identity of legal entities. It is currently available in English, but translations are expected at a later date. Further information is available at: Read the guide

ECHA News, 30 January 2019

http://echa.europa.eu

Documents from MSC-RAC joint workshop published

2019-02-08

The final report and other documents related to the MSC-RAC joint workshop on fine-tuning the testing requirements and evaluation of selected human health endpoints under REACH and CLP have now been published on the European Chemicals Agency's (ECHA) website. The workshop took place in October 2018 and involved committee members, representatives of the European Commission, ECHA staff, stakeholders and observers. Further information is available at: Meeting documents

ECHA News, 6 February 2019

http://echa.europa.eu

A new practical guide on how to report changes in identity under REACH and CLP has been published.

Committees' opinion on one application for authorisation available

2019-02-08

The consolidated opinion of the Committees for Risk Assessment and Socio-economic Analysis for one use of chromium trioxide (EC 215-607-8, CAS 1333-82-0) by Doosan Electro-Materials Luxembourg SARL and Doosan Energy Solution Kft, is available on the European Chemicals Agency (ECHA) website at: Opinion

ECHA News, 6 February 2019

http://echa.europa.eu

REACH Update

Authorisations granted for four uses of two substances

2019-02-08

The European Commission has granted authorisations for four uses related to three substances. The authorisations (expiry date of review period given in brackets) are for:

- formaldehyde oligomeric reaction products with aniline (technical MDA) (EC 500-036-1, CAS 25214-70-4), granted to Polynt Composites France (21 August 2029), details;
- 1,2 –dichloroethane (EDC) (EC 203-458-1, CAS 107-06-2), granted to Eli Lilly Kinsale Limited (22 November 2029), details; and
- 1,2 –dichloroethane (EDC) (EC 203-458-1, CAS 107-06-2), granted to Bayer Pharma AG (22 November 2029), details.

Further information on the opinions is available at: Adopted opinions

ECHA News, 6 February 2019

http://echa.europa.eu

New proposals and intentions to harmonise classification and labelling

2019-02-08

Proposals have been submitted for:

- tellurium dioxide (EC 231-193-1, CAS 7446-07-3);
- tellurium (EC 236-813-4, CAS 13494-80-9); and
- 2-(2-methoxyethoxy)ethanol (EC 203-906-6, CAS 111-77-3).

One intention has also been received for 2-ethyl-4-methylimidazole (EC 213-234-5, CAS 931-36-2).

Further information on the submission is available at: Registry of CLH intentions until outcome

ECHA News, 6 February 2019

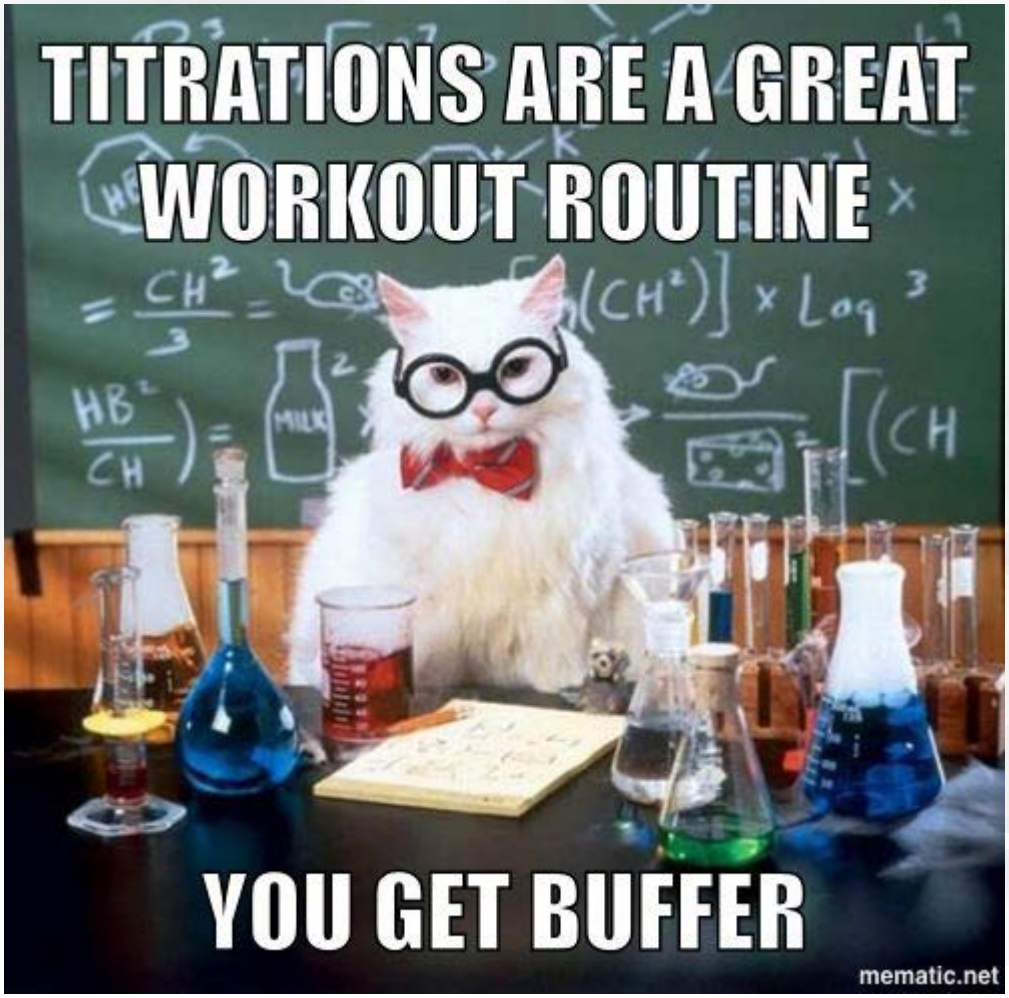
http://echa.europa.eu

The European Commission has granted authorisations for four uses related to three substances.

Janet's Corner

Buffer

2019-02-04



Hazard Alert

Cumene

2019-02-04

Cumene, CAS number: 98-82-8 and molecular formula: C9H12, is the common name for isopropyl benzene, an organic compound that is based on an aromatic hydrocarbon with an aliphatic substitution. It is a constituent of crude oil and refined fuels. [1] Cumene is a flammable colourless liquid with a sharp, penetrating, aromatic odour and has a boiling point of 152°C [2]

USES [3]

Cumene is used to manufacture other chemicals such as phenol, acetone, acetophenone, and methyl styrene. It is used as a thinner in paints, lacquers, and enamels. It is a component of high-octane motor fuels. Cumene is also used in the manufacture of rubber, iron and steel, and pulp and paper.

Cumene is the common name for isopropyl benzene, an organic compound that is based on an aromatic hydrocarbon with an aliphatic substitution.

SOURCES OF EMISSION & ROUTES OF EXPOSURE [3,4]

Sources of Emission

- Industry sources: The primary sources of cumene are the industries that manufacture it or use it in production. Some of the industries that manufacture it or use it in production are oil refiners, chemical industry, rubber manufacturers, pharmaceutical industry, pulp and paper manufacturing, roofing and paving, plastics manufacturing, manufacturers of paints, varnishes and lacquers. These emissions mainly are to the air, but are also to the soil and water.
- Other possible emitters of cumene are vapours and spilling of petrol, commercial and household painting and paint, varnish and lacquer removal, tobacco smoke, and consumer products containing cumene. These emissions are to the air unless there is a spill.
- Natural sources of cumene include crude petroleum and coal tar. It is also found in the oils of plants, marsh grasses and in some foods.
- Transport sources: Some cumene is found in the exhaust of motor vehicles, jet engines, and outboard motors.
- Consumer products: Some of the consumer products containing cumene are foam plastic insulation, rubber floor and wall coverings, bathmats, vinyl floor tile, wood office desks and furniture (modular) and thinners for paints, lacquers and enamels.

ROUTES OF EXPOSURE

The main routes of exposure to cumene are via the inhalation of contaminated air, or breathing in tobacco smoke. Human exposure occurs mainly by breathing air-containing cumene, from the evaporation of petroleum products. Cumene can also enter the body through the skin. A minor route of exposure is through the ingestion of contaminated food and water.

HEALTH EFFECTS

Acute Effects

Acute inhalation exposure to cumene may cause headaches, dizziness, drowsiness, slight incoordination, and unconsciousness in humans. It has a potent CNS depressant action characterised by a slow induction period and long duration of narcotic effects in animals. Acute inhalation exposure also causes CNS depression in rodents. Cumene is a skin and eye irritant in humans and animals. Tests involving acute exposure of rats, mice, and rabbits, have demonstrated cumene to have moderate acute toxicity by inhalation or dermal exposure and low to moderate acute toxicity by ingestion.

Chronic Effects (Noncancer)

No information is available on chronic exposure to cumene in humans. Inhalation studies in rats have reported increased liver, kidney, and adrenal weights. Increased kidney weight was observed in rats chronically exposed to cumene via gavage (experimentally placing the chemical in the stomach). The Reference Concentration (RfC) for cumene is 0.4 milligrams per cubic metre (mg/m3). The Reference Dose (RfD) for cumene is 0.1 milligrams per kilogram body weight per day (mg/kg/d) based on increased kidney weight in rats.

Cancer Risk

No information is available on the carcinogenic effects of cumene in humans or animals. EPA has classified cumene as a Group D, not classifiable as to human carcinogenicity.

SAFETY

First Aid Measures

- Eye Contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.
- Skin Contact: After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.
- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.
- Inhalation: Allow the victim to rest in a well-ventilated area. Seek immediate medical attention.
- 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. Seek medical attention.
- Ingestion: Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Exposure Controls and 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 cumene:

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

REGULATION [3,6,7]

Occupational Exposure Limits

United States

- NIOSH: TWA 50 ppm (245 mg/m3) [skin]
- OSHA: TWA 50 ppm (245 mg/m3) [skin]

Australia

- Safe Work Australia has set an 8-hour time weighted average (TWA) of

25ppm and a short-term exposure limit (STEL) of 75ppm

REFERENCES

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2. http://www.chemspider.com/Chemical-Structure.7128.html
3. http://www.npi.gov.au/substances/cumene/index.html
4. http://www.epa.gov/ttn/atw/hlthef/cumene.html

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Gossip

Carbon fuels go green for renewable energy

2019-01-24

For decades, scientists have searched for effective ways to remove excess carbon dioxide emissions from the air, and recycle them into products such as renewable fuels. But the process of converting carbon dioxide into useful chemicals is tedious, expensive, and wasteful and thus not economically or environmentally viable. Now a discovery by researchers at the U.S. Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) and Joint Centre for Artificial Photosynthesis (JCAP) shows that recycling carbon dioxide into valuable chemicals and fuels can be economical and efficient – all through a single copper catalyst. The work appears in the 17 December edition of the journal Nature Catalysis.

Going where the action is: product-specific active sites

When you take a piece of copper metal, it may feel smooth to the touch, but at the microscopic level, the surface is actually bumpy – and these bumps are what scientists call "active sites," said Joel Ager, a researcher at JCAP who led the study. Ager is a staff scientist in Berkeley Lab's Materials Sciences Division and an adjunct professor in the Department of Materials Science and Engineering at UC Berkeley. These active sites are where the magic of electrocatalysis takes place: electrons from the copper surface interact with carbon dioxide and water in a sequence of steps that transform them into products like ethanol fuel; ethylene, the precursor to plastic bags; and propanol, an alcohol commonly used in the pharmaceutical industry. Ever since the 1980s, when copper's talent for converting carbon into various useful products was discovered, it was always assumed that its active sites weren't product-specific – in other words, you could use copper as a catalyst for making ethanol, ethylene, propanol, or some other carbon-based chemical, but you would have to go through a lot of steps to separate unwanted, residual chemicals formed during the intermediate stages of a chemical reaction before arriving at your final destination – the chemical end-product. "The goal of 'green' or sustainable chemistry is getting the product that you want during chemical synthesis," said Ager. "You don't want to separate things you don't want from the desirable products, because that's expensive and environmentally undesirable. And that expense and waste reduces the economic viability of carbon-based solar fuels." So, when Ager and co-author Yanwei Lum, who was a UC Berkeley Ph.D. student in Ager's lab at the time of the study, were investigating copper's catalytic properties for a solar fuels project, they wondered, "What if, like photosynthesis in nature, we could use electrons from solar cells to drive specific active sites of a

Researchers at Berkeley Lab and the Joint Centre for Artificial Photosynthesis have demonstrated that recycling carbon dioxide into valuable chemicals such as ethylene and propanol, and fuels such as ethanol, can be economical and efficient

copper catalyst to make a pure product stream of a carbon-based fuel or chemical?" Ager said.

Tracing a chemical's origins through its 'passport'

Previous studies had shown that "oxidized" or rusted copper is an excellent catalyst for making ethanol, ethylene, and propanol. The researchers theorized that if active sites in copper were actually product-specific, they could trace the chemicals' origins through carbon isotopes, "much like a passport with stamps telling us what countries they visited," Ager said. "When we thought of the experiment, we thought that this is such an inobvious idea, that it would be crazy to try it," Ager said. "But we couldn't let it go, because we also thought it would work, as our previous research with isotopes had enabled us to discover new reaction pathways." So, for the next few months, Lum and Ager ran a series of experiments using two isotopes of carbon – carbon-12 and carbon-13 – as "passport stamps." Carbon dioxide was labelled with carbon-12, and carbon monoxide – a key intermediate in the formation of carbon-carbon bonds – was labelled with carbon-13. According to their methodology, the researchers reasoned that the ratio of carbon-13 versus carbon-12 – the "isotopic signature" – found in a product would determine from which active sites the chemical product originated. After Lum ran dozens of experiments and used state-of-the-art mass spectrometry and NMR (nuclear magnetic resonance) spectroscopy at JCAP to analyse the results, they found that three of the products – ethylene, ethanol, and propanol – had different isotopic signatures showing that they came from different sites on the catalyst. "This discovery motivates future work to isolate and identify these different sites," Lum said. "Putting these product-specific sites into a single catalyst could one day result in a very efficient and selective generation of chemical products," Lum said.

Green days ahead for chemical manufacturing

The researchers' new methodology – what Ager describes as "straightforward chemistry with an environmental and economic twist" – is what they hope can be a new beginning for green chemical manufacturing where a solar cell could feed electrons to specific active sites within a copper catalyst to optimise the production of ethanol fuels. "Perhaps one day this technology could make it possible to have something like an oil refinery, but powered by the sun, taking carbon

dioxide out of the atmosphere and creating a stream of useful products," he said.

Phys.org, 18 December 2018

http://phys.org

This novel battery can charge electric cars in 15 minutes

2019-01-24

A start-up has developed a novel battery which it claims can charge electric cars (EVs) under 15 minutes, making them more affordable for the end users. The international patent pending technology is scalable, and is more efficient than the current lithium-ion (Li) based batteries, said Jubin Varghese, co-founder and chief executive of Mumbai-based start-up Gegadyne Energy, which developed the battery. Batteries today cost up to 40% of the total cost of electric vehicles (EV) and for the EVs to become more feasible for the end user, the cost of the battery has to come down along with a reduction in charge time. "By 2030, India aspires to achieve 100 per cent electric vehicles sales. A large chunk of the purchase price of an EV today is the battery. Therefore, India can potentially rise to the top in the battery manufacturing industry. Not only is this economically feasible, but also sustainable," said Varghese. At present, lithium ion (Li) is the major source of powering the EVs. Since 2006, when the demand for Li batteries in EVs had just come to fore, to 2016, EVs contributed 50% of demand of Li batteries globally. However, these batteries take longer to charge and therefore, are not feasible to charge EVs, he said. The new technology combines the quick charging capability of supercapacitors with the high energy density of conventional batteries. It uses the concept of electrostatic charge storage & rapid kinetic Faraday reaction, said Varghese. He said the goal is to have the first commercial iteration of the battery by 2020. "That's when we believe the EV market will truly lighten up and we will have more players and more interesting tech in the market," Varghese added. The batteries are aimed to be a direct replacement for existing use cases and will be available in cylindrical, pouch and prismatic form, said Ameya Gadiwan, chief technical officer (CTO) at Gegadyne Energy. In a lithium ion battery, the energy is stored in an electrochemical manner which leads to slow charging of the batteries and overall poor battery cycle life. Compared to that, the new batteries designed by a team of researchers store energy in a combination of the electrostatic and electrochemical process which leads to longer battery cycle life—almost 50 times and faster charge time compared to conventional ones. "We have working prototypes and battery packs for now which are verified by third-

Mumbai-based start-up Gegadyne Energy has developed a battery that aims to be a direct replacement for existing use cases

party and will begin pilot production of the battery cell in India within next 12 months," said Gadiwan. He said the price range of the battery pack will be at par with lithium ion battery. The company expects the prices to drop further as the economy of scale kicks in. Varghese added that electric vehicles are the main focus of the company. However, these batteries can be used in any other consumer devices, telecom towers, and stationary energy storage systems.

Live Mint, 26 December 2018

https://www.livemint.com/

Life-Blood of Tesla Batteries Hits Supply Limits in Andean Mine

2019-01-24

For the past nine months, a U.S. company that is the world's largest producer of lithium—a key ingredient in electric-car batteries—has been locked in battle with the Chilean government over pricing issues, production quotas, and environmental compliance. With no resolution in sight, the fight is sending tremors all the way up the electric vehicle supply chain that provides batteries to Tesla Inc., Nissan Motor Co., Bayerische Motoren Werke AG, and other car makers. The drama is playing out in the northern reaches of Chile's Andes Mountains amid the arid and austere Atacama Desert, a vast, high-altitude bowl surrounded by snow-capped volcanic peaks named after ancient gods of the indigenous people. The U.S. company, Albemarle Corp., has taken over a massive salt-flats mine, pumping scarce briny water through dried-out salt marshes and lagoons to extract the prized mineral. A dozen or so miles away, thick flocks of Andean flamingos feed peacefully in a lagoon teaming with tiny shrimp, as they have for countless millennia. But as mining activity surges, water tables are falling amid growing environmental concerns. It's bad news for the flamingos—and boom times for the miners. Automakers have moved so fast to boost production that prices have tripled in less than four years, sending miners in a frantic search for lithium all over the world. And it's still early days. Demand for lithium for electric vehicle batteries is projected to rise to around 500,000 tons over the next seven years, from a current 64,000 tons, according to estimates by Bloomberg NEF. And Charlotte, North Carolina-based Albemarle aims to invest almost $1 billion to more than triple its production capacity in Chile, which has more lithium reserves than anywhere else on the planet. Not so fast, says the Chilean government, which has slapped the company with a myriad of complaints that threaten to slow that expansion push. The

Demand for lithium for electric vehicle batteries is projected to rise to around 500,000 tons over the next seven years, from a current 64,000 tons

government alleges the company has ignored its requests to adequately detail its expansion plans. At least two government agencies responsible for lithium permits have rejected the company's request for licenses it needs to expand. A third agency has said it will file for international arbitration before the end of the year over a pricing spat between the company and the government. It will be the first time the government has ever taken such a step against a foreign company. Albemarle, which declined to comment for this article, has previously said that it believes "very strongly" in the legality of its position. Until a few years ago, lithium was a minor business, mined mostly for medical uses. In 2015, Albemarle acquired the Atacama lithium operation from another U.S. company; as production rose and prices skyrocketed, several executives from the former ownership were edged out, including John Mitchell, lithium operations president. As production ramped up, Albemarle failed to respond to Chilean officials' calls, emails and formal requests for information about changes at the mining operations, according to government officials. When they did respond, their answers were lacking, according to Maria Elina Cruz, a prosecutor at government development agency Corfo, suggesting that the always delicate relationship between a foreign, multinational company and its hosts might have turned sour as the company changed hands. "Their proposals haven't been reasonable," Cruz said in an interview in Santiago. "It is not such a complex issue. In the end, the problem is that they are not ready to lose one single peso—that's the issue." At a conference call with analysts in November, Chairman and Chief Executive Officer Luke Kissam acknowledged that "there's a dispute" with Corfo, but didn't elaborate on the overall relationship with the Chilean government. In 2016, Corfo signed a contract with Albemarle that awarded the company authorisation to mine increasing levels of lithium through 2043. In exchange, Albemarle agreed to give a break on the price of up to 25 percent of its increased production to companies developing lithium products in Chile. The idea is for Chile to turn the corner from being a mere supplier of raw materials to getting a toe-hold in the lucrative and more technologically advanced world of battery design and production. The clause is part of the government's broader push to develop lithium-based components for batteries. In March, Corfo picked Chile's Molibdenos y Metales SA, or Molymet, a consortium of South Korea's Samsung SDI and Posco, and China's Sichuan Fulin Industrial Group Co. The companies vowed to invest a combined $754 million in northern Chile. The plan is now frozen after Corfo and Albemarle couldn't come to terms on lithium prices. "Albemarle's position is that they won't negotiate anything that impacts their benefit—and this does, because it involves selling lithium at a price lower than the market price," said Cruz, who has

led the negotiations with Albemarle. "The problem is that this was a clause in the contract." "If I thought there was the smallest chance of Albemarle fulfilling its contract, we wouldn't be in this position." Company executives see it differently. "With Corfo, it's been very public what that confusion is; it's a matter of what price needs to be offered to any third party who would build a cathode facility in Chile" to build lithium components for electric autos, Kissam told analysts in November. "We believe very strongly in our position—we think it's clear." Arbitration is expected to last about 18 months, Cruz said, likely delaying investments that would allow the country to become a hub for the industrialisation of lithium products in South America. "We haven't made this decision lightly," Cruz said. "If I thought there was the smallest chance of Albemarle fulfilling its contract, we wouldn't be in this position. This is our last resort; there's no other way of reaching an agreement." Albemarle's troubles with Chilean authorities don't end there. The country's environmental authority, SEA, turned the company down for a license it would need to build a planned $584 million lithium processing plant needed to increase production. The rejection came after the company failed to submit a thorough report on the project's impact on the environment in the area. Obtaining such licenses typically takes months, sometimes years. The company is confident that it will be able to bring new capacity in line "in the coming 12 to 18 months," Kissam told analysts earlier this month. Both Corfo and another agency known as Cchen detected that Albemarle was selling Chilean lithium at a price much lower than the market average to its own subsidiaries in the U.S. and Germany. This could constitute a violation of price parity rules from the Organisation for Economic Cooperation and Development and could mean that the company would be paying lower taxes than it should. Both agencies reported the issue to Chile's internal revenue service, known as SII, which declined a request for comment on whether an investigation is ongoing. Cchen also recently rejected a permit Albemarle needed to extend operations beyond 2021. The agency said the company didn't sufficiently explain how the use of a new technology would make the mine more efficient, allowing Albemarle to increase production without pumping more brine from the salt flat. Albemarle's recent actions signal it has no intention to negotiate anytime soon with the Chilean government. The company has now put its long-term Atacama expansion plan on hold as it focuses on its Australian operations. "When you cross a regulator, it doesn't matter in what country," said Chris Berry, a New York-based battery-metals analyst and founder of research firm House Mountain

Partners. Whether "the U.S., China, Argentina or Chile, you got a real problem on your hands."

The Epoch Times, 25 December 2018

https://www.theepochtimes.com

Japan Discovered a Rare-Earth Mineral Deposit That Can Supply The World For Centuries

2019-01-24

Earlier this year, researchers found a deposit of rare-earth minerals off the coast of Japan that could supply the world for centuries, according to a study. The study, published in the journal Nature in April 2018, says the deposit contains 16 million tons of the valuable metals. Rare-earth minerals are used in everything from smartphone batteries to electric vehicles. By definition, these minerals contain one or more of 17 metallic rare-earth elements (for those familiar with the periodic table, those are on the second row from the bottom). These elements are actually plentiful in layers of the Earth's crust, but are typically widely dispersed. Because of that, it is rare to find any substantial amount of the elements clumped together as extractable minerals, according to the USGS. Currently, there are only a few economically viable areas where they can be mined and they're generally expensive to extract. China has tightly controlled much of the world's supply of these minerals for decades. That has forced Japan – a major electronics manufacturer – to rely on prices dictated by their neighbour.

Earlier this year, researchers found a deposit of rare-earth minerals off the coast of Japan that could supply the world for centuries, according to a study.

A new finding that could change the global economy

The recently discovered deposit is enough to "supply these metals on a semi-infinite basis to the world," the study's authors wrote in the paper. There's enough yttrium to meet the global demand for 780 years, dysprosium for 730 years, europium for 620 years, and terbium for 420 years. The cache lies off of Minamitori Island, about 1,150 miles (1,850 km) southeast of Tokyo. It's within Japan's exclusive economic zone, so the island nation has the sole rights to the resources there. "This is a game changer for Japan," Jack Lifton, a founding principal of a market-research firm called Technology Metals Research, told The Wall Street Journal. "The race to develop these resources is well underway." Japan started seeking its own rare-earth mineral deposits after China withheld shipments of the substances amid a dispute over islands that both countries claim as their own, Reuters reported in 2014. Previously, China reduced its export

quotas of rare earth minerals in 2010, pushing prices up as much as 10 percent, The Journal reports. China was forced to start exporting more of the minerals again after the dispute was taken up at the World Trade Organisation. Rare-earth minerals can be formed by volcanic activity, but many of the minerals on our planet were formed initially by supernova explosions before Earth came into existence. When Earth was formed, the minerals were incorporated into the deepest portions of the planet's mantle, a layer of rock beneath the crust. As tectonic activity has moved portions of the mantle around, rare earth minerals have found their way closer to the surface. The process of weathering - in which rocks break down into sediment over millions of years - spread these rare minerals all over the planet. The only thing holding Japan back from using its newly found deposit to dominate the global market for rare-earth minerals is the challenge involved in extracting them. The process is expensive, so more research needs to be done to determine the cheapest methods, Yutaro Takaya, the study's lead author, told The Journal. Rare-earth minerals are likely to remain part the backbone of some the fastest-growing sectors of the global tech economy. Japan now has the opportunity to control a huge chunk of the global supply, forcing countries that manufacture electronics, like China and the US, to purchase the minerals on Japan's terms.

Science Alert, 30 December 2018

http://www.sciencealert.com.au

Hybrid SDSs: OSHA Explains

2019-01-24

In 2012, OSHA completed a comprehensive revision of its Hazard Communication Standard (HCS) with the general objective of achieving alignment with the United Nations' (U.N.) 2009 Globally Harmonised System of Classification and Labelling of Chemicals (GHS). The revision provided much needed improvements in how information about hazardous chemicals in the workplace is communicated to employees, but there remain questions about implementation of the HCS and particularly about one of its critical components—safety data sheets (SDSs). For example, in a recent letter of interpretation (LOI) to a company that provides worldwide services related to the HCS and similar international programs, OSHA's Directorate of Enforcement Programs answered questions about the applicability of the HCS and the SDS requirements to imported products. The company's main question concerned the degree to which SDSs can include information and be formatted to meet

both OSHA's HCS requirements and the requirements of Health Canada's Hazardous Products Regulations (HPR) and its Workplace Hazardous Materials Information System (WHMIS). The LOI also addresses whether a company contracted to develop SDSs for a chemical manufacturer or importer may be a liable party with regard to meeting the HCS requirements. While the letter covers these and other aspects of SDS requirements, OSHA's main point seems to be that additional information can be included in hybrid SDSs as long as it does not "contradict or cast doubt" on the information required in SDSs.

Background

OSHA issued the original HCS in 1983. Chemical manufacturers and importers were required to evaluate the chemicals they produce or import and provide hazard information to downstream employers and employees by putting labels on containers and preparing material safety data sheets (MSDSs). Information that was mandatory in MSDSs included the properties of each chemical; the physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical. Perhaps the major problem with the 1983 MSDS requirement was that it was performance-based. While certain information about the chemicals and their hazards was mandatory, there was no requirement that the information had to be provided in a specific format. Accordingly, chemical manufacturers and importers conveyed the required information in MSDSs and on labels in whatever format they chose. Manufacturers were also required to evaluate the potential hazards of chemicals, a vague word that resulted in more information disparities among MSDSs. The result was that employers were forced to continually relearn how to read and understand MSDSs that were dissimilar in how they presented data and described hazards. In its 2012 final rule, OSHA revised the HCS to conform to the U.N.'s GHS (Rev. 3, 2009). The revisions included adoption of the GHS's standardised format for MSDSs. To differentiate from the original HCS, OSHA introduced a new term for the new format—safety data sheet (SDS). The information required in SDSs was largely the same as what was required in MSDSs. But the new format (which chemical manufacturers had already been using for years on a voluntary basis) comprises 16 sections in a specific order of presentation. Items of primary interest to exposed employees and emergency responders are presented at the beginning of the document, while more technical information is presented in later sections. Also, in line with the GHS, the revised HCS requires that chemical manufacturers and importers provide their chemicals with labels that include harmonised

signal words, pictograms, and hazard statements for each hazard class and category. Precautionary statements must also be provided. "The modifications to the HCS will significantly reduce burdens and costs, and also improve the quality and consistency of information provided to employers and employees regarding chemical hazards by providing harmonised criteria for classifying and labelling hazardous chemicals and for preparing safety data sheets for these chemicals," OSHA stated in the preamble to the revision.

U.S. and Canada Signed MOU

All this brings us back to OSHA's LOI. As noted, the thrust of the letter was to determine how information in SDSs required by Canada's WHMIS can be incorporated into or is interchangeable with information in SDSs required by OSHA's HCS. Co-operation on this issue has already been addressed by the two nations. For example, in June 2013, OSHA and Health Canada signed a memorandum of understanding (MOU) to formalise implementation of the GHS in ways that reduced differences between the two jurisdictions and to build a common approach to future changes of the GHS (see OSHA memo). Also, in May 2015, OSHA announced that it would continue its partnership with Health Canada to align the U.S. and Canadian regulatory approaches regarding labels and SDSs and classification requirements for workplace chemicals. "Where an SDS element is required by Health Canada's WHMIS, and not by OSHA's Hazard Communication standard, it is permitted/allowed by OSHA, unless the information would contradict or cast doubt on the required information," the memo states. "Similarly, an SDS element that is required under HCS 2012 is permitted in Canada. An example applies to carcinogenicity. The HCS 2012 requires that if a chemical is identified as a carcinogen by OSHA, the International Agency for Research on Cancer (IARC), or the National Toxicology Program (NTP), then this information must be disclosed in SDS section 11, Toxicological information. Health Canada permits this information on the SDS even though under WHMIS the IARC and NTP listed carcinogens are not required to be disclosed on the SDS. However, if an SDS from Health Canada is sent to the U.S., the SDS must disclose information on any OSHA, IARC and NTP listed carcinogens."

Avoiding Confusion

Points made in the LOI include the following.

- Section 1 of the SDS must include the name, address, and telephone number of the manufacturer, importer or other responsible party. (The HCS defines responsible party as "someone who can provide

additional information on the hazardous chemical and appropriate emergency procedures, if necessary." A responsible party may also be a partnership, association, corporation, business trust, legal representative, or any organized group of persons. These parties automatically become the responsible party.)

- Section 1 must also include an emergency phone number. "The address must be in the United States, and the phone number must be a domestic number," states OSHA. "If a manufacturer, importer, distributor, or employer chooses to add a foreign address to an SDS, it may be listed in Section 1 if the responsible party believes they may be able to provide additional supplemental information and it is done in a fashion that does not cause confusion. To avoid confusion, the supplemental information may instead be provided in Section 16 of the SDS."
- The party or importer that receives the chemical shipment from a foreign supplier is liable for all HCS 2012 requirements for that chemical, including classification and developing an SDS as soon as it is in the importer's possession. If the chemical arrives at the facility without an SDS, the importer must create an HCS-compliant SDS. If the shipment arrives at the facility with an HCS 2012-compliant SDS, the importer may use that SDS to meet the HCS requirement.
- If the chemical will not be leaving the facility, the U.S. importer may follow the workplace labelling requirements at 29 Code of Federal Regulations (CFR) 1910.1200(f)(6), which provide several options not available when chemicals leave the workplace.
- Health Canada's 2015 WHMIS regulation does not require an importer to include its address on its SDS for chemicals to be used on-site. OSHA's HCS does require that all SDSs must include a U.S. address in Section 1 of the SDS. OSHA says it does not currently plan to change this requirement.
- A contracted company that provides additional information for a hazardous chemical may be an SDS author or contracted preparer. In this arrangement, a manufacturer or importer may agree to list the contracted company on its chemical label and SDS as the party to be contacted to provide additional or emergency information. However, the manufacturer or importer remains the responsible party and, as such, maintains the ultimate responsibility for compliance with OSHA's HCS. The contracted party may not claim responsibility for the SDS and its contents.

Gossip

- Hybrid labels and SDSs that contain all the required HCS elements may include foreign country information as long as no information contradicts any requirement in OSHA's HCS.
- A responsible party may follow the most recent version of the GHS as long as the hazard information does not contradict or cast doubt on the HCS 2012 required information. If the hazard and precautionary statements in Canada's HPRs differ from 2012 HCS statements because they were adopted from a more recent revision of the GHS, the responsible party may use them as long as the hazard information does not cast doubt on the HCS 2012 required information. Minor differences are acceptable. (See OSHA Standard Interpretation at https://www.osha.gov/laws-regs/standardinterpretations/2017-11-29.) However, classification or hazard categories may be different in a more recent version of the GHS than in HCS 2012. In these cases, it is not permissible to use the hazard and precautionary statement from the more recent revision of the GHS because it would contradict or cast doubt on HCS required information.
- The HCS requires inclusion of health hazards not otherwise classified (HNOCs) in the SDS. Also, HNOCs may be included on the label as supplemental information. Additionally, OSHA permits the use of the exclamation mark pictogram to indicate the hazards of an HNOC on the label and SDS if the label also indicates that the pictogram is being used for an HNOC. However, the exclamation mark pictogram may appear only once on a label; if it already appears as a required pictogram for a classified hazard, it may not appear a second time as supplemental information for the HNOC.
- Canada's HPR requires the use of precautionary statements for hazard classes not covered by the GHS. These hazard classes are combustible dusts, simple asphyxiants, pyrophoric gases, physical hazards not otherwise classified (PHNOC), and biohazardous infectious materials. The question was whether OSHA would allow the hybrid SDS to add precautionary statements for hazard classes not covered by the GHS. OSHA responded that while it does not require precautionary statements for HNOCs, it permits them as supplemental information as long as the statement does not contradict or cast doubt on the requirement information. HCS 2012 requires hazard statements for combustible dust, pyrophoric gas, and simple asphyxiants but does not require precautionary statements for those hazards.

EHS Daily, 2 January 2018

http://ehsdailyadvisor.blr.com/

Gossip

How Far Does the Periodic Table Go?

2019-01-24

Until December 2015, there were holes in the periodic table, elements synthesised but not yet officially recognised. But as we enter the International Year of the Periodic Table, the classic periodic table has been filled to its seventh row: In late 2015, the International Union of Pure and Applied Chemistry officially confirmed elements 113, 115, 117, and 118. The new elements also received their final names: nihonium, moscovium, tennessine, and oganesson. Efforts to find the next elements, 119 and 120, are underway. The periodic table of elements is a "stalwart symbol" of chemistry, the chemist Eric R. Scerri enthused. "It graces the walls of lecture halls and laboratories of all types, from universities to industry," he wrote in American Scientist. "It is one of the most powerful icons of science. It captures the essence of chemistry in one elegant pattern." Dmitri Mendeleev first published a scheme to organise all then-known elements in 1869, and this system, although not perfect, became fundamental in the study of chemistry. Mendeleev wasn't the first to come up with a system to categorise elements, but, Scerri points out, "his version is the one that had the biggest impact on the scientific community." The periodic table organises elements by rows according to their atomic number, the number of protons in an atom's nucleus, and by columns according to the configurations of the atom's outermost electrons. This configuration usually dictates an element's "personality" as well as its size and shape. Soft metals like lithium and potassium, which react strongly with others, inhabit one column, while fluorine and iodine, non-metallic reactive elements, live in another. Mendeleev didn't just predict the existence of then-unknown elements, but also their properties. In the beginning, not even Mendeleev recognised the magnitude of his discovery, writes the historian of science Michael Gordin. "Had Mendeleev been cognisant of the implications of the periodic system, he would likely not have relegated its presentation to the Russian Chemical Society in March 1869 to N.A. Menshutkin while he went off to inspect cheese-making cooperatives." But this changed quickly, "by 1871, Mendeleev was quite clear on his belief that he had isolated a new law of chemistry." This law is being pushed to its limits as chemists synthesise new elements. Already, as atomic numbers reach ever higher, the chemical properties of some of the new elements do not resemble those of other elements in the same group. This, Scerri writes in a 2013 article for Scientific American, "might undermine the very rationale behind the table's existence: the recurring patterns that give the periodic table its name." Exactly how many elements are still to be

Efforts to fill the periodic table raise questions of special relativity that "strike at the very heart of chemistry as a discipline."

discovered? Is there an end to the periodic table? When will we reach it? What does it teach us about the nature of the elements?

Creating New Elements

Until physicists probed around in the debris produced in nuclear reactors and explosions, only 92 naturally occurring elements were known, up to uranium. In radioactive material, physicists found new elements: neptunium, plutonium, americium, einsteinium, and more. Beyond element 100, fermium, however, not even hydrogen bombs were powerful enough to produce new elements, so scientists changed their tactics. Instead of brute force, finesse was the key. Scientists used cyclotrons and accelerators to bring ions of lighter elements to high speed, then fired them at the nuclei of elements with higher atomic numbers. If everything went exactly right, the nuclei of the atoms in the beam and the target fused. The aim: to add a proton and increase the atomic number, thereby making a new element. Fittingly, the first element created this way was named mendelevium. Research centres in the U.S. and Russia, mainly the Lawrence Berkeley National Laboratory and the Joint Institute for Nuclear Research in Dubna, pushed forward in the 1950s, 60s, and 70s. Every few years, a new element would be discovered and named, eventually reaching element 106 (seaborgium). The GSI Helmholtz Centre for Heavy Ion Research (GSI) in Germany got the upper hand as they changed their approach to "cold fusion:" focusing a low-energy beam at a target with a high atomic number led to the discovery of elements from bohrium (107) to copernicium (112). When making new superheavy elements, scientists are engaged in a battle against the fundaments of nature. Creating a new element is a fleeting joy, and in fact this appears to be a guiding rationale for the scientists who create them. As leading nuclear physicist Yuri Oganessian, after whom element 118 is named, writes in Scientific American: "By bombarding heavy nuclei with ion beams of lighter nuclei, scientists create superheavy nuclei that are so unstable that they split apart, oftentimes only a tiny fraction of a second after they are created." When making new superheavy elements, scientists are engaged in a battle against the fundaments of nature: In elements with low atomic weight, protons and neutrons stick together because the strong nuclear force pulls them together. But when more and more protons are packed into a nucleus, the strong nuclear force starts to lose out to another force, the Coulomb force. This force causes particles of the same charge to push each other apart. Most superheavy nuclei undergo nuclear fission within milliseconds, splintering into lighter elements, or they spit out a few alpha

particles—made of two protons and two neutrons—at first and then split apart.

On the Shores of the Island of Stability

With elements 113 to 118, the discoverers were closing in on a tantalising goal: the island of stability. Theories predict that when certain "magic" numbers of protons and neutrons are packed in a nucleus, the nucleus becomes more stable and long-lived. Calcium, nickel, tin, and lead have exceptionally stable nuclei, which theorists believe is because these elements have magic numbers of protons and/or neutrons. These "magic numbers" correspond to filled nuclear shells, which could make the nucleus more stable. The elements around where proton and neutron magic numbers would come together, the "island of stability," is enticing superheavy element researchers. But the island's precise location in the periodic table is unknown. Some of the newly synthesised elements seem to be more stable: one form of element 117 with 177 neutrons stuck around for 112 milliseconds. The next "magic number" for neutrons is predicted to be 184, but so far, 177 neutrons have been the maximum. Scientists may be getting closer to the shore, but they haven't reached dry land yet. That's because producing even a tiny amount of a new superheavy element is a superheavy endeavour. Creating element 117 posed a particular challenge. The only place that produces enough of the target, berkelium, is Oak Ridge National Laboratory, in Tennessee, thousands of miles from Dubna, where Oganessian's team carried out the collision. Production of berkelium started two years before the experiment in Dubna was scheduled to start. It took 250 days of irradiation to produce enough berkelium, and 90 days of processing to purify it. Then the clock started ticking. Berkelium is radioactive, with a half-life of 327 days. All 22 milligrams of it had to be rushed to JINR during the time window in which the accelerator and beam were available. It worked: 150 days of bombarding the precious berkelium target with calcium created six atoms of element 117. Work on creating element 119, the next superheavy element, started in December 2017 at the RIKEN laboratory in Wako, Japan. Oganessian's team, in Dubna, is preparing to hunt for 119 from 2019 onwards. As early as 2007, researchers in Dubna and at the GSI in Germany started trying to synthesise element 120. So far, no sign of either element has been found.

Into the Unknown

Efforts to fill row eight of the periodic table could lead to new insights into the physics of atoms. Elements have a periodic pattern in their chemical

properties because those properties are determined in large part by the space an atom's electrons inhabit around its nucleus, especially the outermost region. These regions, mathematically described as "orbitals," come in a discrete range of sizes and shapes, and the structures of the outer orbitals change in a periodic, or repeating, way. Atoms with different atomic numbers thus can have similar shapes, leading to a repeating or "periodic" pattern of element blocks which have the same outer orbital shapes. With element 121, electrons would occupy an entirely new orbital never encountered before, the g orbitals.

Nobody really knows where the table will end.

How much larger the periodic table can get is still an open question. "We know that the number of elements in the periodic table is finite. The question to be answered is, How far can we go?" wrote the physicists Peter Armbruster and Fritz Peter Hessberger, co-discoverers of elements 108-112, in Scientific American. At their time of writing, in 1998, they already recognised what had been achieved: "[W]e has come a long way since the 1940s when Niels Bohr predicted that fermium, element 100, would be the last element of the periodic table." Richard Feynman predicted that element 137 would be the last one. But nobody really knows where the table will end. Calculations of the table's end are based on the theory of relativity. When nuclei get larger, more protons in the nucleus mean more force pulling electrons in, so the electrons traveling around them have to go faster and faster, reaching speeds that are a substantial fraction of the speed of light. At these speeds, the electrons become "relativistic," and the atoms behave differently from what is expected based on their position in the table. Eventually, calculations predict that the electrons would have to travel faster than light, which is impossible. On this basis, some scientists predict that the end may be element 170, since this may be the point at which there are enough protons to ask the electrons to do the impossible. We see some relativistic effects on elements in everyday life. In gold atoms, the electrons whizz around the nucleus at more than half the speed of light. This changes the electrons' orbitals so that gold absorbs blue light, while photons of all other colours bounce off. We observe white light minus blue light, the distinctive golden-yellow gleam of wedding bands that sets gold apart from the silver-coloured elements surrounding it in the periodic table. Will chemical properties in the newly-discovered elements follow periodicity, or will the relativistic effects lead to cracks in the periodic law? As new super-heavies are made in extremely small quantities, chemists cannot investigate them with traditional approaches, like sticking the element into a flask and watching it react with other

chemicals. Instead, they are devising experiments to gain simple yes-no answers about their properties, asking, for example, will element 112, at very low temperature, bind to gold like a metal? Will it deposit on ice like a noble gas? Already in the 1990s, early experiments showed that rutherfordium (104) and dubnium (105) do not behave in keeping with their positions in the periodic table. According to the periodic law, the two should behave like the elements directly above them, hafnium and tantalum. Instead, rutherfordium reacts like plutonium, which is quite far away in the periodic table, while dubnium behaves like protactinium, a distant element in the table. But not all super-heavies behave unexpectedly. Seaborgium (106) and bohrium (107) act so in keeping with what Mendeleev's table would have predicted, scholarly papers on them were titled "Oddly Ordinary Seaborgium" and "Boring Bohrium," Scerri notes. Whether or not the periodic table remains periodic for very heavy atoms is, Scerri admits, "of no great practical consequence, at least for the foreseeable future. The loss of predictive power in the superheavy realm will not affect the usefulness of the rest of the table." However, "the question of special relativity's effect strikes at the very heart of chemistry as a discipline." If the periodic law loses its predictive power due to special relativity, chemistry will be more reliant on physics. But if the periodic law remains (largely) valid, chemistry would keep some independence.

JSTOR Daily, 2 January 2019

https://daily.jstor.org

A filter allows blood to go through but a sticky coating catches the excess drug

The end of chemo's brutal side effects? Scientists create 3D-printed 'drug sponge' that is inserted into the veins to mop up the leftovers of the powerful drugs after treatment

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A 3D-printed 'drug sponge' could offer a potential solution to chemotherapy's brutal side effects, scientists claim. The device - based on absorbers used to remove chemicals from petrol - filters the powerful drugs out of the blood once it has treated tumours, so that healthy cells do not suffer. Early tests on pigs showed the 'chemofilter' soaked up 64 per cent of a liver cancer drug, doxorubicin, injected upstream. It could save millions from the gruelling side effects of the treatment, including hair loss, nausea, fatigue and diarrhoea. Higher doses of the drug could also be administered, making treatment faster, the researchers now believe. The researchers from University of California at Berkeley said the development

was 'a significant step forward'. Chemotherapy is typically accompanied by major side effects including nausea, vomiting, hair loss, suppression of the immune system, and anaemia. Although chemotherapy drugs - of which there are hundreds - can kill cancer cells effectively, it effects the normal working of the body. Typically, more than 50 to 80 per cent of the injected drug does not reach the tumour but enters the body's circulation, the researchers said. They hope that this device will slow, or even stop the healthy tissue from being affected. The researchers used a 3D printer to make tiny cylinders, no more than 3mm in length, made of poly(ethylene glycol) diacrylate. Inside the cylinders was a square lattice structure that would allow blood cells to pass through it. However, a coating, called copolymer, applied to the lattice attaches to the chemotherapy drug to stop it passing through. The researchers, led by Professor Nitash Balsara, designed the device to test on pigs. They spent a year perfecting the method. Professor Balsara said: 'An absorber is a standard chemical engineering concept. 'Absorbers are used in petroleum refining to remove unwanted chemicals such as sulphur. 'Literally, we've taken the concept out of petroleum refining and applied it to chemotherapy.' Doxorubicin is a chemotherapy drug used for many different types of cancer, also known by its brand name Adriamycin. They tested the absorbers in three pigs, inserting them into a vein. The findings were published the in American Chemical Society's journal Central Science. When they injected doxorubicin into the same vein, the drug flowed in the bloodstream, reaching the device. By measuring the doxorubicin concentration in the vein afterwards, the researchers determined that it captured about 64 per cent of the drug from the bloodstream. It is not clear to what extent this would reduce the lingering side effects. But it was noted that the device did not cause side effects on its own. When developing the device, the researchers were aware of the risk of thrombrosis, when blood clots in a vein. The authors said: 'Problems related to blood clots, vein wall dissection, and other biocompatibility issues were not observed. 'This development represents a significant step forward in minimising toxic side effects of chemotherapy. The device could open a new route to help patients fight cancer, enabling reduced side effects or an increased chemotherapy dose, the researchers say. 'Although much work remains, we believe that the present study opens a new route to help patients fight cancer by minimising drug toxicity, and better treat their disease and improve survival by enabling high-dose regional chemotherapy,' the paper said. Potentially they could also be used to soak up other dangerous drugs, such as high-powered antibiotics that are toxic to kidneys. Chemotherapy is a vital part of treatment for cancer, with 28 per cent of UK patients

needing it, according to Cancer Research. Each year, about 650,000 US cancer patients receive chemotherapy in an outpatient oncology clinic.

The Daily Mail, 10 January 2019

http://www.dailymail.co.uk

Researchers diversify drug development options with new metal catalyst

2019-01-24

A University of Illinois team of researchers led by chemistry professor M. Christina White has developed a new manganese-based catalyst that can change the structure of druglike molecules to make new drugs, advancing the pace and efficiency of drug development. Their findings appear in the journal Nature Chemistry. Many pharmaceuticals contain aliphatic and aromatic carbon-hydrogen scaffolds to which chemists introduce oxygen atoms in precise locations to dictate the behaviour of the drug. Aliphatic molecules have carbon-hydrogen bonds that are strong, ubiquitous and difficult to manipulate without affecting other, more reactive parts of the molecule. For example, aromatics have a type of bond that is often more reactive than aliphatic carbon-hydrogen bonds. "Nature tells us in examples of drugs such as erythromycin and Taxol that by swapping out specific hydrogen atoms with oxygen atoms at strategic locations, chemists can control the function of a drug," White said. "However, carbon-hydrogen bonds in aliphatic structures are some of the strongest in nature, and our previously developed methods to convert them to carbon-oxygen bonds—a process called oxidation—tend not to tolerate aromatics, which also are very prevalent in drugs." "We have developed a synthetic manganese catalyst that can oxidise aliphatic scaffolds in the presence of aromatics that serve as frameworks for most drugs," White said. White often refers to what her group does as "molecular surgery." Think of this manganese catalyst as analogous to a saw that can cut the skull without touching the brain, she said. "Our new catalyst does the work of a complex enzyme, but is a simple substance that uses basic principles and can be stored in a refrigerator," she said. "It will allow drug developers to replace a hydrogen atom with an oxygen atom without having to make a new drug from scratch." The team has used the new manganese catalyst to successfully demonstrate oxidation in 50 molecules, four of which are drug scaffolds, with the potential to rapidly produce derivatives having different biological activities or metabolites. This is important because metabolites—the by-products of metabolising a drug—sometimes cause side effects or are more active than the original drug, White said. "Moving

Chemistry professor M. Christina White and graduate student Jinpeng Zhao developed a new catalyst that has the potential to advance the pace and efficiency of drug development.

forward, we believe this catalyst may enable chemists to expedite the drug discovery process by producing new drugs from old ones and identifying metabolites without having to do new syntheses," she said.

Phys.org, 9 January 2019

http://phys.org

Real-world Photoshop: Procter & Gamble debut a handheld device that could replace makeup

2019-01-24

Procter & Gamble debuted its newest tool in the fight against aging. At CES this week, the company introduced the world to "Opté," a handheld device that prints anti-aging product on top of your skin, acting as a real-world Photoshop, essentially. Opté covers up hyperpigmentation, or age spots, by gliding a device the size of an electric shaver over the skin's surface. Using blue LED lights, the device maximises contrasts in melanin before using onboard cameras to take more than 200 images per second. Images are then sent to a microprocessor that analyses 70,000 lines of code to determine the size, shape, and intensity of each blemish. After photographing and analysing the skin, a tiny onboard printer with 120 nozzles, each thinner than a human hair, deposits a specially-formulated skin care serum directly to the problem area — foregoing solution on areas where it's not needed. According to Procter & Gamble, its internal inkjet printers can reproduce any skin colour, starting with cartridges for fair, medium, and dark skin as a base. For anyone currently wearing makeup to cover blemishes, the company says, this could replace it entirely. And, bonus, it won't sweat off like traditional concealers. It's not just a concealer, though. Opté could, over time, reduce the appearance of these blemishes with anti-aging ingredients used in the coverup solution. Pricing information is still up in the air, but Procter & Gamble plans to release the device later this year, or in early 2020.

Opté covers up hyperpigmentation, or age spots, by gliding a device the size of an electric shaver over the skin's surface.

The Next Web, 12 January 2019

https://thenextweb.com

Materials chemists tap body heat to power 'smart garments'

2019-01-24

Many wearable biosensors, data transmitters and similar tech advances for personalised health monitoring have now been "creatively miniaturised,"

says materials chemist Trisha Andrew at the University of Massachusetts Amherst, but they require a lot of energy, and power sources can be bulky and heavy. Now she and her Ph.D. student Linden Allison report that they have developed a fabric that can harvest body heat to power small wearable microelectronics such as activity trackers. Writing in an early online edition of Advanced Materials Technologies, Andrew and Allison explain that in theory, body heat can produce power by taking advantage of the difference between body temperature and ambient cooler air, a "thermoelectric" effect. Materials with high electrical conductivity and low thermal conductivity can move electrical charge from a warm region toward a cooler one in this way. Some research has shown that small amounts of power can be harvested from a human body over an eight-hour workday, but the special materials needed at present are either very expensive, toxic or inefficient, they point out. Andrew says, "What we have developed is a way to inexpensively vapor-print biocompatible, flexible and lightweight polymer films made of everyday, abundant materials onto cotton fabrics that have high enough thermoelectric properties to yield fairly high thermal voltage, enough to power a small device." For this work, the researchers took advantage of the naturally low heat transport properties of wool and cotton to create thermoelectric garments that can maintain a temperature gradient across an electronic device known as a thermopile, which converts heat to electrical energy even over long periods of continuous wear. This is a practical consideration to ensure that the conductive material is going to be electrically, mechanically and thermally stable over time, Andrew notes. "Essentially, we capitalised on the basic insulating property of fabrics to solve a long-standing problem in the device community," she and Allison summarise. "We believe this work will be interesting to device engineers who seek to explore new energy sources for wearable electronics and designers interested in creating smart garments." Specifically, they created their all-fabric thermopile by vapor-printing a conducing polymer known as persistently p-doped poly(3,4-ethylenedioxythiophene) (PEDOT-Cl) onto one tight-weave and one medium-weave form of commercial cotton fabric. They then integrated this thermopile into a specially designed, wearable band that generates thermo-voltages greater than 20 milliVolts when worn on the hand. The researchers tested the durability of the PEDOT-Cl coating by rubbing or laundering coated fabrics in warm water and assessing performance by scanning electron micrograph, which showed that the coating "did not crack, delaminate or mechanically wash away upon being laundered or abraded, confirming the mechanical ruggedness of the vapor-printed PEDOT-Cl." They measured the surface electrical conductivity of the coatings using a custom-built probe and found that the looser weave

cotton demonstrated higher conductivity than the tighter weave material. The conductivities of both fabrics "remained largely unchanged after rubbing and laundering," they add. Using a thermal camera, they established that the wrist, palm and upper arms of volunteers radiated the most heat, so Andrew and Allison produced stretchy knitted bands of thermoelectric fabric that can be worn in these areas. The air-exposed outer side of the band is insulated from body heat by yarn thickness, while only the uncoated side of the thermopile contacts the skin to reduce the risk of allergic reaction to PEDOT-CI, they point out. The researchers note that perspiration significantly increased the thermovoltage output of the stretchy armband, which was not surprising, as damp cotton is known to be a better heat conductor than dry fabrics, they observe. They were able to turn off heat transfer at will by inserting a heat-reflective plastic layer between the wearer's skin and the band, as well. Overall, they say, "We show that the reactive vapor coating process creates mechanically-rugged fabric thermopiles" with "notably-high thermoelectric power factors" at low temperature differentials compared to traditionally produced devices. "Further, we describe best practices for naturally integrating thermopiles into garments, which allow for significant temperature gradients to be maintained across the thermopile despite continuous wear."

Phys.org, 22 January 2019

http://phys.org

Creating attraction between molecules deep in the periodic table

2019-01-24

A McGill-led international research team provides the first experimental and theoretical proof that it is possible to form strong, stable attractions between some of the heavier elements in the periodic table—such as arsenic or even antimony. Because hydrogen is not involved in creating the bond between these elements, these new materials should be resistant to water and humidity. Imagine a waterproof computer. It's not going to happen tomorrow, but it may no longer be a pipedream since a McGill-led international research team has shown for the first time that it is possible to form strong, stable attractions between some of the heavier elements in the periodic table. A recent article in Nature Communications provides the first experimental and theoretical proof that heavy, large atoms of an increasingly metallic nature—such as arsenic or even antimony—can be used to create new materials called cocrystals by using halogen bonds.

A McGill-led international research team provides the first experimental and theoretical proof that it is possible to form strong, stable attractions between some of the heavier elements in the periodic table—such as arsenic or even antimony.

Because hydrogen is not involved in creating the bond between these elements, these new materials should be resistant to water and humidity.

Creating cocrystals from deep in the periodic table

Much of recent research in chemistry has focused on creating new materials by manipulating the way that molecules recognise one another and come together to build more complex, self-organized structures. For example, cocrystals based on either hydrogen or halogen bonds have been extensively used by scientists in the design and manufacture of new improved pharmaceuticals, polymers with enhanced properties such as Kevlar, and more recently, materials for use in electronics. Until recently, such interactions invariably had to include at least one atom of a 'lighter' element found at the very top of the periodic table, such as hydrogen, nitrogen, oxygen, fluorine etc. "Quite apart from the potentially practical applications of this discovery, it is a big advance in fundamental chemistry," says McGill chemistry Professor Tomislav Friščić, one of the senior authors on the paper. "For the first time researchers have demonstrated molecular recognition events including only heavier elements located in the 4th and 5th periods. This is significantly deeper in the periodic table than has been seen until now. It is a very exciting time to be a chemist—it's as though we were explorers moving closer to the South Pole of the periodic table—and who knows what we will find there." The research grew out of a collaboration between scientists from Canada, Croatia and the UK who continue to work in the area. Their next goal is to include bismuth, the heaviest element that can be considered stable, in this type of material design. According to Friščić, that would really be going to the very tip of the South Pole.

Phys.org, 22 January 2019

http://phys.org

Scientists have succeeded in developing a chemical process to convert visible light into infrared energy, allowing innocuous radiation to penetrate living tissue and other materials without the damage caused by high-intensity light exposure.

Novel materials convert visible into infrared light

2019-01-24

Columbia University scientists, in collaboration with researchers from Harvard, have succeeded in developing a chemical process to convert visible light into infrared energy, allowing innocuous radiation to penetrate living tissue and other materials without the damage caused by high-intensity light exposure. Their research is published in the January 17 issue of Nature. "The findings are exciting because we were able to perform a series of complex chemical transformations that usually require high-energy, visible light using a non-invasive, infrared light source," said

Gossip

Tomislav Rovis, professor of chemistry at Columbia and co-author of the study. "One can imagine many potential applications where barriers are in the way to controlling matter. For example, the research holds promise for enhancing the reach and effectiveness of photodynamic therapy, whose full potential for managing cancer has yet to be realised." The team, which includes Luis M. Campos, associate professor of chemistry at Columbia, and Daniel M. Congreve of the Rowland Institute at Harvard, carried out a series of experiments using small quantities of a novel compound that, when stimulated by light, can mediate the transfer of electrons between molecules that otherwise would react more slowly or not at all. Their approach, known as triplet fusion upconversion, involves a chain of processes that essentially fuses two infrared photons into a single visible light photon. Most technologies only capture visible light, meaning the rest of the solar spectrum goes to waste. Triplet fusion upconversion can harvest low-energy infrared light and convert it to light that is then absorbed by the solar panels. Visible light is also easily reflected by many surfaces, whereas infrared light has longer wavelengths that can penetrate dense materials. "With this technology, we were able to fine-tune infrared light to the necessary, longer wavelengths that allowed us to noninvasively pass through a wide range of barriers, such as paper, plastic moulds, blood and tissue," Campos said. Scientists have long tried to solve the problem of how to get visible light to penetrate skin and blood without damaging internal organs or healthy tissue. Photodynamic therapy (PDT), used to treat some cancers, employs a special drug, called a photosensitizer, that is triggered by light to produce a highly reactive form of oxygen that is able to kill or inhibit the growth of cancer cells. Current photodynamic therapy is limited to the treatment of localised or surface cancers. "This new technology could bring PDT into areas of the body that were previously inaccessible," Rovis said. "Rather than poisoning the entire body with a drug that causes the death of malignant cells and healthy cells, a nontoxic drug combined with infrared light could selectively target the tumour site and irradiate cancer cells." The technology could have far-reaching impact. Infrared light therapy may be instrumental in treating a number of diseases and conditions, including traumatic brain injury, damaged nerves and spinal cords, hearing loss, as well as cancer. Other potential applications include remote management of chemical storage solar power production and data storage, drug development, sensors, food safety methods, mouldable bone-mimic composites and processing microelectronic components. The researchers are currently testing photon-upconversion technologies in additional biological systems. "This opens up unprecedented opportunities to change the way light interacts

with living organisms," Campos said. "In fact, right now we are employing upconversion techniques for tissue engineering and drug delivery."

Science Daily, 22 January 2019

http://www.sciencedaily.com

Micro-dispenser for long-term storage and controlled release of liquids

2019-01-24

Lab-on-a-chip (LOC) technology could transform medicine in ways comparable with the microprocessor revolution—once it can be manufactured in a scalable, cost-effective way. Researchers in Sweden now report a development that could hasten this revolution. A team from KTH Royal Institute of Technology in Stockholm has created a device that precisely dispenses and stores liquids that can be used on a range of diagnostic lab-on-a-chip platforms, at an estimated manufacturing cost of $2 to $6. The technology, which could also be scaled up in size for use in packaging food, cosmetics and chemicals, was reported in Nature Communications. Aman Russom, professor at KTH's Science for Life Laboratory research centre, says that it overcomes challenges that in many cases make lab-on-a-chip too expensive to be of value outside of research labs. Lab-on-a-chip technology promises to transform expensive health care laboratories into small, affordable and portable chips that can perform various tests automatically at points of care. Simpler examples of LOC, such as home pregnancy tests, have already begun this transition to a degree. Just as all laboratories rely on storage and dispensing devices, LOC, too, relies on being efficient storage and release of liquids on a chip. Russom says that the system developed at KTH not only solves and automates these two problems, but can also perform other required techniques, such as filtering, separation and mixing different liquids with minor modification. And importantly, it consolidates these functions on a single device, without the multiple mechanical parts and complex components that today's dispensers rely on – and which also are costly to produce. "We have shown that our simplified micro-dispenser performs different operations without sacrificing scalability or compatibility across different fluidic platforms," he says. The simplified dispenser comprises a tube with an aperture that is covered by an elastic membrane. It's activated when the internal pressure becomes greater than the force required to stretch the membrane. Pressure can be exerted by pushing mechanically or from centrifuge spin. When the internal pressure reaches the critical level, the membrane stretches and provides a path for the

Lab-on-a-chip (LOC) technology could transform medicine in ways comparable with the microprocessor revolution—once it can be manufactured in a scalable, cost-effective way.

liquid to discharge. Co-author Amin Kazemzadeh, the researcher who led the development of the device, says the dispenser enables full automation of a variety of clinical tests. "For the first time, it enables and automates separation of precise amounts of both plasma and red blood cells from a few micro-litres to several millilitres of whole blood in portable rotating lab-on-a-chip or centrifugal devices." He says the device proved accurate in numerous tests with different fluids. Lab-on-a-chip devices can be used for performing simple health-related tests such as measuring concentrations of different chemical or biological analytes, such as in blood, plasma or urine. "The use of these devices for performing such tests significantly reduces the amount of samples and expensive chemical reagents used, and in many cases, shortens the duration of the test from days to less than an hour," Kazemzadeh says. In blood diagnostic tests, whole blood is most often separated into components. For example, concentrated red cells can be used for measuring hematocrit levels and for patients needing oxygen therapy. Plasma is the most convenient source of proteins, fatty acids, hormones, circulating biomarkers and transport cells that are used for disease diagnostics, including those for cancer and infectious diseases. Russom and Kazemzadeh say their dispenser may also be valuable in other industries by extending the shelf life of beverages, chemicals, cosmetics and medicinal substances, which spoil quickly after their packages are opened. "Our technology allows for dispensing liquids without allowing air to enter the container. Therefore, the liquid inside the containers remains intact even after being used. That extends the shelf-life of the content to the nominal shelf-life of the product."

Phys.org, 22 January 2019

http://phys.org

Researchers have reported creating a durable silicone polymer coating capable of repelling ice from any surface.

Breakthrough in ice-repelling materials

2019-01-24

Icy weather is blamed for multibillion dollar losses every year in the United States, including delays and damage related to air travel, infrastructure and power generation and transmission facilities. Finding effective, durable and environmentally stable de-icing materials has been stymied by the stubborn tenacity with which ice adheres to the materials on which it forms. Researchers from the University of Houston have reported a new theory in physics called stress localisation, which they used to tune and predict the properties of new materials. Based on those predictions, the researchers reported in Materials Horizons that they have created a durable silicone polymer coating capable of repelling ice from any surface.

Gossip

"We have developed a new physical concept and the corresponding icephobic material that shows extremely low ice adhesion while having long-term mechanical, chemical and environmental durability," they wrote. Hadi Ghasemi, Bill D. Cook Assistant Professor of mechanical engineering at UH and corresponding author for the work, said the findings suggest a way to take trial and error out of the search for new materials, in keeping with the movement of materials science toward a physics-driven approach. "You put in the properties you want, and the principle will tell you what material you need to synthesise," he said, noting that the concept can also be used to predict materials with superb antibacterial or other desirable properties. His collaborators on the project include Payman Irajizad, Abdullah Al-Bayati, Bahareh Eslami, Taha Shafquat, Masoumeh Nazari, Parham Jafari, Varun Kashyap and Ali Masoudi, all with the UH Department of Mechanical Engineering, and Daniel Araya, a former UH faculty member who is now at the Johns Hopkins University Applied Physics Laboratory. Ghasemi previously has reported developing several new icephobic materials, but he said those, like other existing materials, haven't been able to completely overcome the problem of ice adhering to the surface, along with issues of mechanical and environmental durability. The new understanding of stress localisation allows the new material to avoid that, he said. The new material uses elastic energy localization where ice meets the material, triggering cracks at the interface that slough off the ice. Ghasemi said it requires minimal force to cause the cracks; the flow of air over the surface of an airplane acts as a trigger, for example. The material, which is applied as a spray, can be used on any surface, and Ghasemi said testing showed it is not only mechanically durable and unaffected by ultraviolet rays -- important for aircraft which face constant sun exposure -- but also does not change the aircraft's aerodynamic performance. Testing indicates it will last for more than 10 years, with no need to reapply, he said.

Science Daily, 15 January 2019

http://www.sciencedaily.com

Chemists at the University of Münster have developed a simple synthesis method for producing such fluorine-bearing piperidines.

New synthesis method for producing fluorinated piperidines

2019-01-24

Synthetic molecules are essential for many products, including medicines, crop protection agents and special materials such as Teflon. These molecules have several components, which can be combined in a variety of ways, resulting in different properties. Both so-called piperidines and

fluorinated groups are particularly important. Piperidines are small, ring-shaped chemical compounds. As a result of their particular properties, fluorine atoms bring about dramatic changes in the properties of certain products. Thus, they are often integrated in pharmaceuticals. Around 20 percent of all medicines sold worldwide contain fluorine. Up to now, however, combining fluorine atoms and piperidines has always been an extremely laborious process. Now, for the first time, chemists at the University of Münster have developed a simple synthesis method for producing such fluorine-bearing piperidines. The study, written by Dr. Zackaria Nairoukh, Marco Wollenburg, Dr. Christoph Schlepphorst, Dr. Klaus Bergander and Prof. Frank Glorius, has just been published in the online edition of the Nature Chemistry journal. In 2017, the Münster chemists had already published a study in Science in which they presented a method by which cyclic, fluorinated molecules could be produced simply and quickly. The chemists' new study follows on from this breakthrough. "Up to now, it had been very difficult to combine piperidines and fluorine molecules," explains Prof. Frank Glorius from the Institute of Organic Chemistry at Münster University, "and this was despite the fact that together, they have outstanding chemical properties relevant to the production of active ingredients."

Methodology

The method developed by Frank Glorius and his team runs in two consecutive steps, but in the same vessel: The starting molecules are easily accessible, fluorinated pyridines, so-called "aromatic" compounds. These compounds are flat and have a particularly high stability, which makes them inert for many chemical processes. In the method now published, the first step involves removing the aromaticity in a process called, unsurprisingly, dearomatisation. This makes the second step possible, in which hydrogen atoms are transferred specifically to one side of the ring system (hydrogenation). The resulting fluorinated piperidines are now no longer flat, in contrast to the aromatic starting substances, and this can be helpful for the formation of complex three-dimensional structures. For both reactions, the chemists used a catalyst. The results can now be used to produce new types of valuable components previously unavailable for research in the fields of pharmaceuticals and agrochemicals. "We hope that these components can soon be produced in large quantities," says Frank Glorius. The Münster University chemists want to use part of the grant of 2.5 million euros recently awarded by the European Research Council to work on a "renaissance" of the hydrogenation of aromatics, leading to the efficient production of such new types of molecule.

Gossip

"We're going flat out in our efforts to try to understand more about the mechanism of catalysis, so that better catalysts can be developed and the potential of these reactions can be exploited to the full," says Glorius.

Phys.org, 22 January 2019

http://phys.org

Curiosities

Does metal corrode or rust in space?

2019-01-25

Surprisingly, yes. Earth's atmosphere still contains oxygen up to about 700km altitude (the ISS orbits at 400km). At that altitude, oxygen exists as single atoms, rather than O2 molecules, and it is more reactive. Aluminium and stainless-steel form a protective oxide layer and won't corrode, but silver and iron corrode quickly in low orbit. In deep space, however, the lack of oxygen means that corrosion does not occur.

Science Focus, December 2018

http://www.sciencefocus.com

Essential knowledge for long-term spacecraft upkeep.

Chronic Bullying Could Actually Reshape The Brains of Teens

2019-01-25

Sticks and stones may break your bones, but name-calling could actually change the structure of your brain. A new study has found that persistent bullying in high school is not just psychologically traumatising, it could also cause real and lasting damage to the developing brain. The findings are drawn from a long-term study on teenage brain development and mental health, which collected brain scans and mental health questionnaires from European teenagers between the ages of 14 and 19. Following 682 young people in England, Ireland, France and Germany, the researchers tallied 36 in total who reported experiencing chronic bullying during these years. When the researchers compared the bullied participants to those who had experienced less intense bullying, they noticed that their brains looked different. Across the length of the study, in certain regions, the brains of the bullied participants appeared to have actually shrunk in size. In particular, the pattern of shrinking was observed in two parts of the brain called the putamen and the caudate, a change oddly reminiscent of adults who have experienced early life stress, such as childhood maltreatment. Sure enough, the researchers found that they could partly explain these changes using the relationship between extreme bullying and higher levels of general anxiety at age 19. And this was true even when controlling for other types of stress and co-morbid depressive symptoms. The connection is further supported by previous functional MRI studies that found differences in the connectivity and activation of the caudate and putamen activation in those with anxiety. "Although not classically considered relevant to anxiety, the importance of structural changes in the putamen and caudate to the development

of anxiety most likely lies in their contribution to related behaviours such as reward sensitivity, motivation, conditioning, attention, and emotional processing," explains lead author Erin Burke Quinlan from King's College London. In other words, the authors think all of this shrinking could be a mark of mental illness, or at least help explain why these 19-year-olds are experiencing such unusually high anxiety. But while numerous past studies have already linked childhood and adolescent bullying to mental illness, this is the very first study to show that unrelenting victimisation could impact a teenager's mental health by actually reshaping their brain. The results are cause for worry. During adolescence, a young person's brain is absolutely exploding with growth, expanding at an incredible place. And even though it's normal for the brain to prune back some of this overabundance, in the brains of those who experienced chronic bullying, the whole pruning process appears to have spiralled out of control. The teenage years are an extremely important and formative period in a person's life, and these sorts of significant changes do not bode well. The authors suspect that as these children age, they might even begin to experience greater shrinkage in the brain. But an even longer long-term study will need to be done if we want to verify that hunch. In the meantime, the authors are recommending that every effort be made to limit bullying before it can cause damage to a teenager's brain and their mental health. This study has been published in Molecular Psychiatry.

Science Alert, 16 December 2018

http://www.sciencealert.com.au

Study finds chronic fatigue clues in overactive immune response

2019-01-25

Scientists exploring what may trigger a complex disorder known as chronic fatigue syndrome (CFS) have found clues in the way some people's immune systems respond more actively to a health attack.

Scientists exploring what may trigger a complex disorder known as chronic fatigue syndrome (CFS) have found clues in the way some people's immune systems respond more actively to a health attack. A severe illness characterised by long-term physical and mental fatigue, CFS is thought to affect up to 17 million people worldwide and around 250,000 people in Britain. Sufferers are often bed-bound and unable to carry out basic daily activities like washing and feeding themselves. The researchers used a drug known as interferon alpha to create a model of the syndrome and found that patients whose immune response to treatment was hyperactive or exaggerated were more likely to then develop severe fatigue. "For the first time, we have shown that people who are prone to develop a CFS-like illness have an overactive immune system, both before

and during a challenge to the immune system," said Alice Russell of King's College London's Institute of Psychiatry, Psychology & Neuroscience (IoPPN), who led the work. The condition, as well as research into it, is highly contentious, in part because its possible causes and range of debilitating symptoms are poorly understood. Interferon alpha is used as a treatment for hepatitis C infection, and activates the immune system in the same way as a powerful infection. Many patients who receive interferon alpha experience extreme fatigue during treatment, and some continue to feel chronic fatigue for many months after the drug course is completed. Russell's team used this knowledge and measured fatigue and immune system markers in 55 patients before, during and after treatment with interferon alpha. They found that the 18 of those 55 who went on to develop a CFS-like illness had a hyperactive immune system before treatment, and a highly overactive response during treatment. "(This suggests) people who have an exaggerated immune response to a trigger may be more at risk of developing CFS," Russell told reporters at a briefing about the findings. IoPPN professor Carmine Pariante stressed that while the study's main finding is a useful addition to scant scientific knowledge about CFS - also known as myalgic encephalopathy (ME) - it offers few clues on how to treat, cure or prevent it. "It's a light in the fog," he told reporters. "But a better understanding of the biology underlying the development of CFS is needed to help patients."

Reuters Health, 17 December 2018

http://www.reuters.com/news/health

Vapers inhale significantly lower levels of toxic chemicals than smokers of traditional cigarettes, a new study suggests.

Vapers inhale lower levels of toxins than smokers

2019-01-25

Compared to non-smokers, vapers had more biomarkers of toxic chemicals in their urine - but they had lower levels than smokers of traditional cigarettes, said study leader Maciej Goniewicz of the Roswell Park Cancer Centre. "For smokers trying to quit it might be beneficial to use e-cigarettes as a transition," he added. But some e-cigarette users may end up both vaping and smoking, the study suggests. A significant number of people surveyed were "dual users," with biomarkers showing higher consumption of both nicotine and toxicants, Goniewicz noted. "E-cigarettes are a benefit to smokers only if they completely switch to vaping," Goniewicz said. "And we know from epidemiological studies that dual use is very common. Some people use e-cigarettes in environments where they are not allowed to smoke and then smoke at home." The number of people who were both vaping and smoking "was really

surprising," Goniewicz said. Goniewicz and colleagues analysed 2013-2014 data from the nationally representative Population Assessment of Tobacco and Health Study, which is designed to assess tobacco use and health in the U.S. The 5,105 adult participants provided urine samples to be analysed for biomarkers. Overall, 2,411 of the volunteers smoked cigarettes only, 247 used only e-cigarettes, 792 used both traditional and e-cigarettes and 1,655 never vaped nor smoked, researchers reported in JAMA Network Open. Dual users had the highest levels of nicotine biomarkers, followed by those who smoked traditional cigarettes only. Biomarkers for the heavy metals lead and cadmium were lower in vapers than smokers, but still significantly higher in vapers than non-smokers. Exposure to cancer-causing tobacco-specific nitrosamines was far higher in smokers and those who both vaped and smoked, compared to those who used e-cigarettes only or never used tobacco. The same was true for several other toxic substances. Experts said the study helps clarify health risks related to e-cigarettes. "Use of e-cigarettes has risen significantly and we're all trying to figure out the potential risks and benefits compared to combustible cigarettes," said Dr. Michael Lynch, a toxicologist and emergency medicine physician and medical director of the Pittsburgh Poison Centre at the University of Pittsburgh Medical Centre. "But the results should be taken as preliminary, as they don't have as many pure e-cigarette users as they do combustible cigarette users." It's hoped that e-cigarettes will be more helpful for smoking cessation than nicotine patches and gum, said Lynch, who was not involved in the study. "It fulfils the same fixation of putting the product into your mouth and puffing," he explained. "A critical question has been: how toxic are e-cigarettes?" said Dr. Michael Blaha, director of clinical research at the Ciccarone Centre for the Prevention of Heart Disease at Johns Hopkins Medicine in Baltimore. "This is vitally important to understand as we assess the potential benefits of e-cigarettes as cessation aids versus the very real harms of 'sole e-cigarette' use among young non-smokers picking up e-cigarettes as the first tobacco product." This study "will be very important to a wide array of researchers," Blaha, who was not involved in the research, said by email. "The study shows that while e-cigarettes are clearly associated with less toxic exposure than combustible cigarettes, they are certainly associated with more exposure than complete non-use of tobacco. In other words, e-cigarettes are 'safer' than traditional cigarettes, but are not themselves 'safe.' In particular, e-cigarettes are associated with volatile

organic compounds and heavy metals that are known to be associated with cardiovascular disease."

Reuters Health, 15 December 2018

http://www.reuters.com/news/health

Inflammatory bowel disease tied to heart attack risk

2019-01-25

People with inflammatory bowel diseases like Crohn's disease and ulcerative colitis may be up to 12 times more likely to have a heart attack, a U.S. study suggests. Inflammatory bowel disease (IBD) involves chronic or recurring inflammation of the gastrointestinal tract. Ulcerative colitis and Crohn's are the most common forms. People with Crohn's have inflammation throughout the digestive tract, while in ulcerative colitis, only the large intestine is inflamed. While chronic inflammation in the body has long been linked to an increased risk of cardiovascular disease, the potential for conditions like Crohn's disease and ulcerative colitis to lead to heart attacks isn't as well understood, the study team notes in the journal Inflammatory Bowel Diseases. The researchers examined a nationwide database of medical records for more than 29 million people, including almost 132,000 with ulcerative colitis and 159,000 with Crohn's disease. Over the five-year study period, people with IBD were 25 percent more likely than those without the disorder to have a heart attack, the study found. "IBD should be regarded as an independent risk factor for the development of heart disease," said senior author Dr. Mahazarin Ginwalla of University Hospitals Cleveland Medical Centre in Ohio. This means people with IBD should be monitored carefully for cardiac risk factors like smoking, obesity, high blood pressure, diabetes and high cholesterol, Ginwalla said by email. Treating risk factors, and keeping symptoms of IBD controlled, may lower the risk of heart attacks, Ginwalla said. For people with IBD, "the risk of adverse cardiovascular events is highest during active flares or persistent disease, with this risk diminishing during times of remission," Ginwalla added. During the study, 3.3 percent of people without IBD had a heart attack, compared to 6.7 percent of patients with ulcerative colitis and 8.8 percent of individuals with Crohn's disease. The biggest increased risk of heart attacks for people with IBD was seen among younger people. IBD patients ages 30 to 34 were 12 times more likely to have a heart attack than people in their age group without IBD, the study found. By age 65, however, people with IBD were only about twice as likely to have a heart attack as people without these conditions. It's possible that chronic inflammation in people with IBD might lead to

People with inflammatory bowel diseases like Crohn's disease and ulcerative colitis may be up to 12 times more likely to have a heart attack, a U.S.

clotting in the blood and more clots in the arteries, which then leads to heart attacks, said Dr. Miguel Regueiro of Cleveland Clinic in Ohio. "The IBD is probably indirectly causing the heart attack from the body's response to inflammation," Regueiro, who wasn't involved in the study, said by email. The results add to growing evidence that patients with IBD may be at increased risk for heart attacks, said Dr. Gilaad Kaplan of the University of Calgary in Canada. "With this knowledge, it is important that patients with IBD minimise their future risk by talking to their primary care doctor about risk factor modifications," Kaplan, who wasn't involved in the study, said by email. This includes a healthy diet, smoking cessation, controlling blood pressure and cholesterol, and managing diabetes, Kaplan advised.

Reuters Health, 14 December 2018

http://www.reuters.com/news/health

High-salt diets linked to bone damage

2019-01-25

Diets high in salt might be causing the body to chew into its own bones, leaving them riddled with holes like Swiss cheese, Melbourne researchers fear. If the research holds up – it remains in the early stages – addressing Australia's salt addiction would become a major priority. We consume almost twice the recommended amount of salt a day. Doctors might even begin prescribing medications to cut salt intake. "This gives us a whole new reason why salt may be bad for your heart. It's a really interesting and separate story," says Professor Steve Nicholls, a world-renowned cardiologist and the head of the new Victorian Heart Hospital. He was not involved in the research. At a lab at the Baker Heart and Diabetes Institute, Associate Professor Andrew Murphy's team has been feeding mice a high-salt diet for 12 weeks – equivalent to 12 grams of salt a day, which is what many Australians consume. Scientists know high-salt diets can cause high blood pressure. But, on a hunch, Professor Murphy's team decided to look elsewhere in the mice's bodies, to see what the salt was doing. They discovered the mice had extremely overactive immune systems, and way too many white-blood cells. These cells, they discovered, were being produced by rogue stem cells in the spleen. "We kept chasing the data. It kept snowballing," says Professor Murphy. They checked the mice's bones, where the stem cells usually reside, and found them riddled with tiny holes. An overactive immune cell, driven haywire by exposure to high levels of salt, was chewing into the bone. "We found that these immune cells essentially attack the bone," says Professor Murphy. Our bones are not solid. They are filled with a scaffold of bone cells, with stem cells,

Diets high in salt might be causing the body to chew into its own bones, leaving them riddled with holes like Swiss cheese, Melbourne researchers fear.

responsible for making new cells for our blood, living in between them. When the immune cells start chewing up the bone, the stem cells flee into the spleen. There, they start producing too many white blood cells, which can block blood vessels and raise blood pressure. It may be, Professor Murphy says, that this overlooked process is in fact part of the reason high-salt diets cause heart attacks. Unusually for such early-stage research (the study has not yet been accepted for publication, although its results have been presented at national and international conferences), Professor Murphy has human data. Coincidentally, as he was studying mice, a lab in Germany was studying humans on a high-salt diet, monitoring signs of bone decomposition in the blood. They found people who ate 12 grams or more of salt a day had significant signs of bone decomposition. "They showed the same changes in immune cells we found in the mice, and the same inflammatory molecules were changing," says Professor Murphy. The study does not prove his theory, but is certainly troubling. Professor Murphy's work is part of a wider move across the scientific community to reconsider cardiovascular disease – the catch-all term for diseases of the heart caused by high blood pressure and high cholesterol. It is the leading cause of death in Australia, and for years was considered a lifestyle disease, linked to smoking, lack of exercise, and poor diet. But new studies are showing the immune system has a big role to play. One recent milestone paper showed a drug that reduces inflammation, which is caused by an overactive immune system, also cuts cardiovascular disease deaths. "Some people think it's entirely an inflammatory disease, and all these other factors are driving inflammation," says Professor Nicholls. After decades of trying to treat cardiovascular disease by improving people's lifestyles, "our hospitals are still full. So that tells us we still have a long way to go".

Sydney Morning Herald, 16 December 2018

http://www.smh.com.au/

Global cancer study to explore link between gas anaesthesia and likelihood of relapse

2019-01-25

Melbourne scientists will spearhead a global study to see whether the use of gas anaesthetics on cancer patients who undergo surgery could contribute to a higher risk of the cancer recurring. The study, which will run for five years and include 5,700 patients, is likely to shape the way cancer surgeries are managed worldwide, according to Peter MacCallum Cancer Centre's Bernhard Riedel, who is a chief investigator on the project. Professor Riedel said there was "mounting evidence" that gas-based

Melbourne scientists will spearhead a global study to see whether the use of gas anaesthetics on cancer patients who undergo surgery could contribute to a higher risk of the cancer recurring.

anaesthetics — also known as "volatile anaesthetics" — could promote the growth of any cancer cells left in the body after surgery. He said a study on mice had found that those who were given intravenous anaesthesia had higher rates of cancer survival than those who were treated with anaesthetic gases, suggesting gas anaesthetics could increase the risk of a cancer relapse. "There's some literature that's suggesting … that some of the volatile gases may drive some of the cancer pathways, and so if there's any residual disease or cancer that's left undiagnosed at the time of surgery, this has a chance to get a foothold and lead to recurrence," he said. "These gases don't cause cancer … these gases [may] add fuel to the fire." Professor Riedel said some hospitals were already favouring the use of intravenous anaesthesia over gas-based anaesthesia in light of those studies, but there was still no "robust" evidence available to warrant a ban on the use of volatile anaesthesia.

Gas anaesthetic still 'safe'

He said despite the need for the study to improve anaesthetists' best practice, patients should not be concerned that gas-based anaesthetics are unsafe. "The workhorse of anaesthesia has always been volatile-based anaesthesia, it's used by the majority of anaesthetists, it's safe … the opportunity to study this and see whether we can make it a little bit safer for the cancer patient is important," Professor Riedel said. "The volatiles are easy to turn on, they're titratable … they're easy to switch off, they've been the primary technique used by anaesthetists for decades." The study's synopsis said 80 per cent of anaesthetists routinely used inhaled anaesthesia and 50 per cent of respondents felt that the anaesthetic technique used impacted cancer outcomes. "This lack of clinical consensus on optimal anaesthesia reflects the need for a definitive randomised clinical trial," the synopsis stated. The trial — which will involve international collaboration between scientific centres — will examine whether the already widely used intravenous anaesthetic propofol could reduce inflammation and cancer relapse in patients being treated for lung and colorectal cancers. The Federal Government has committed $4.88 million towards the research, which is being jointly coordinated by the Peter MacCallum Cancer Centre and the University of Melbourne.

ABC News, 6 December 2018

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

Curiosities

Babies and toddlers at greater risk from second-hand smoke than previously thought, study finds

2019-01-25

Infants and toddlers in low-income communities may be even more at risk from second- and third-hand smoke exposure than has been believed, according to new federally supported research. In testing that included more than 1,200 children, researchers found that up to 15 percent of them had levels of cotinine, a by-product of the body's breakdown of nicotine, comparable with what would be found in an adult smoker. Overall, about 63 percent of the babies and young children in the study had discernible levels of cotinine, evidence of significant exposure to second- and third-hand smoke, according to the study, published last week in the journal Nicotine & Tobacco Research. Previous similar research, focused on older children, detected cotinine in less than half of the children studied or did not document levels of cotinine. For those who remain sceptical about the body's susceptibility to passive smoke exposure, the study may serve as a wake-up call. "We're finding (as much as) 15 percent of the babies have levels as if they were smokers themselves," said Clancy Blair, senior study author and a professor of cognitive psychology at New York University. "It was definitely more than we expected, and it's scary," said Lisa M. Gatzke-Kopp, the study's lead author and a professor of human development and family studies at Pennsylvania State University. "Smoke continues on in the environment even after the cigarette is out." The study, which also included researchers from other universities, sought to find if infants and very young children are at increased risk from passive tobacco smoke exposure given their higher respiration rates and likely contact with surface residues. The exposure included second-hand smoke from being around a smoking adult or third-hand smoke from residue on surfaces like toys, floors, or clothing. "I think some parents are trying to reduce their children's exposure," said Gatzke-Kopp. "They're making a good effort. They go outside, or they don't smoke around their child, but they may not know it's all over them, and when they pick the baby up and cuddle the baby, the baby's getting it through their clothes, their hair." The study was part of the Environmental Influences on Child Health Outcomes (ECHO) program, a nationwide research effort with funding from the National Institutes of Health. Its aim is to learn about the effects of a broad range of environmental influences on child health and development. The cotinine study focused on mostly low-income children in rural communities in central Pennsylvania and North Carolina. Saliva samples were taken from children ages 6 months, 12 months, 15 months, and 2 and 4 years. Certain factors that often coincide with poverty also tended to coincide with

Infants and toddlers in low-income communities may be even more at risk from second- and third-hand smoke exposure than has been believed, according to new federally supported research.

higher cotinine levels—more residential moves, unstable households with adults coming and going, low educational attainment by adults in the household, and low income. Children who spent time in centre-based day care were less likely to have high cotinine levels. The majority of the children's mothers did not profess to be smokers. According to Gatzke-Kopp, about a quarter of the mothers said they smoked while pregnant, and about 30 percent said they smoked after their children were born. And while the children tested for the study lived in rural communities, the researchers said it's unlikely children in urban communities are any less at risk. "It might be even more worrisome, in that kids in urban environments are operating in more of a toxic chemical soup than kids in a more rural environment," Blair said. Gatzke-Kopp said the researchers plan to use the data to learn if increased exposure to second- and third-hand smoke is related to later health problems, including learning deficits. "It's definitely true that nicotine binds in the brain in special receptors that affect things like cognition and attention, and there's every reason to believe all brains are equally vulnerable," she said.

Medical Xpress, 16 December 2018

http://medicalxpress.com

Folate deficiency creates more problems in connection with cell division and DNA replication than previously thought, a study shows

2019-01-25

Once a person lacks folate, the resulting damage is irreversible.

Once a person lacks folate, the resulting damage is irreversible. The researchers therefore encourage people to be more aware of the level of folate in the blood. Folate is a type of vitamin B found in, for example, broccoli, spinach, peas, mushrooms, shellfish, and fruit such as bananas and melon. The Danish Health Authority recommends that pregnant women and women trying to get pregnant take a daily supplement of folic acid. But everyone, not just pregnant and soon-to-be pregnant women, should focus on this vitamin, says the last author of the study, associate professor Ying Liu from the Centre for Chromosome Stability at the department of cellular and molecular medicine at the University of Copenhagen. "The problem with folate deficiency is that it affects chromosome maintenance, and once a cell has lost a chromosome or part of it, it can never be fixed. That is, once cell division has gone wrong, you cannot fix it subsequently by consuming a lot of folic acid. Once the damage is done, it is irreversible," says Liu. "Therefore, we need a guide

telling us what the level of folate in the blood in the population in general should be. Once we have that knowledge, we can determine whether a person needs folic acid supplements to make sure the level in the blood is high enough for the cells to reproduce the DNA successfully." A blood sample can determine the level of folate in the blood. Researchers have known for many years that folate deficiency is associated with mental illness, age-related dementia, and deformation of the brain and spinal cord of foetuses, also known as neural tube defects. But they have not been able to establish the causality—that is, whether folate deficiency directly causes the disorders or the disorders result from the secondary effect of folate deficiency. To answer this question, the researchers studied lymphocytes, which are a type of white blood cell, from men. However, the results would also apply to women, Liu says. The researchers analysed the part of the genome called FRAXA, which contains an extensive so-called CGG sequence, a genetic code. Here they saw that folate deficiency caused abnormalities in connection with cell division, mitosis, especially in cells with an abnormally long CGG sequence. Among other things, it caused faulty segregation of chromosomes. The researchers also saw how the entire X chromosome became unstable in cases of long exposure to folate deficiency. "In the study, we demonstrate that folate deficiency leads to both higher levels of and more harmful chromosome abnormalities than previously known. This causes the daughter cells to inherit the incorrect amount of DNA following cell division or, in some cases, to even lose an entire chromosome. This could explain why folate deficiency is associated with diseases like infertility, mental health disorders, and cancer," Liu explains. Other parts of the genome also contain extensive CGG sequences. The researchers assume that folate deficiency will also affect those regions. As a next step, they aim to map all the areas of the human genome that folate deficiency may affect. The research appears in PNAS. Funding came from the Nordea Foundation, the US National Institute of Health, the Danish National Research Foundation, and the European Union Horizon 2020 program.

Futurity, 14 December 2018

http://www.futurity.org

Thanks to the Apollo missions, scientists on Earth have samples of lunar dust that they can test, and a new research effort discovered that the pale powder is packed with compounds that react with human cells.

Breathing in Moon dust could kill you

2019-01-25

Dreams of a lunar colony where people walk around on the dusty surface inside of big domes will remain a dream for a while longer. We might eventually reach a point where humans could feasibly create comfortable

living conditions on Earth's Moon, but new research suggests that the material covering our nearest neighbour is actually toxic to humans. Thanks to the Apollo missions, scientists on Earth have samples of lunar dust that they can test, and a new research effort discovered that the pale powder is packed with compounds that react with human cells. As New Scientist reports, the minerals prompt the formation of hydroxyl radicals which are thought to promote lung cancer. When NASA visited the Moon many decades ago, they quickly found out just how hostile the lunar surface could be. The dusty surface was tough on the space suits the astronauts wore as well as vehicles like the lunar rover. What they couldn't have predicted is that the dust could actively damage human DNA. In another recent round of research, scientists exposed living cells from rodents and humans to a Moon dust analogue. The cells didn't fare well, and some 90% of mouse brain cells and human lung cells ultimately died after coming into contact with the faux Moon dust. This is a pretty serious problem for any astronauts who aim to visit the Moon in the future. Equipping a sealed space suit to venture out onto the surface is easy enough (relatively speaking), but upon returning to a ship or — in the more distant future — a lunar base, ensuring that no visitors come into contact with Moon dust could prove a steep challenge. Renewed interest in the Moon over recent years has resulted in several planned missions to study Earth's satellite more closely than in the past. Eventually, manned missions will indeed return, so it'll be interesting to see how engineers plan on dealing with this "new" hazard.

BGR, 17 December 2018

http://www.bgr.com

More than a third of vintage Scotch whiskies tested at a specialist laboratory have been found to be fake, BBC Scotland has learned.

Third of rare Scotch whiskies tested found to be fake

2019-01-25

More than a third of vintage Scotch whiskies tested at a specialist laboratory have been found to be fake, BBC Scotland has learned. Twenty-one out of 55 bottles of rare Scotch were deemed to be outright fakes or whiskies not distilled in the year declared. The tests were conducted at the East Kilbride-based Scottish Universities Environmental Research Centre (SUERC). It used advanced radiocarbon dating techniques to reach its conclusions. SUERC measured residual concentrations of a radioactive isotope of carbon present in the alcohol contained in each bottle in order to establish the ages of the whiskies. The samples had been sent for analysis by whisky broker Rare Whisky 101 (RW101), which said it was responding to "growing concern surrounding the proliferation of

fake whisky" in the secondary market. The bottles had been selected at random from auctions, private collections and retailers. Last year, the same company exposed a £7,600 dram of vintage Scotch bought in a Swiss hotel as a fake. The rare whisky bottles identified as fakes this year included an Ardbeg 1885, which had been acquired from a private owner, and a Thorne's Heritage early 20th Century blended whisky purchased from an auctioneer. RW101 said a total of 10 single malts purporting to be from 1900 or earlier were found not to be genuine. The company said that if tests had proven all 21 bottles to be genuine, collectively they could have been valued at about £635,000. RW101 has estimated that about £41m worth of rare whisky which is currently circulating in the secondary market - and present in existing collections - is fake. That is more than the entire UK whisky auction market, which RW101 has forecast will exceed £36m by the end of this year.

'Rogue elements'

RW101 co-founder David Robertson said "the vast majority" of vendors were not knowingly selling fake Scotch but every purported rare whisky bottle "should be assumed to be fake until proven genuine", especially if it claimed to be a single malt. He added: "This problem will only grow as prices for rare bottles continue to increase. "The exploding demand for rare whisky is inevitably attracting rogue elements to the sector."

BBC News, 20 December 2018

http://news.bbc.co.uk

It has "significant potential" to be a target for a new type of depression drug.

Depression Linked to Shortage of a Single Naturally Occurring Chemical

2019-01-25

Depression plagues about 300 million people worldwide, and as scientists learn more about the condition, they are realising it's far more complex than we once thought. This year alone, a new type of depression was identified, and scientists uncovered about 80 genes that might determine why some people are more susceptible than others. Fortunately, these discoveries are also showing us how to better treat depression. A paper released in July took a step in a new direction by identifying a naturally occurring chemical linked to depression that could be a key target for future drugs. The paper, released in Proceedings of the National Academy of Sciences, focused on acetyl-L-carnitine (ALC), which usually is involved in converting food into energy. Led by Stanford University professor of

psychiatry and behavioural sciences, Natalie Rasgon, Ph.D., this study was among the first to show that low levels of ALC are linked to depressive states in humans. Rasgon established this connection by collecting life history details and blood samples from a diverse sample of participants ranging from 20 to 70 years old.

Depression

A future drug that targets ALC might provide a new avenue for depression treatment Rasgon compared the blood samples of 45 healthy controls and 71 participants who suffered from either moderate or severe depression and found that those with depression had significantly lower levels of ALC in their blood. Importantly, she also found that those with the lowest levels of ALC tended to have the most severe symptoms, developed depression later in life, and reported experiencing little relief when they adhered to traditional treatment. In a previous interview with Inverse, Rasgon speculated that dips in ALC could partially explain patterns of depression that emerge in individuals who had experienced neglect, poverty or other trying circumstances during childhood. "We've known that people who experienced childhood adversity subsequently experience worse overall health, cognitive performance, and are at risk for depression when they reach mid-life," Rasgon said. "This study mechanistically addresses the link between adversity and depression because of the low ALC levels. This is speculative, but it could decrease the body's capacity to tolerate stress." Rasgon emphasised that while it might be tempting to try to treat low ALC levels with a supplement (ALC supplements are easy to find), she doesn't think that restoring ALC levels with external sources is the answer. She believes that supplementation could "just derail the potential efficacy of a drug" that may be developed in the future. "At this point, we want to be very careful in specifying what we've achieved: We have found a new biomarker for depression, and it has significant potential for finding a new molecular target for drugs," Rasgon said. Instead, it's best to look at ALC as a target for some future treatment that might provide solace to millions of people in years to come.

Inverse, 20 December 2018

http://inverse.com

Can You Really Get Sick from Smelling Dirty Socks?

2019-01-25

A man in China had a habit of walking home from work every day, taking off his socks and… taking a great big whiff of them, according to news

A man in China had a habit of walking home from work every day, taking off his socks and… taking a great big whiff of them, according to news reports.

reports. Bizarre? Yes. But harmful? Well, according to a video posted on the Chinese platform Pear Daily, also yes. The video says that the 37-year-old man was hospitalized for chest pain, and was diagnosed with a fungal infection in his lungs — an infection that his doctors attributed to fungal spores that he had inhaled from his socks. But is it even possible to get an infection like this from smelling socks? Technically, yes — but it's very unlikely that something like this would happen, said Dr. William Schaffner, an infectious-disease specialist at Vanderbilt University who was not involved with the Chinese man's case. Indeed, Schaffner noted that in his "long clinical experience," he'd never heard of a case like this. The case is "very interesting, if true," he added. However, the lack of details about the case in local news reports, such as what kind of fungus caused the infection, makes Schaffner "kind of dubious to start with," he said. Biologically, it's possible for someone to develop a lung infection by inhaling fungal spores that had built up heavily in someone's socks, Schaffner told Live Science. Indeed, lung infections from inhaling fungal spores are well-documented. Cave explorers, for example, run the risk of an infection called histoplasmosis, which is caused by inhaling fungal spores that can be found in bat droppings. And inhaling coccidioides fungal spores — which are found throughout the western and southwestern United States — can cause a flu-like infection called valley fever. "We don't live in a sterile world, we're surrounded by bacteria and fungi all the time," Schaffner said. That doesn't mean we're definitely going to get sick, though. What makes the Chinese man's case different, though, is that he's said to have "put the source [of fungus] right up to his nose and inhaled quite frequently, in unusually large doses and repeated doses, [which would have] made him more susceptible to actually developing an illness," he said. There's also not much known about the patient himself, based on the available reporting. For example, the man could have had a weakened immune system that would've made him more susceptible to such an infection, Schaffner said. The man's doctor said in local news reports that the man likely did have a weaker immune system, and this was due to a lack of rest because he was looking after a child. But Schaffner said that he found that explanation "rather thin." That's not typically a reason doctors would consider a patient to be immune-suppressed, he said, "so [when] I saw that, I raised my eyebrows." In any case, the whole situation "reinforces the notion that one ought to launder ones socks frequently rather than trying to make a daily assessment as to whether you want to put them on again for the seventeenth time," Schaffner added. Still, the occasional sock-smeller — you know, the person who grabs a sock for a quick is-this-clean check before getting dressed —

can rest easy, and need not fear a fungal infection. "Not to worry," Schaffner said.

Live Science, 18 December 2018

http://www.livescience.com

Experts: Stop Adding Cancers-Causing Chemicals To Our Meats

2019-01-25

Experts in the UK are smoking mad over a lack of regulation surrounding food additives which may be leading to increased rates of cancer in people who eat processed meats. Meat has had a mighty difficult go of things since a concerning 2015 World Health Organization report which reclassified processed meats as Group 1, carcinogenic to humans. The news that your crispy bacon might be causing cancer was met with mixed reactions. But scientists in the UK are now suggesting there may be a way to have your bacon and eat it too. Part of the problem may centre around the meat industry's use of nitrites as preservatives. Nitrites are used as both a preservative and colour fixture, ensuring meat has a pinkish hue, according to the Food and Drug Administration (FDA). A coalition led by Queen's University professor Chris Elliott claims there is a "consensus of scientific opinion" that adding nitrites to cure meats can cause an increased risk of cancer in humans and leading to 6,600 cases of bowl cancer in the UK. Coalition members, like cardiologist Dr. Aseem Malhotra, are calling upon the UK government to stop the use of nitrites are preservatives. "Government action to remove nitrites from processed meats should not be far away. Nor can a day of reckoning for those who dispute the incontrovertible facts. The meat industry must act fast, act now – or be condemned to a similar reputational blow to that dealt to tobacco," Malhotra said to The Guardian.

Experts in the UK are smoking mad over a lack of regulation surrounding food additives which may be leading to increased rates of cancer in people who eat processed meats.

Futurism, 30 December 2018

https://futurism.com

Woman Develops Donor's Peanut Allergy After Lung Transplant

2019-01-25

Sometimes, you just really want a peanut butter and jelly sandwich. And, as long as you're not allergic to the ingredients, that's totally fine. At least, that's what one woman thought. The 68-year-old woman, who had never

had a peanut allergy, had a severe allergic reaction to the sandwich, according to a recent report of her case, which was published in August in the journal Transplantation Proceedings. But someone else did have a peanut allergy, it turned out: the donor who supplied the woman with a transplant lung. It's a very rare occurrence for lung transplant recipients to acquire a food allergy from a donor organ, said lead case report author Dr. Mazen Odish, a fellow in pulmonary and critical care medicine at the University of California - San Diego Medical Centre, who treated the woman. There have only been about four or five case reports in which organ recipients have acquired peanut allergies with anaphylaxis following a lung transplant, Odish told Live Science.

Identifying the culprit

The woman in the case had needed a single-lung transplant to treat her emphysema, a condition in which the air sacs in the lungs become damaged, making it difficult to breathe. She received a new left lung from a 22-year-old male donor, Odish said. The woman's recovery was going well after the transplant, but the day before she was scheduled to go home from the hospital, she felt tightness in her chest and found it very difficult to breathe, according to the report. Initially, her doctors weren't sure why she was experiencing these symptoms of respiratory failure, and tests done at the time didn't turn up any clear explanation for it. It wasn't until the woman mentioned that her symptoms started immediately after she had eaten a PB & J sandwich that doctors began to suspect a food allergy, even though the woman lacked other common allergy symptoms, such as a rash or stomachache. Because the woman had never had problems eating peanuts before, doctors contacted the transplant agency, who confirmed that the male donor had a known peanut allergy, according to the case report. So, along with the lung, the woman also appears to have received a peanut allergy from the donor, Odish told Live Science. Although it's rare for food allergies to be transferred from organ donors to transplant recipients, it does occur: cases of food allergies being acquired from organ donors have been reported after liver, kidney, lung, bone marrow, heart and kidney transplants, the authors wrote. But not every transplant recipient who obtains an organ from a donor with food allergies picks up the sensitivity, which may turn up anywhere from days to months after the transplant. Studies have suggested, for example, that children and people who receive liver transplants may be more likely to develop food allergies from organ donors who have them. Other research has shown that transplant-acquired food allergies occur more frequently when organ recipients are prescribed tacrolimus, an immunosuppressive

drug used to reduce the risk of organ rejection following a transplant. The woman in this case had been on tacrolimus. Skin tests later confirmed that the woman was allergic to peanuts, and she also tested positive for almonds, cashews, coconuts and hazelnuts. Doctors advised her to avoid peanuts and tree nuts, and she was given an EpiPen in case of another severe allergic reaction to these foods. It's unclear if transplant-acquired food allergies remain a lifelong concern for patients, Odish said, because it's possible that the allergy may wane in some individuals. Allergy doctors will likely continue to test the woman for peanut and tree nut allergies to see if her tolerance to these foods change over time, he noted.

Live Science, 31 December 2018

http://www.livescience.com

Would you eat it? Israeli algae falafel wins prize

2019-01-25

It's traditionally made with chickpeas. But Israel's signature street food recently got a makeover from a group of Techion students looking to develop new sources of protein. The invention, titled "Algafalafel," was created by a team of graduate students from the Biotechnology and Food Engineering Faculty at the Technion-Israel Institute of Technology. And last month, the dish won first prize at the EIT Food Project competition held at the university. The aim of the competition – which saw students working on it for a full year – was to develop a protein-replacement dish to feed the growing world population. Scientists expect that by the year 2050 – with 9.8 billion mouths to feed – there will be a serious protein shortage. The "Algafalafel" are enriched with spirulina, which is a "biomass of blue-green algae which produce their own food by photosynthesis without a living organic carbon," according to the university. Dried spirulina contains 5% water, 24% carbohydrates, 8% fat and about 60% protein. The "tahini" on the falafel is also enriched with astaxanthin, "a health-promoting compound found naturally in certain algae and seafood." Spirulina, which grows in both fresh and saltwater, is one of the foods that has long been suggested as scientists tackle the concerns of food insecurity. Cultivating spirulina requires less land and water than producing cattle or poultry.

Last month the algae falafel dish won first prize at the EIT Food Project competition held at the Haifa Technion.

The Jerusalem Post, 2 January 2019

https://www.jpost.com

Curiosities

The five most addictive substances in the world

2019-01-25

What are the most addictive drugs? This question seems simple, but the answer depends on whom you ask. From the points of view of different researchers, the potential for a drug to be addictive can be judged in terms of the harm it causes, the street value of the drug, the extent to which the drug activates the brain's dopamine system, how pleasurable people report the drug to be, the degree to which the drug causes withdrawal symptoms, and how easily a person trying the drug will become hooked. There are other facets to measuring the addictive potential of a drug, too, and there are even researchers who argue that no drug is always addictive. Given the varied view of researchers, then, one way of ranking addictive drugs is to ask expert panels. In 2007, David Nutt and his colleagues asked addiction experts to do exactly that -- with some interesting findings.

1. Heroin

Nutt et al.'s experts ranked heroin as the most addictive drug, giving it a score of 3 out of a maximum score of 3. Heroin is an opiate that causes the level of dopamine in the brain's reward system to increase by up to 200% in experimental animals. In addition to being arguably the most addictive drug, heroin is dangerous, too, because the dose that can cause death is only five times greater than the dose required for a high. Heroin also has been rated as the second most harmful drug in terms of damage to both users and to society. The market for illegal opiates, including heroin, was estimated to be $68 billion worldwide in 2009.

What are the most addictive drugs? This question seems simple, but the answer depends on whom you ask.

2. Cocaine

use of dopamine to convey messages from one neuron to another. In essence, cocaine prevents neurons from turning the dopamine signal off, resulting in an abnormal activation of the brain's reward pathways. In experiments on animals, cocaine caused dopamine levels to rise more than three times the normal level. It is estimated that between 14 million and 20 million people worldwide use cocaine and that in 2009 the cocaine market was worth about $75 billion. Crack cocaine has been ranked by experts as being the third most damaging drug and powdered cocaine, which causes a milder high, as the fifth most damaging. About 21% of people who try cocaine will become dependent on it at some time in their life. Cocaine is similar to other addictive stimulants, such as methamphetamine -- which is becoming more of a problem as it becomes more widely available -- and amphetamine.

3. Nicotine

Nicotine is the main addictive ingredient of tobacco. When somebody smokes a cigarette, nicotine is rapidly absorbed by the lungs and delivered to the brain. Nutt et al's expert panels rated nicotine (tobacco) as the third most addictive substance. More than two-thirds of Americans who tried smoking reported becoming dependent during their life. In 2002 the WHO estimated there were more than 1 billion smokers and it has been estimated that tobacco will kill more than 8 million people annually by 2030. Laboratory animals have the good sense not to smoke. However, rats will press a button to receive nicotine directly into their bloodstream -- and this causes dopamine levels in the brain's reward system to rise by about 25% to 40%.

4. Barbiturates ("downers")

Barbiturates -- also known as blue bullets, gorillas, nembies, barbs and pink ladies -- are a class of drugs that were initially used to treat anxiety and to induce sleep. They interfere with chemical signalling in the brain, the effect of which is to shut down various brain regions. At low doses, barbiturates cause euphoria, but at higher doses they can be lethal because they suppress breathing. Barbiturate dependence was common when the drugs were easily available by prescription, but this has declined dramatically as other drugs have replaced them. This highlights the role that the context plays in addiction: if an addictive drug is not widely available, it can do little harm. Nutt et al's expert panels rated barbiturates as the fourth most addictive substance.

5. Alcohol

Although legal in the US and UK, alcohol was scored by Nutt et al.'s experts 1.9 out of a maximum of 3. Alcohol has many effects on the brain, but in laboratory experiments on animals it increased dopamine levels in the brain's reward system by 40% to 360% -- and the more the animals drank the more dopamine levels increased. Some 22% of people who have taken a drink will develop dependence on alcohol at some point during their life. The WHO has estimated that 2 billion people used alcohol in 2002 and more than 3 million people died in 2012 due to damage to the body caused by drinking. Alcohol has been ranked as the most damaging drug by other experts, too.

CNN, 6 January 2019

http://www.cnn.com/health

Curiosities

Researchers Have Bad News About the Health Benefits of Sweeteners

2019-01-25

With the rising popularity of low-carb diets, sugar substitutes are experiencing a resurgence, but it turns out their advantage may be overstated. Sure, non-sugar sweeteners — including artificial sweeteners like aspartame or sucralose and natural, non-caloric sweeteners like stevia — might seem like healthier alternatives to sugar since they ostensibly deliver fewer carbohydrates and calories, but there's no comprehensive research to help consumers and healthcare professionals make well-informed choices about these substances. That picture is about to get a bit clearer, though. To illuminate how non-sugar sweeteners actually stack up, the World Health Organization commissioned a systematic review of all the available research on sugar alternatives, and the results came out recently. In a paper published in The BMJ, a team of researchers outlined what the available evidence shows and — perhaps just as importantly — does not show about non-sugar sweeteners. To put it simply, the team found there isn't good evidence showing that non-sugar sweeteners are actually good for you. Corresponding author Joerg Meerpohl, M.D., director of the Institute for Evidence in Medicine at the University of Freiburg in Germany, says much of the available research on the topic is inconsistent in terms of how the studies were conducted, what effects they were measuring, and how long the studies lasted. "Despite the fact that [non-sugar sweeteners] are available for many years, and widely used and promoted, overall there is currently only limited data of mostly low or very low certainty available to assess health benefits and potential harms of [non-sugar sweetener] use," he tells Inverse. "Unfortunately, we need more and better research on this topic." A systematic review of studies on non-sugar sweeteners shows that there's little evidence supporting their healthfulness. To assess the state of evidence on non-sugar sweeteners, Meerpohl and his team combed through 56 different studies. Here's what they found in the current state of evidence on how non-sugar sweeteners affect various aspects of human health:

"There is no need to either add additional sugar or sweeteners in most instances."

<u>Body Weight</u>

Out of the randomised controlled trials — the gold standard of evidence in medical research — examining the relationship between non-sugar sweeteners and body weight in adults, there was no significant effect on body weight in subjects who consumed non-sugar sweeteners as opposed to sugar or a placebo. A few other studies did show small amounts of weight loss, but not in people who were actually trying to lose weight.

Curiosities

Diabetes or Glycemic Control

Two randomised controlled trials showed slightly lower blood glucose levels in people who used non-sugar sweeteners versus sugar, but these studies included a relatively small number of people, so they aren't considered strong evidence. Other studies, though, showed no improvement.

Eating Behaviour

Studies examining whether non-sugar sweeteners helped people consume fewer calories showed mixed results. One large study did show significantly reduced caloric intakes, while others did not. In obese participants, those consuming non-sugar sweeteners did eat less sugar — a fairly obvious conclusion. But another study showed no difference in sugar intake.

Cancer

The cancer risk in people who consumed non-sugar sweeteners did not seem to be much different than those who didn't, though the researchers note that these studies showed a very low certainty of evidence. In other words, just because the studies found no strong effect, that doesn't mean it's not there.

Blood Pressure

Again, this category was a mixed bag. Some studies showed that people who used non-sugar sweeteners had lower blood pressure, whereas other studies showed no significant difference between them and sugar eaters.

So, What Does This All Mean?

All in all, this paper shows that the evidence for or against non-sugar sweeteners is inconclusive. Some studies show that replacing sugar with non-sugar sweeteners can improve certain aspects of your health, while other studies suggest that it doesn't make a major difference. This conclusion comes down to the study designs, in a lot of cases. Some of the researchers didn't follow enough people, some of them didn't follow people for long enough, and some of them simply didn't collect data very well. Meerpohl and his colleagues note that they initially identified nearly 14,000 studies on non-sugar sweeteners, but only ended up including 56 once they had screened them for quality and relevance. And even among the studies that remained, the evidence that remained generally wasn't of very high quality. "I would say that there is no convincing evidence of clear

health benefits in the general population," Meerpohl says. "There might be a small benefit on weight, but we don't have high-quality data with long-term follow-up that definitely confirm this effect."

Right, but What Should I Do?

For anyone who's trying to decide whether to switch from sugar to non-sugar sweeteners in order to lose weight, Meerpohl advises avoiding the whole mess with a simple piece of advice: Just steer clear of sweets altogether. "Water, and non-/less-sweetened foods," he counsels. "In other words, there is no need to either add additional sugar or sweeteners in most instances."

Inverse, 2 January 2019

http://inverse.com

'Wound Botulism' Outbreak in San Diego Linked to Black Tar Heroin

2019-01-25

Nine people in San Diego recently developed a rare but serious illness called wound botulism after using black tar heroin, according to a new report from the Centres for Disease Control and Prevention (CDC). The outbreak has health officials warning doctors and the public to be aware of this condition, which is tied to injection drug use. Wound botulism occurs when a bacterium called Clostridium botulinum — the same germ that causes botulism from contaminated food — gets into a wound and produces a toxin, according to the CDC. The toxin attacks the body's nerves and can cause breathing difficulties, muscle paralysis and death, the CDC says. In the United States, there are only about 20 cases of wound botulism diagnosed each year, and in San Diego, only about one case is reported each year. So, when San Diego health officials saw that two people had contracted wound botulism in just one week in September 2017, they sent out an alert to doctors and launched an investigation to see if there were more cases. Ultimately, health officials identified nine cases of wound botulism that occurred between September 2017 and April 2018, according to the new report, published in the Jan. 4 issue of the CDC journal Morbidity and Mortality Weekly Report. All of the patients injected drugs, and seven of the patients specifically reported injecting black tar heroin, a dark and sticky form of the drug that is crudely processed and often contaminated with other substances. Six patients reported having injected black tar heroin under their skin in a practice

Nine people in San Diego recently developed a rare but serious illness called wound botulism after using black tar heroin, according to a new report from the Centres for Disease Control and Prevention (CDC).

called "skin popping," which is linked with wound botulism infections. The most common symptoms of the infection were muscle weakness, difficulty swallowing and blurred vision. Wound botulism can be treated with an antitoxin, but it's important to provide prompt treatment to prevent life-threatening complications. All of the patients in the San Diego outbreak were admitted to intensive care units at nearby hospitals, but one patient ultimately died. It is unclear exactly why black tar heroin increases the risk of wound botulism, the CDC says. But C. botulinum is found in soil and may get into black tar heroin when the drug is produced or transported. For example, the drug is sometimes transported inside car tires, where it might be contaminated with the bacteria, the report said. As heroin use in the U.S. rises, along with that of other opioids that contribute to the opioid epidemic, there may be an increase in cases of wound botulism, the CDC said. As such, "there is a growing need for awareness of the risks and symptoms of wound botulism," the report said. Diagnosing wound botulism can be challenging, in part because symptoms of the illness can overlap with signs of opioid intoxication or overdose. Indeed, in the San Diego outbreak, four of the nine patients initially had their symptoms attributed to drug intoxication, and two were treated with opioid overdose medication, the report said. People who inject drugs should be aware that wound botulism is a risk, particularly if they use black tar heroin, and doctors who treat injection drug users should be on the lookout for symptoms of wound botulism in their patients, the report concluded.

Live Science, 3 January 2019

http://www.livescience.com

Air pollution may take a more personal toll on us than we'd suspected: happiness.

New research shows air pollution sours our mood and makes us unhappy

2019-01-24

China is notorious for the heavy pollution affecting its cities. It's a product of the massive uptick in industrialisation, coal use, and the number of cars China has seen in the last few decades. While definitely good from an economic point of view — the country can boast an annual economic growth rate of 8% — air pollution has become a major public concern in China, with significant effects on the quality of life in its urban areas. This pollution may have a much more direct effect on the country's urbanites than previously believed, according to a paper lead-authored by, Siqi Zheng, associate professor of Real Estate Development and Entrepreneurship Faculty Director at MIT Future City Lab. The study

found a strong inverse correlation between air pollution levels and locals' happiness.

Bad air

"Pollution also has an emotional cost," Zheng says. "People are unhappy, and that means they may make irrational decisions." "So, we wanted to explore a broader range of effects of air pollution on people's daily lives in highly polluted Chinese cities." Air pollution is a major concern around the world, especially in developing or developed countries. Just last year, the State of Global Air/2018 report — published by the non-profit Health Effects Institute — estimated that roughly 95% of the world's population lives in areas with unsafe levels of outdoor air pollution (10 µg pollutants/square meter of air, as per the World Health Organization's guidelines). Around 60% live in areas where air pollution exceeds even the WHO's least-stringent air quality target of 35 µg/m3. Roughly one-third of the world, the report adds, also has to contend with unsafe levels of indoor air pollution. The main culprits were the burning of fossil fuels in cars, power plants, and factories (outdoor pollution) or for heating and cooking (indoor), respectively. The problem is definitely global, but China does stand out in regards to bad air. The clouds of Chinese smog have made headlines again and again over the last few years, due to their striking appearance and cost in human lives. Combined with Prof. Zheng's background — environmental economics, urban development, and real estate market, with a special focus on China — this made the country a perfect place to study the effect of air pollution on our emotional well-being. The team used real-time data drawn from social media microblogging platform Sina Weibo (similar to Twitter) to track the happiness levels in 144 Chinese cities. Roughly 210 million geotagged tweets posted between March and November of 2014 were processed using a machine-algorithm the team developed to measure which emotions each post conveyed. The team explains that they opted for this method of measuring people's happiness levels instead of using questionnaires (the more usual approach) because questionnaires tend to reflect individuals' overall feelings of well-being; what they wanted was snapshots of the happiness people felt on particular days. This data was pooled to generate a median value per day for each city (which the team calls the "expressed happiness index", or EHI) ranging from 0 to 100, with 0 indicating a very negative mood and 100 a very positive one.

Bad mood

Curiosities

"Social media gives a real-time measure of people's happiness levels and also provides a huge amount of data, across a lot of different cities," Zheng says. Zheng's team also looked at daily readings of ultrafine particulate matter — or PM 2.5 — concentrations in urban areas recorded by China's Ministry of Environmental Protection. Airborne particulate matter has become the primary pollutant in China's cities in recent years, the authors note, with PM 2.5 particles being particularly hazardous to lung health. Finally, the team put the two datasets together. They found a very solid negative correlation between pollution and happiness levels. As a whole, women seemed to be more sensitive to the effects of pollution than men, as were individuals with higher incomes. Interestingly, both people in the most polluted and cleanest of China's cities were most affected by air pollution, the team writes. Their hypothesis is that people who are particularly concerned about air quality and their own health tend to move to cleaner cities — making the EHI of these urban centres particularly sensitive to pollution levels — while those in very dirty cities are more aware of the damage to their health from long-term exposure to pollutants. Past research has shown that people are more likely to engage in impulsive and risky behaviour that they may later regret on days with heavy pollution, possibly as a result of short-term depression and anxiety, according to Zheng. Air pollution also has a well-documented negative effect on health, cognitive performance, labour productivity, and educational outcomes, she adds. Together with their own findings, Zheng believes such data showcases how important it is for politicians to respond to public demand for cleaner air and take measures to curb air pollution. People may move to cleaner cities, buildings, or green areas, buy protective equipment such as face masks and air purifiers, and spend less time outdoors, to avoid the effects of air pollution. Prof. Zheng plans to continue researching the impact of pollution on people's behaviour in the future. The National Institute of Environmental Health Sciences has more details on types of air pollution and preventive measures here. There's a growing body of evidence that houseplants help improve indoor quality by scrubbing various pollutants like allergy-irritating dust and volatile organic compounds. The paper "Air pollution lowers Chinese urbanites" has been published in the journal Nature Human Behaviour.

Environmental Health News, 22 January 2019

http://www.environmentalhealthnews.org/

Curiosities

A Totally New Type of Blood Vessel Has Been Discovered Hidden in Human Bones

2019-01-25

We often think of bone as something that is structurally solid, especially its hard-outer layer, called cortical bone. But a new discovery of never-before-seen hidden passages traversing these rigid organs in both animals and humans could lead to a rethink of the structure and function of basic skeletal anatomy. In a new study, researchers in Germany report finding a previously undetected network of fine blood vessels that act like a secret tunnelling system inside bone, helping blood and immune cells spread efficiently and rapidly throughout the body. "It is really unexpected being able to find a new and central anatomical structure that has not been described in any textbook in the 21st century," explains molecular immunologist Matthias Gunzer from the University of Duisburg-Essen. These tiny canals, called 'trans-cortical vessels' (TCVs), may be new to science, but they help explain how emergency drug infusions first pioneered on the battlefield were able to rapidly revive injured soldiers. In such emergencies, medics don't always have the time or ability to find or access veins, resorting to injecting drugs directly into bone marrow. "Despite accumulating evidence for the presence of a complex blood supply in bone, the molecular mechanisms and anatomy underlying these rapid shifts of cells and fluid from bone marrow to the circulation have remained elusive," a commentary on the new research explains. Now, the basis of that mechanism is laid bare, having first been spotted by accident several years ago. Gunzer was studying fluorescent-dyed blood cells in mice, and observed them under the microscope appearing to pass through what should have been solid bone. Unable to discover anything in medical literature that could explain the phenomenon, he devised a new research project to explore what was going on. In the new study, Gunzer's team used a chemical called ethyl cinnamate on mice tibiae (leg bones) to 'clear' the bones, making them transparent. Then, using a combination of light-sheet fluorescence microscopy (LSFM) and X-ray microscopy, they were able to detect for the first time several hundreds of these tiny TCVs passing through the cortical layer of the leg bones. According to the researchers, a mouse tibia can contain more than 1,000 of these small capillaries, and amazingly enough, the team says over 80 percent of arterial and 59 percent of venous blood passes through the channels. That's a lot of blood flow for something scientists didn't even know about. "I have never seen such vessels," biomechanics researcher Ralph Müller from the Swiss Federal Institute of Technology, who wasn't involved with the study, told STAT. "But we have never really looked either.

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Curiosities

So, this is a surprise for me … that certainly will need some replication in other labs." When the team examined human anatomy by imaging the leg bone of a human volunteer (Gunzer himself), they found evidence of the same kind of TCV structures, although they were thicker, and the researchers acknowledge more work is needed to confirm their exact function. As for how these hidden passages escaped our notice up until now, the team says the breakthrough is down to technological advances in imaging, but they admit even they are surprised by the unexpected result. "It's totally crazy there are still things to find out about human anatomy," Gunzer told New Scientist. "We have discovered blood vessels in a new place that we didn't know about before." The discovery – reminiscent of another secret tunnelling system in the skull uncovered by a Harvard-led study last year – could bring about all sorts of new medical leads for research into inflammatory diseases, tissue injuries, cell migration, or just understanding how blood flows. "Since key bone pathologies are associated with alterations in the TCV system," the authors write in their paper, "entirely new research possibilities that further characterise the role of TCVs in skeletal biology and disease can be envisioned." The findings are reported in Nature Metabolism.

Science Alert, 22 January 2019

http://www.sciencealert.com.au

Technical Notes

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

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Grand Challenges in Assessing the Adverse Effects of Contaminants of Emerging Concern on Aquatic Food Webs.

Analytical and bioanalytical assessments of organic micropollutants in the Bosna River using a combination of passive sampling, bioassays and multi-residue analysis

MEDICAL RESEARCH

Impact of chronic lead exposure on liver and kidney function and hematologic parameters

Organic Transistor-Based Chemical Sensors for Wearable Bioelectronics

Targeted and Untargeted Detection of DNA Adducts of Aromatic Amine Carcinogens in Human Bladder by Ultra Performance Liquid Chromatography-High Resolution Mass Spectrometry

Concentrations of perfluoroalkyl substances and bisphenol A in newborn dried blood spots and the association with child behaviour

Improved lung function and patient-reported outcomes with co-suspension delivery technology glycopyrrolate/formoterol fumarate metered dose inhaler in COPD: a randomised Phase III study conducted in Asia, Europe, and the USA.

OCCUPATIONAL RESEARCH

Occupational manganese exposure, reproductive hormones, and semen quality in male workers: A cross-sectional study

The reproducibility of urinary ions in manganese exposed workers

Technical Notes

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Risk of various types of cataracts in a cohort of Mayak workers following chronic occupational exposure to ionising radiation

Chronic Exposure to Solvents Among Construction Painters: Reductions in Exposure and Neurobehavioral Health Effects

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Atopic dermatitis at preschool age and contact allergy in adolescence: a population-based cohort study.

Variability of urinary concentrations of non-persistent chemicals in pregnant women and school-aged children.

Endocrine disruptor compounds in environment: As a danger for children health

Relationship between buprenorphine adherence and relapse, health care utilisation and costs in privately and publicly insured patients with opioid use disorder