Bulletin Board

OCT. 19, 2018

CHEMWATCH

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Assessment certificate applications under the reforms

2018-10-11

The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) are seeking feedback on the amount and types of information that you will be required to provide when applying for an assessment certificate for an unlisted chemical introduction under the proposed new scheme, the Australian Industrial Chemicals Introduction Scheme. Information in this paper includes:

- when you will be required to apply for assessment certificate;
- information on:
- chemical identity;
- physico-chemical properties;
- introduction, use, exposure and release;
- hazard and fate;
- how the information we need will vary depending on the circumstances of your introduction;
- information waivers - when they apply;
- additional information for:
- specified classes of introduction;
- certain chemicals at the nanoscale;
- certain fluorinated organic chemicals;
- introductions involving a designated kind of release into the environment.

Further information is available at: Download PDF version - Applications for certificates under the reforms [PDF 642 KB].

Comments can be submitted via the online form.

NICNAS, 27 September 2018

http://www.nicnas.gov.au

The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) are seeking feedback on the amount and types of information that you will be required to provide when applying for an assessment certificate for an unlisted chemical introduction under the proposed Australian Industrial Chemicals Introduction Scheme.

Regulatory Update

'No safe level': Mandatory alcohol warning labels to be voted on by health ministers

2018-10-11

Australians could soon be confronted with warning labels spelling out the dangers of drinking alcohol while pregnant, with state and federal government ministers due to meet to vote on a proposal to make the stickers mandatory. The proposal, spearheaded by the Western Australian government and supported by doctors and public health lobbyists, would force alcoholic beverage makers to display clear warnings on their products stating that there is no safe level of alcohol consumption for pregnant women. But stakeholders fear that Rural Health Minister Bridget McKenzie may bow to pressure from industry groups and sabotage their efforts by pushing for a watered-down version of the scheme, despite indications that most state governments will support the move. AMA president Tony Bartone called on the federal government to back "clear and precise, significant front-of-label warnings" to address the concerningly high incidence of drinking among pregnant women. "Too many women are unaware of the dangers of drinking alcohol while pregnant or trying to conceive," Dr Bartone said. Currently, less than half of alcoholic beverages carry any type of warning, and public health advocates argue that the DrinkWise sticker used by those producers who do choose to participate in the voluntary scheme is too small and unclear to be effective. "At the moment under the voluntary code, those small labels that are currently present on some of the products - not all of the products - are still not getting the intended message across," Dr Bartone said. He said many Australians were unaware of the devastating lifelong effects of foetal alcohol spectrum disorder and that the problem was found across the spectrum of socioeconomic classes. "We need to be very clear that the effects, things like neurodevelopmental abnormality associated with foetal alcohol spectrum disorder are significant ... and also can have effects in the offspring of the children involved. "It's a message to Senator McKenzie, the Prime Minister, and all the state and territory ministers to get on board and be very clear in their message." Senator McKenzie, who declined to reveal her stance on the issue when contacted by Fairfax Media, will cast the federal government's vote at a meeting with her fellow ministers on Thursday. The Nationals senator is the chair of the Australia and New Zealand Ministerial Forum on Food Regulation, meaning that she is in a position to steer the debate and the wording of any suggested amendments. The forum is made up of health and primary industry ministers representing the Commonwealth, states and territories and New Zealand. WA Health Minister Roger Cook said

it was time governments took seriously the problem of foetal alcohol spectrum disorder, which damages cognitive ability and impulse control. "I'm concerned about how it impacts on our remote communities," Mr Cook said, citing a study that found one-third of West Australian children in custody showed symptoms of the disorder. "This is a bigger problem than we understand, and we have to start tackling it now." He drew a line in the sand for ministers set to vote on the issue, saying: "You're either for reducing FASD - in which case, pregnancy warning labels are just the beginning of what we need to do - or, you're willing to turn a blind eye to the current situation, which will allow another generation of disadvantage to take hold." Mr Cook said that while mandatory labelling was "just the beginning of what we need to do" to tackle foetal alcohol spectrum disorder, "we can't do that if we are prepared to fudge on the basics of what is required to address this - and that is pregnancy warning labels." Foundation for Alcohol Research and Education chief executive Michael Thorn said Senator McKenzie "must not capitulate to the pressure applied by the alcohol industry on this critical issue". Alcohol Beverages Australia executive director Fergus Taylor said awareness was already "very high under the current system" and that policies to address alcohol consumption during pregnancy "should instead be targeted measures that encourage and support those who are still not changing their behaviour". The National Party has historically resisted efforts to roll out health labelling on food and beverage products, which is vigorously opposed by the farming lobby. In 2014, then assistant federal health minister and Nationals senator Fiona Nash came under fire after she ordered a food star ratings website to be shut down. Her chief of staff resigned after it emerged that he had connections to the packaged food industry.

Sydney Morning Herald, 9 October 2018

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

The Four Corners episode that aired 8 October 2018 has questioned the safety of glyphosate products registered for use in Australia following a decision in the Californian Superior Court to award damages to a man who alleged that glyphosate-based weed-killers caused his cancer.

Response to Four Corners' story on Glyphosate

2018-10-11

The Australian Pesticides and Veterinary Medicines Authority (APVMA) considered the evidence presented in the Californian case and found no grounds to take regulatory action in Australia. The APVMA understands that the public may have concern regarding glyphosate. There is a lot of information out there, and discussion in the media does not always get the facts or the science right. Australia's risk-based, scientific approach to regulation ensures that each agricultural chemical product is thoroughly and independently assessed by the APVMA prior to

registration and supply. The registration system is supported by a range of post market surveillance, compliance, audit verification and review activities that ensure products available in Australia continue to be used safely and effectively. The APVMA's regulatory decisions take account of extensive scientific information and the World Health Organization's International Agency for Research on Cancer (IARC) report 2015 provided a valuable input to our ongoing assessment of the risks associated with glyphosate. The APVMA considered the IARC report in 2016, along with an examination of many other scientific trials and studies, and like other regulators, the APVMA determined that glyphosate is safe to use according to label directions. The manner in which the APVMA is funded bears no influence on our independent regulatory activities that continue to protect the health of Australia's people, our agricultural industry, farmers, the environment and animals. Our regulatory history demonstrates that we hold industry to account and take action when a risk is identified. In the past 12 months, the APVMA has acted to change label directions for 2,4-D, fined manufacturers when products did not meet specification and suspended registrations where products no longer met safety requirements. Australian's can have confidence in the decisions of the APVMA and that our regulation will continue to protect the health and safety of people, animals and the environment. Information relating to the APVMA's examination of glyphosate is available online.

APVMA, 8 October 2018

http://www.apvma.gov.au

China MEE Consults on the 9th Batch of Regular Notifications to Be Approved under China NCSN in 2018

2018-10-09

On 9 Oct 2018, China MEE (Ministry of Ecology and Environment) issued the 9th batch of China new chemical substance notifications (China NCSN, a.k.a China REACH) to be approved in 2018 for public consultation.

On 9 Oct 2018, China MEE (Ministry of Ecology and Environment) issued the 9th batch of China new chemical substance notifications (China NCSN, a.k.a China REACH) to be approved in 2018 for public consultation. The consultation will close on 11 Oct 2018.

In this batch, 12 new notifications are to be approved (see in table 1). In addition, MEE also consults on the modification details of 8 registration certificates previously approved (see in table 2).

Table 1. Regular Notifications to be Approved under China NCSN (Batch 9 of 2018)

No.	Admissible No.	Chemical Name	Notifier	Notification Type	Environmental Management Category
1	受17096	烷基酸与烷基醇钛盐的反应产物	雅富顿添加剂(北京)有限公司	Regular notification	Hazardous
2	受18015	双({3-[2-(2-羟基乙氧基)乙氧基]烷基}氨基)-9,10-蒽二酮	科莱恩涂料(上海)有限公司	Regular notification	General
3	受18022	[[[(取代杂单环基)甲氨基]-1-取代基-3-磺酸基-2-多环芳基]二氮烯基]萘多磺酸碱金属盐	台湾永光化学工业股份有限公司	Regular notification	Hazardous
4	受18023	含铝金属氧化物	Grace GmbH	Regular notification	Hazardous of priority environmental concern
5	受18034	(烷基联环烷基)苯酚	中节能万润股份有限公司	Regular notification	General
6	受18056	多卤代-[(二氢-二氧代-杂多环芳基)杂多环芳基]杂多环芳二酮	LG Chem, Ltd.	Regular notification	General
7	受18058	羟基-多环烷基氧代烷基羧酸	吉林凯莱英医药化学有限公司	Regular notification	Hazardous
8	受18064	环烷磺酰胺	江西仁明医药化工有限公司	Regular notification	General
9	受18068	亚磷酸烷基酯金属盐	浙江嘉华化工有限公司	Re-notification for increased tonnage band	General
10	受18075	烷氧羰基-亮氨酸	斯福瑞(南通)制药有限公司	Regular notification	Hazardous
11	受18076	1,4-环己二羧酸二异辛酯	Hanwha Chemical Corporation	Regular notification	General
12	受17076	重氮化氨基-[(取代乙基)磺酰基]苯磺酸随后与多取代苯甲酸偶合再进一步与重氮化[(氨基苯基)磺酰基]硫酸氢乙酯偶合的反应产物的钠盐	台湾永光化学工业股份有限公司	Regular notification	Hazardous of priority environmental concern

Table 2. Modification of Information on Registration Certificates to Be Approved

	Application Company	Certificate No.		Modification Items		Reason for modification
		No.	After modification	Before modification	After modification	

Regulatory Update

1.	富士胶片和光纯药制膜材料(无锡)有限公司	新常登C-13066	新常登C-13066(变1)	Notifier: 富士胶片精细化学(无锡)有限公司；Cetificate holder: 富士胶片精细化学(无锡)有限公司	Notifier: 富士胶片和光纯药制膜材料(无锡)有限公司；Cetificate holder: 富士胶片和光纯药制膜材料(无锡)有限公司	Company name changed
2.	富士胶片和光纯药制膜材料(无锡)有限公司	新常登C-15075	新常登C-15075(变1)	Notifier: 富士胶片精细化学(无锡)有限公司；Cetificate holder: 富士胶片精细化学(无锡)有限公司	Notifier: 富士胶片和光纯药制膜材料(无锡)有限公司；Cetificate holder: 富士胶片和光纯药制膜材料(无锡)有限公司	Company name changed
3.	富士胶片和光纯药制膜材料(无锡)有限公司	新常登C(L)-15109(1/2)	新常登C(L)-15109(1/2) (变1)	Notifier: 富士胶片精细化学(无锡)有限公司；Cetificate holder: 富士胶片精细化学(无锡)有限公司	Notifier: 富士胶片和光纯药制膜材料(无锡)有限公司；Cetificate holder: 富士胶片和光纯药制膜材料(无锡)有限公司	Company name changed
4.	富士胶片和光纯药制膜材料(无锡)有限公司	新常登C-16106	新常登C-16106(变1)	Notifier: 富士胶片精细化学(无锡)有限公司；Cetificate holder: 富士胶片精细化学(无锡)有限公司	Notifier: 富士胶片和光纯药制膜材料(无锡)有限公司；Cetificate holder: 富士胶片和光纯药制膜材料(无锡)有限公司	Company name changed
5.	富士胶片和光纯药制膜材料(无锡)有限公司	新常登C(L)-17095(1/2)	新常登C(L)-17095(1/2)(变1)	Notifier: 富士胶片精细化学(无锡)有限公司；Cetificate holder: 富士胶片精细化学(无锡)有限公司	Notifier: 富士胶片和光纯药制膜材料(无锡)有限公司；Cetificate holder: 富士胶片和光纯药制膜材料(无锡)有限公司	Company name changed
6.	Firmenich SA/芬美意香料(中国)有限公司	新常登C-14091	新常登C-14091(变1)	Notified amount: 9.9 t/y	Notified amount: 4.9 t/y	Business adjustment

7.	常熟宇菱电池材料有限公司	新常登C(L)-16101(1/2)(变1)	新常登C(L)-16101(1/2)(变2)	Notified amount: 50 t/y	Notified amount: 79 t/y	Market demand increased
8.	Novvi, LLC/北京金杜知识产权代理有限公司	新常登C(L)-17065(1/2)	新常登C(L)-17065(1/2)(变1)	Notified amount: 34.9 t/y	Notified amount: 24.9 t/y	Business adjustment

Further information is available at (In Chinese): MEE news

Chemlinked, 9 October 2018

http://chemlinked.com/en/news

China to fully align with fourth edition of UN GHS

2018-10-11

China's State Administration of Market Supervision (SAMR) and the National Standardisation Administration Committee (SAC) have released a national standard for Annexes 9 and 10 of the fourth revision of the UN Global Harmonised System (GHS). Following the release, all of the annexes for the fourth edition of GHS will be covered by Chinese national standards, which are direct Chinese translations of the English language GHS. The standard GB 36700 — chemicals classification guide for aquatic environmental hazards — is divided into eight parts:

- introduction;
- harmonised classification scheme;
- aquatic toxicity;
- degradation;
- bioaccumulation;
- quantitative structure activity relationship (Qsar);
- classification of metals and metal compounds; and
- guidance on transformation/dissolution of metals and metal compounds in aqueous media.
- Parts 1-7 relate to Annex 9 of UN GHS (fourth edition), and Part 8 to Annex 10.

The standard is aimed at foreign and domestic companies. It is not yet available for purchase but likely to be released before the end of the year, effective from 1 April 2019. The SAC made the announcement on 17 September together with approvals for 446 other national standards and

China's State Administration of Market Supervision (SAMR) and the National Standardisation Administration Committee (SAC) have released a national standard for Annexes 9 and 10 of the fourth revision of the UN Global Harmonised System (GHS).

six amendments. They will become effective on various dates between 1 January and October 2019. Further information is available at:

- SAC announcement (in Chinese)
- Annex 9
- Annex 10

Chemical Watch, 3 October 2018

http://chemlinked.com/en/news

AMERICA

FDA Finds Exposure to Pesticides and Glyphosate in Food Samples Below Federal Limits

2018-10-11

On 1 October 2018, the United States Food and Drug Administration (FDA) released a report showing the majority of human and pet foods produced and imported into the U.S. during FY 2016 tested below the federal limits for pesticide chemical residues. FDA tested for 711 pesticides and industrial chemicals in 6946 human food products and 467 animal foods during the fiscal year running from 1 October 2015 to 30 September 2016 under the FDA's Pesticide Monitoring Program. For human food products, FDA found that over 99% of domestic and 90% of import human foods were compliant with federal standards. Further, no pesticide chemical residues were found in 52.9% of the domestic and 50.7% of the import samples that FDA analysed. FDA also publicised the findings of its "Collection of Selected Domestic and Imported Foods for Herbicides Analysis" study that examined residues of glyphosate, glufosinate, and 30 selected acid herbicides in foods. Glyphosate, the active ingredient in popular garden weed killers and one of the most-used agricultural chemicals in the world, has been the subject of much controversy. As previously reported on this blog, on 10 August 2018, a San Francisco jury awarded a former school groundskeeper dying of non-Hodgkin's lymphoma $289 million against Monsanto for claims that the Roundup herbicide was a substantial contributing factor in causing his cancer. Analysing 274 grain corn, 267 soybean, 113 milk, and 106 egg samples, FDA found non-volatile levels of glyphosate in 63.1% of corn samples and 67% of soybean samples. Non-volatile levels of glufosinate were found in 1.4% of corn tested and 1.1% of soybeans. In a statement accompanying the release of the results, FDA Commissioner Scott Gottlieb said, "…the

results show that overall levels of pesticide chemical residues are below the Environmental Protection Agency's tolerances, and therefore don't pose a risk to consumers."

National Law Review, 3 October 2018

http://www.natlawreview.com

CEPA 1999 SNAc Notice published

2018-10-11

On 22 September 2018, a Significant New Activity (SNAc) Notice was published under the Canadian Environmental Protection Act, for the following substance: Siloxanes and silicones, di-Me, mono[3-[(2-methyl-1-oxo-2-propenyl)oxy]propyl] group-terminated, polymers with Bu methacrylate, 2-ethylhexyl acrylate and Me methacrylate.

Yorda's Hive, 3 October 2018

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

US advocacy group sues EPA over unreleased formaldehyde IRIS assessment

2018-10-11

Public Employees for Environmental Responsibility (PEER), a US alliance of state and federal professionals, is suing the US EPA for failing to respond to a public records request related to an assessment of formaldehyde. The claim relates to an unreleased revised draft assessment of the substance under the EPA's Integrated Risk Information System (IRIS) program. The controversial draft is said to link the substance to leukaemia, despite loud industry dissent. And suspicions have arisen that this pushback has slowed its release. The NGO filed a 9 July Freedom of Information Act request seeking the most recent draft of the IRIS assessment, as well as certain accompanying records. These include correspondences from senior agency officials, information on a 24 January meeting between the EPA and the American Chemistry Council (ACC), and any recommendations received from an outside party to delay release of the assessment. But in a 25 September complaint, PEER says that EPA has failed to respond to its request by the statutory deadline. It is seeking judicial review to obtain the "wrongfully withheld" records. "So far, EPA has shared this important, tax-supported science with industry but not the public," said PEER staff counsel Kevin Bell. "We believe the documents this lawsuit seeks will evidence the extent to which industry keeps EPA in regulatory captivity

On 22 September 2018, a Significant New Activity (SNAc) Notice was published

to the detriment of public health." Speaking at an August Congressional hearing, EPA Acting Administrator Andrew Wheeler hinted that the agency may be revisiting the science underlying the assessment. He did not indicate a timeline for its formal release. "It is my understand that we still have a number of steps to complete," he said in response to questions from lawmakers. An EPA spokesperson said the agency does not comment on pending legislation, and declined to provide an update on a timeline for the assessment's release.

Further information is available at:

- PEER lawsuit
- PEER release

Chemical Watch, 27 September 2018

http://chemicalwatch.com

Academics, NGOs protest TSCA PBT risk review approach

2018-10-11

NRDC call systematic review document inconsistent with science

The United State EPA should not use the approach outlined in its TSCA systematic review document for the five 'PBT' substances that will be subject to expedited risk management action, according to comments from NGOs. The Lautenberg Act, which amended TSCA in 2016, requires the EPA to take quick or "expedited" action on certain substances that are persistent, bioaccumulative and toxic (PBT). The law directs the EPA to skip risk evaluation of these substances and proceed directly to imposing rules to reduce their exposure "to the extent practicable". The five substances are:

- decaBDE;
- hexachlorobutadiene (HCBD);
- pentachlorothiophenol (PCTP);
- tris(4-isopropylphenyl) phosphate (IPTPP); and
- 2,4,6-tris(tert-butyl) phenol (2,4,6-TTBP).

In comments submitted in response to two EPA documents that analyse their uses, exposure routes and hazards, NGOs and academics have remained strongly critical of the EPA's systematic review document. This recently released guidance outlines the approach the EPA will take to integrating data from multiple sources, a key step in risk assessment of data-rich substances. "The document is incomplete, inconsistent with the

state of the science, and too flawed to be used," said the Natural Resources Defence Council in its comments. "Accordingly, use of the document violates TSCA and is otherwise arbitrary and capricious." The NRDC said that it was "particularly concerned" about the use of the document for assessment of the five PBT substances. Its comments – dated 16 August but posted to the public docket this month – were supported by 19 other organisations. The concern about use of the systematic review document for assessment of the five PBT substances was echoed in comments from Safer Chemicals Healthy Families (SCHF) and a group of 33 scientists, including ten from the University of California.

Other issues

The NGOs also criticised the EPA for failing to account for many routes of exposure and for dismissing a large volume of exposure data. The "principle concern" of the SCHF, however, was that the EPA had not clearly explained how the two documents on the five PBT substances will influence restriction of the substances under TSCA section 6(h), "It's critical that the agency has a clear understanding of the goals and requirements of section 6(h) and how the two documents will contribute to meeting them," it said. The American Chemistry Council, meanwhile, described as "problematic" the proposed use of read-across for exposure assessment of the antioxidant 2,4,6-TTBP. "We commend the extension of this principle [of read-across] to the area of exposure characterisation," the trade association said. "However, EPA has not identified those characteristics that would make a surrogate chemical suitable for read-across for exposure." It also recommended against the proposed use of exposure data from outside the US and from studies that have not been put in their "temporal context" with respect to substance use trends. Proposed risk management rules for all five substances are due by 22 June 2019. Final rules are set to follow within 18 months.

Further information is available at:

- Docket
- NRDC comments
- SCHF comments
- ACC comments

Chemical Watch, 27 September 2018

http://chemicalwatch.com

Regulatory Update

EUROPE

European Parliament revs up CO2 car limits

2018-10-11

On 3 October, MEPs voted in Strasbourg in favour of a 40% CO2 reduction target for light vehicles by 2030. The target is higher than what the Commission has proposed and tough talks with national capitals now loom large on the horizon. Environment ministers are due to meet in Luxembourg on 9 October to hash out a position and documents seen by EURACTIV show that the Austrian presidency of the EU is going to put 35% overall cuts on the table. In Strasbourg though, lawmakers supported Socialist MEP Miriam Dalli's report on CO2 cut, meaning the European Parliament will back 20% cuts by 2020 and 40% cuts by 2030. It marks a tightening of the proposed European Commission rules, which only foresaw a 30% cut at the end of the next decade. MEPs also ramped up the EU executive's incentive scheme for low and zero emission car sales by introducing targets of 20% for 2025 and 35% for 2030. More significantly, the Parliament reintroduced a penalty system or malus for manufacturers that fail to meet those benchmarks. The Commission had actually removed that measure from its proposal following lobbying from the German car industry. While the Dieselgate scandal still roars on, the European Union may be about to water down new CO2 limits for cars at the behest of German automakers. As reported by EURACTIV, European People's Party MEPs tried to add an amendment that would establish a carbon correction factor and allow carmakers to use biogas to count towards their CO2 reductions. But that was also rejected. Rapporteur Dalli told EURACTIV before the vote that her political group would ask the Commission to review the issue before 2023. However, the gas industry was keen to tackle the issue sooner rather than later. Environmental groups like Transport & Environment had warned that, if passed, the amendment would allow carmakers to double count biofuels and alternative fuels, thanks to a provision already included in the finalised Renewable Energy Directive. Biofuel association ePURE, although disappointed by the Parliament's failure to recognise renewable fuels, welcomed the EU assembly's move towards changing the methodology of actually calculating emissions. Secretary-General Emmanuel Desplechin said that it was good that MEPs are starting to recognise "the shortcomings of the current tank-to-wheel methodology and more realistically calculating the life-cycle emissions of new cars and fuels". Europe's gas industry wants renewable fuels completely accounted for in updated car CO2 rules. But the MEP charged

MEPs want CO2 to be reduced by 40% by 2030.

with helming the legislation's revision hopes to shield her report from industry attacks ahead of a crucial vote.

Next stop…

Dalli also managed to secure support from the chamber to go straight to three-way talks with the Commission and member states, although the Council has yet to agree on a final negotiating position and will meet in Luxembourg next week. But a 35% compromise proposed by the Austrian presidency will be a difficult pill to swallow for many member states, some of whom consider the Commission's initial proposal inadequate, while others, most notably Germany, are keen to stick with what the Berlaymont suggested. Germany's environment ministry revealed on 26 September that the Bundesrepublik will back an EU-wide 30% CO2 cut for cars and vans – lower than expected by green NGOs – ahead of an important vote in the European Parliament next week. Countries like the Netherlands, Ireland and Denmark want to go far beyond what the Commission wanted, proposing in a non-paper that the EU should adopt an overall target between 40 and 70%, meaning the Parliament's position is right at the bottom of their bracket. French President Emmanuel Macron showed part of France's hand at a gala dinner for the automotive industry in Paris on 1 October, when he revealed that his preferred avenue to CO2 cuts is to get rid of older and more polluting cars that are already on the road. Macron added that cutting emissions should go hand-in-hand with increasing France's buying power, by making it easier for people to trade up to a low emission vehicle. He called on manufacturers to take part in the financing of the government's scrappage scheme. Member states that do not have their own domestic car industry to protect have targeted transport as an important sector in which to make emissions cuts to meet the EU's Paris Agreement obligations. The Parliament vote was welcomed by clean mobility group T&E, but it warned that the current ambition is still not sufficient to meet the Paris target of keeping global temperature rises "well below 2 degrees Celsius" and to try and limit it to 1.5 degrees. A landmark report by the Intergovernmental Panel on Climate Change is expected to reveal next week that the world has more time than previously thought to achieve 1.5 but that the consequences of a 2 degrees increase would be worse.

Euractiv, 3 October 2018

http://www.euractiv.com/

Regulatory Update

Public consultation: Guidance on feed additives and the environment

2018-10-11

The European Food Safety Authority (EFSA) has launched a public consultation on its draft guidance for assessing the safety of feed additives for the environment. The guidance document is intended to help applicants prepare and present applications for the authorisation of feed additives. It specifies what kind of information and data applicants need to include in their dossiers to allow EFSA to assess the safety of the feed additive for the environment. Interested parties should submit written comments by 19 November 2018

EFSA, 8 October 2018

http://www.euractiv.com/

European countries are making progress on tackling soil contamination.

2018-10-11

A new report from the European Commission's Joint Research Centre (JRC) finds that over 5,000 new sites are under remediation or risk-reduction measures since 2011. At the same time, prevention and remediation remain a work in progress. The new report estimates that polluting activities potentially took place in 2.8 million sites in the EU. A significant effort is being made by Member States to identify which sites need urgent action and where remediation or risk reduction measures are required. In most countries, the inventory process starts with the establishment of a register of sites where polluting activities have, or may have, taken place. The report finds that there are more than 650k officially registered contaminated sites across Europe. More than 170k sites still to be investigated, 68k are currently under investigation and more than 125k sites need or might need remediation. while 65 500 sites have already been remediated, or are under aftercare measures. The status of soil contamination in Europe report is based on a questionnaire the JRC sent to 39 European countries in 2017, of which 29 replied. Differences between data collection and management efforts are also highlighted. The scientists call for a common European framework to help national governments in their efforts to prevent and remediate soil contamination. An average of 3.6 contaminated sites per square kilometre of artificial surface are registered in the country inventories of EU Member States. More than 76 000 new sites have been registered since the latest survey

The European Food Safety Authority (EFSA) has launched a public consultation on its draft guidance for assessing the safety of feed additives for the environment.

conducted in 2011. A significant effort is being made to remediate these identified contaminated sites, with more than 5,000 new sites under remediation or risk-reduction measures. More than 65 500 sites have already been remediated, or are under aftercare measures: this represents an increment of more than 8 500 new remediated sites in the past 5 years.

Differences in management approach

Countries like the Netherlands, Germany, the UK, and the Flanders region in Belgium who have been tackling the problem of soil contamination for at least three decades, are focusing their efforts on remediating those sites where they have identified that polluting activities took or are taking place. Countries that have more recently started to address soil contamination are currently focusing on the identification of contaminated sites. Of the 39 countries surveyed, 28 maintain inventories for contaminated sites at different administrative levels - national, regional or local. Most of the inventories are managed at national level, frequently by environmental agencies. Poland and Portugal are preparing their inventory, which will be managed at regional and at national level, respectively. Since 2011, Cyprus has developed its national register of contaminated sites and Malta is currently collecting information on contaminated sites. Due to the wide variety of soil types, land uses, depths of groundwater tables and site and building characteristics, the most extensively used practice for dealing with soil contamination across Europe involves a combined approach. This allows flexibility in the tools used to for site-specific risk assessment. However, the data collected by countries are not fully comparable, due to a lack of commonly accepted European terminology and guidelines. This prevents scientists from being able to evaluate certain parameters at the European scale, such as the total surface area contaminated per class of contaminant, the percentage of population exposed to the contamination and the environmental damage caused by contaminated sites.

The "polluter pays" principle and the cost of putting things right

On average more than 42 % of the total expenses come from public budgets for all countries that responded to the questionnaire. This is mostly linked to the fact that the "polluter-pays" principle, while applied to all new cases, is rarely applicable to historical contamination. Of all respondents, 26 countries have a national programme to deal with orphan sites – contaminated sites where the parties responsible for the contamination are unknown. The responsibility for identification and

remediation of these sites varies both within and between countries, as does the funding regime.

Background

The EU's Seventh Environment Action Program recognises that soil degradation is a serious challenge. It provides that by 2020 land is managed sustainably in the EU, soil is adequately protected and the remediation of contaminated sites is well underway. It also commits the EU and Member States to increasing efforts to reduce soil erosion, increase soil organic matter and to remediate contaminated sites. The 'Progress in the management of contaminated sites in Europe' indicator has been used since 2001 to reflect how industrially polluted sites are remediated. In 2017, the methodology to assess the status of contaminated sites was revised to accommodate the range of definitions used by countries. The results of this new approach are presented in the JRC's report, which will form the basis of an updated indicator and will facilitate a more accurate reflection of trends in site remediation.

European Commission's Joint Research Centre, 21 September 2018

http://ec.europa.eu/dgs/jrc/index.cfm

REACH Update

Member States to evaluate 96 substances in 2019-2021

2018-10-12

The European Chemicals Agency (ECHA) proposes 96 substances for evaluation by Member States under the Community rolling action plan (CoRAP) for 2019-2021. If you have registered any of these substances, you should coordinate actions with your co-registrants and contact the evaluating authority. 28 substances are planned to be evaluated in 2019, while 43 are currently listed for evaluation in 2020 and 25 for 2021. Registrants of a listed substance should start coordinating their actions and contact the evaluating Member State authority. Downstream users of a listed substance should review the information they have available and share it with the registrants. In particular, it is important that the use and exposure scenarios as well as the exposure estimations are up to date and clearly documented within the registrants' chemical safety reports. For the 28 substances planned to be evaluated in 2019, the relevant dossier updates should be made before March 2019. The draft plan includes the non-confidential substance names, the CAS and EC numbers, the tentative year of evaluation, the contact details of the proposed evaluating Member State, and an indication of the initial area of concern. This year, the groups of structurally similar substances that could potentially be evaluated together are also marked in the plan. The draft plan has been prepared together with the Member States, taking into account risk-based criteria for selecting the substances. At this draft stage, some changes to the plan are still possible. The final updated plan will be adopted in March 2019. Registrants will soon be able to get an overview of substance-specific activities (including substance evaluation) using the updated public activities coordination tool (PACT). It offers companies one entry point to information about substances that are on an authority's radar and which are potentially going for regulatory risk management.

The European Chemicals Agency (ECHA) proposes 96 substances for evaluation by Member States under the Community rolling action plan (CoRAP) for 2019-2021.

Next steps

ECHA's Member State Committee will discuss the draft CoRAP this week and will prepare an opinion on the draft plan in February 2019. Based on the opinion, ECHA will adopt and publish the CoRAP update for 2019-2021 in March 2019. From the date of publication onwards, the Member States have one year to prepare a draft decision requesting further information from the respective registrants to clarify potential concerns identified during evaluation. Further information is available at:

- Draft CoRAP 2019–2021
- Substance evaluation

REACH Update

- Registrant's guide - how to act in substance evaluation
- Interaction between the evaluating Member State and the registrants under substance evaluation – Recommendations
- Public activities coordination tool (PACT)

ECHA, 10 October 2018

http://echa.europa.eu

Two restriction dossiers submitted

2018-10-12

On 5 October, Italy submitted a proposal to restrict N,N-dimethylformamide (EC 200-679-5, CAS 68-12-2) and the European Chemicals Agency (ECHA) submitted a proposal to restrict five soluble cobalt salts. ECHA's scientific committees are currently performing a conformity check on the dossiers. The dossiers will be published on ECHA's website within two weeks to increase transparency and to help stakeholders prepare for the six month public consultations on the dossiers, which are expected to be launched in mid-December if the dossiers pass conformity. Further information ios available at: Registry of restriction intentions

ECHA News, 10 October 2018

http://echa.europa.eu

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Testing proposals

2018-10-12

The European Chemicals Agency (ECHA) has launched 42 new public consultations on testing proposals. The deadline to comment these is 19 November 2018. Further information on the proposals is available on ECHA's website. Comments can be submitted at: Give comments.

ECHA News, 10 October 2018

http://echa.europa.eu

Updated list of substances with harmonised classification and labelling now available

2018-10-12

The European Chemicals Agency (ECHA) has updated its list of hazardous substances with harmonised classification and labelling to take account

of the Commission's update in the 13th adaptation to technical progress (ATP) to the CLP Regulation. The official source for this information remains the Official Journal of the European Union. Further information is available at:

- Commission Regulation
- Table of harmonised entries
- C&L Inventory

ECHA New, 10 October 2018

http://echa.europa.eu

Public consultations on harmonised classification and labelling

2018-10-12

The European Chemicals Agency (ECHA) is looking for comments on the harmonised classification and labelling proposals for the following substances:

- Mecoprop-P (ISO) [1] and its salts; (R)-2-(4-chloro-2-methylphenoxy) propionic acid [1] and its salts (EC 240-539-0; CAS 16484-77-8). Comments are invited on the acute toxicity via oral route, reproductive toxicity, specific target organ toxicity - repeated exposure, and hazardous to the aquatic environment hazard classes.
- Imidacloprid (ISO); (E)-1-(6-chloropyridin-3-ylmethyl)-N-nitroimidazolidin-2-ylidenamine (EC -; CAS 138261-41-3). Comments are invited on acute toxicity and on the environmental hazard classes.
- Azamethiphos (ISO); S-[(6-chloro-2-oxooxazolo[4,5-b]pyridin-3(2H)-yl) methyl] O,O-dimethyl thiophosphate (EC 252-626-0; CAS 35575-96-3). Comments are invited on selected physical hazards as well as hazards on human health and the environment except respiratory irritation and hazardous to the ozone layer hazard classes.
- Diflufenican (ISO); N-(2,4-difluorophenyl)-2-[3-(trifluoromethyl) phenoxy]-3-pyridinecarboxamide; 2′ ,4′ -difluoro-2-(α,α,α-trifluoro-m-tolyloxy)nicotinanilide (EC -; CAS 83164-33-4). Comments are invited on the reproductive toxicity, hazardous to the aquatic environment, and hazardous for the ozone layer hazard classes. Please note that this public consultation run in parallel with the one on the draft (renewal) assessment report prepared according to Regulation (EC) No 1107/2009. For additional information on the active substance and the

studies included in the CLH report, consult the draft assessment report on EFSA's consultation website.

- Tetrakis(2,6-dimethylphenyl)-m-phenylene biphosphate; tetrakis(2,6-dimethylphenyl) 1,3-phenylene bis(phosphate) (EC 432-770-2; CAS 139189-30-3). Comments are invited on skin corrosion/irritation and on skin sensitisation hazard classes.
- 3-aminomethyl-3,5,5-trimethylcyclohexylamine (EC 220-666-8; CAS 2855-13-2). Comments are invited on the acute toxicity via the oral and dermal routes, serious eye damage/eye irritation, skin sensitisation, and hazardous to the aquatic environment hazard classes.
- 6,6'-di-tert-butyl-2,2'-methylenedi-p-cresol (EC 204-327-1; CAS 119-47-1). Comments are invited on the reproductive toxicity hazard class.

Comments can be submitted at: Give comments

ECHA News, 10 October 2018

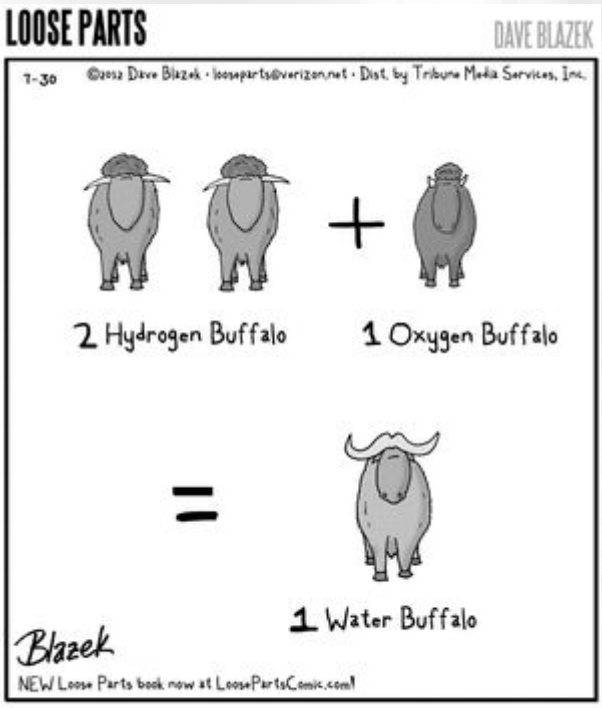
http://echa.europa.eu

Janet's Corner

CHEMWATCH

Water Buffalo

2018-10-12



Chemistry

Hazard Alert

CHEMWATCH

Phthalic Anhydride

2018-10-01

Phthalic anhydride is the organic compound with the molecular formula C8H4O3. It is the anhydride of phthalic acid. [1] Phthalic anhydride occurs as white, lustrous crystalline needles, and has a characteristic pungent choking odour. It is soluble in hot water, benzene, carbon disulfide, and alcohol and is slightly soluble in water and ether. [2] Phthalic anhydride is obtained by catalytic oxidation of ortho–xylene or naphthalene. When separating the phthalic anhydride from production by products such as o–xylene in water, or maleic anhydride, a series of "switch condensers" is required. It can also be prepared from phthalic acid. [3]

USES [2,4]

Phthalic anhydride is used in the manufacture of plasticisers, polyester and alkyd resins. It is also used in the manufacture of phthaleins, phthalates, benzoic acid, synthetic indigo, artificial resins, synthetic fibres, dyes, pigments, pharmaceuticals, and chlorinated products.

Phthalic anhydride is an important chemical intermediate in the plastics industry from which are derived numerous phthalate esters that function as plasticisers in synthetic resins. Phthalic anhydride itself is used as a monomer for synthetic resins such as glyptal, the alkyd resins, and the polyester resins. It is also used as a precursor of anthraquinone, phthalein, rhodamine, phthalocyanine, fluorescein, and xanthene dyes.

Phthalic anhydride is the organic compound with the molecular formula C8H4O3.

Phthalic anhydride is used in the synthesis of primary amines, the agricultural fungicide phaltan, and thalidomide. Other reactions with phthalic anhydride yield phenolphthalein, benzoic acid, phthalylsulfathiazole (an intestinal antimicrobial agent), and orthophthalic acid.

ENVIRONMENTAL EFFECTS [4]

Phthalic anhydride is released to the environment from chemical plants, mainly those that manufacture the chemical or use it in the production of plastics and resins. The major sources of these releases are process off-gases and industrial effluents; however, the use of catalytic oxidation now reduces the release of pollutants in off-gases. Phthalic anhydride has been identified but not quantified in U.S. drinking water and in the volatile flavour components of baked Idaho potatoes. No information was found for the transport of phthalic anhydride in the environment or in soil.

However, in moist soil, the chemical will hydrolyse to phthalic acid and significant leaching is not expected to occur, other than in the case of a large spill. Phthalic anhydride is not expected to bioaccumulate in aquatic organisms. Plants and animals exposed to radiolabelled di-2-ethylhexyl phthalate (DEHP) in a microecosystem contained, but did not accumulate to any great extent, phthalic anhydride, a metabolite of DEHP.

SOURCES & ROUTES OF EXPOSURE

Sources of Exposure [5]

- Exposure to phthalic anhydride may occur during the manufacture of phthalate-derived products.
- It has been suggested that exposure to phthalic anhydride may occur from the use of plastics from which phthalate plasticisers are leached, specifically certain medical plastics such as blood bags, plastic syringes, and plastic tubing.
- Phthalate esters have been identified as environmental pollutants.

Routes of Exposure [2]

The probable routes of exposure to phthalic hydride are:

- inhalation;
- ingestion; and
- skin and/or eye contact

HEALTH EFFECTS [5]

Acute Effects

- Phthalic anhydride is irritating to the eyes, respiratory tract, and the skin in humans, but no permanent injury is observed. Since phthalic anhydride has no effect on dry skin, but burns wet skin, it has been suggested that the actual irritant is phthalic acid, which is formed on contact with water.
- Tests involving acute exposure of rats have shown phthalic anhydride to have moderate acute toxicity.

Chronic Effects

- Conjunctivitis, rhinitis, rhinoconjunctivitis, bronchitis, and irritation of the skin and mucous membranes of the respiratory tract have been observed in workers exposed to phthalic anhydride. Other effects

observed in workers chronically exposed to phthalic anhydride were occasional bloody sputum, emphysema, lower blood pressure, and minor signs of central nervous system (CNS) excitation.

- Animals exposed to heated phthalic anhydride experienced congestion, irritation, and injury of lung cells.
- Hypersensitivity of guinea pigs to phthalic anhydride dust has been reported, with bronchoconstriction, transiently increased respiratory rate, and elevated IgG antibodies observed following an inhalation challenge.
- Decreased body weight, increased incidence of lung and kidney lymphocytosis, bile duct inflammation, adrenal atrophy, and mineralization of the thalmus were reported in mice exposed to phthalic anhydride in the diet.
- EPA has calculated a provisional Reference Concentration (RfC) of 0.12 milligrams per cubic metre (mg/m3) for phthalic anhydride based on respiratory effects in humans.
- EPA has established a Reference Dose (RfD) of 2.0 milligrams per kilogram body weight per day (mg/kg/d) for phthalic anhydride based on lung and kidney effects in mice.

Reproductive/Developmental Effects

- No studies regarding reproductive or developmental effects in humans were available.
- Phthalic anhydride was reported to be teratogenic in mice following intraperitoneal injection.
- Decreased spermatozoa motility time was reported in one study in which male rats were exposed via inhalation.

Cancer Risk

- No studies were available on the carcinogenic effects of phthalic anhydride in humans.
- A bioassay of phthalic anhydride for possible carcinogenicity was conducted by administering phthalic anhydride in feed to groups of male and female rats and mice. It was observed that no tumours occurred in the rats or mice of either sex at incidences that could be clearly related to the administration of phthalic anhydride.
- EPA has not classified phthalic anhydride regarding carcinogenicity.

Hazard Alert

SAFETY [6]

First Aid Measures

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

Fire Information

- Phthalic anhydride may be combustible at high temperature.
- Auto-ignition temperature is 570°C
- Phthalic anhydride is slightly flammable to flammable in presence of heat and non-flammable in presence of shocks.
- For fighting small phthalic anhydride fires, use dry chemical powder.
- For fighting large fires, water spray, fog or foam should be used. Do not use water jet.

Exposure Controls & Personal Protection

Engineering Controls

- Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits.
- If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protective Equipment

The following personal protective equipment is recommended when handling phthalic anhydride:

- Splash goggles;
- Synthetic apron;
- Vapour and dust respirator (be sure to use an approved/certified respirator or equivalent);
- Gloves.

Personal Protective Equipment in Case of a Large Spill:

- Splash goggles;
- Full suit;
- Vapour and dust respirator;
- Boots;
- Gloves;
- A self-contained breathing apparatus should be used to avoid inhalation of the product.
- Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

REGULATION

United States [7]

NIOSH: The National Institute for Occupational Safety and Health has set a recommended exposure limit (REL) for phthalic anhydride of 6 mg/m3 and 1 ppm TWA

OSHA: The Occupational Safety & Health Administration has set a permissible exposure limit (PEL) for phthalic anhydride of 12 mg/m3 and 2 ppm TWA

Australia [8]

Safe Work Australia: Safe Work Australia has established a time weighted average concentration (TWA) for phthalic anhydride of 6.1 mg/m3 and 1 ppm for a 40-hour work week.

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Gossip

Chemists demonstrate sustainable approach to carbon dioxide capture from air

2018-10-02

Chemists at the Department of Energy's Oak Ridge National Laboratory have demonstrated a practical, energy-efficient method of capturing carbon dioxide (CO2) directly from air. They report their findings in Nature Energy. If deployed at large scale and coupled to geologic storage, the technique may bolster the portfolio of responses to global climate change. Negative emissions technologies—for net removal of greenhouse gases from the atmosphere—are now considered essential for stabilising the climate," said Radu Custelcean of ORNL, who conceived and led the study. This opinion echoes conclusions of a recent report from the National Academy of Sciences. "Our direct-air-capture approach provides the basis for an energy-sustainable negative emissions technology," he added. The accomplishment builds on a proof-of-principle study the chemists conducted last year, which was improved through a two-cycle process that dramatically enhanced the speed and capacity of CO2 absorption and that completely recycles both the amino acid sorbent and the guanidine compound. It's cheaper and easier to cut CO2 emissions at their source than to recapture emissions from the atmosphere. Regardless, large-scale deployment of technologies such as direct air capture of CO2is now considered necessary to limit the rise in average global temperature to 2 degrees C (~4 degrees Fahrenheit). Limiting warming to 2 degrees C would require grabbing billions of tons, or gigatons, of CO2 from the atmosphere. In principle, trees could do it. However, to capture CO2 at this scale, "you'd need to plant trees on a surface the size of India," Custelcean said. Capturing a gigaton of CO2 per year with industrial scrubbers would require only approximately 7,000 square kilometres (~2,700 square miles)—an area less than the big island of Hawaii, said co-author Neil Williams. For the recent ORNL study, Williams and Flavien Brethomé mixed amino acids with water to make an aqueous sorbent to grab CO2 from air. Amino acids are safer than caustic sodium or potassium hydroxides or smelly amines, the sorbents used in industrial CO2 scrubbers. The scientists put their aqueous sorbent in a household humidifier to maximise contact between air and sorbent and thus speed CO2 uptake. Once absorbed into the liquid, the CO2 formed a bicarbonate salt. Colleague Charles Seipp had designed and synthesised an organic compound containing guanidines, chemical groups common in proteins that can bind negatively charged ions. Williams and Brethomé added Seipp's guanidine compound to the loaded amino acid sorbent solution containing bicarbonate, creating an insoluble carbonate salt that

Chemists at the Department of Energy's Oak Ridge National Laboratory have demonstrated a practical, energy-efficient method of capturing carbon dioxide (CO2) directly from air.

precipitated out of solution and regenerating the amino acid sorbent, which could be recycled. A critical part of the study was a thorough thermodynamic analysis of the process by Custelcean and Michelle Kidder, who determined how much energy was needed to drive each chemical reaction. The last step—releasing CO2 from the carbonate crystals so it can be stored long-term—is especially important for developing an energy-sustainable process. Because the CO2 is bound in a guanidine carbonate solid, it can be liberated at much lower temperatures (80–160 degrees C, or 176–320 degrees F) than from the inorganic salts used in current capture technologies, which require temperatures over 800 degrees C (1,472 degrees F) to release the CO2. Nevertheless, the analysis showed the heat needed to release the CO2 from the guanidine carbonate crystals is still significant. To make the overall process energy-sustainable, Custelcean decided to employ concentrated solar power. He acquired a solar-powered oven, normally used to cook foods using a parabolic mirror to concentrate the sun's rays. The guanidine carbonate crystals were placed on a tray inside the solar oven, and the CO2 was liberated in as little as 2 minutes, in a process regenerating the guanidine compound for recycling. "Using renewable energy is important because as much as possible you want to avoid producing more CO2 in the process of trying to capture it," Custelcean said. This experiment used solar heat, but waste heat—such as from air conditioners and power plants—would work as well, he said. Moving forward, the researchers would like to design simpler, more efficient guanidine-based sorbents and gain a better understanding of the structural, thermodynamic and mechanistic aspects of the direct air capture process. "All crystals that we've made so far include water that hydrates the carbonate anions," Custelcean explained. "When you try to release the CO2, you have to desorb the water as well, and that takes most of the energy. We are trying to design next-generation guanidine ligands that bind the CO2 as 'dry' carbonate."

Technology.org, 23 September 2018

http://www.technology.org

A team of researchers affiliated with several institutions in Japan has developed a material made from just a single molecule that self-forms into a lattice that can self-heal and store gases.

Material made from single molecule self-forms into a lattice that can self-heal, store gases

2018-10-02

A team of researchers affiliated with several institutions in Japan has developed a material made from just a single molecule that self-forms into a lattice that can self-heal and store gases. In their paper published in the journal Science, the group describes synthesizing the aromatic

molecule, which bears a symmetrical outer shell. The researchers note that most porous materials are made from linkers and connecting units—metal organic frameworks are one example. Such frameworks are often custom-developed to allow for storing other material, such as hydrogen, in the pores. The downside to such an approach is the multitude of options available, which requires researchers to spend time screening for the optimal structure. In this new effort, the researchers report on the development of a new porous material made from a single synthesised molecule. They claim it is possible to create a complex, useful type of material without a complex set of building blocks. The molecule the team made had a symmetrical outer shell, giving it a shape akin to a propeller. It consisted of three polar dipyridylphenyl parts hooked to a middle non-polar mesitylene. In the presence of isopropanol or acetonitrile, it assembled automatically into a network that was held together by hydrogen bonds (non-classical). The researchers note that the bonds were weaker than normal hydrogen bonds but were stable up to 202°C. They further note that other similar-purpose crystals begin to degrade at temperatures of 130°C. Above the stable point, the pores in the crystal started to collapse causing the material to become non-porous—suggesting a means for delivering a material that it has been holding. Interestingly, the researchers found that the pores could be regenerated by cooling the material and treating it with acetonitrile vapor—a form of self-healing. The researchers note that the oddly shaped molecule serves as a linker and connector allowing for the creation of a simple porous network in a material. They note also that the arms of the propeller serve different functions—from walls, to roof to floor—all around 6Å wide pores that offer a size capable of harbouring nitrogen gas or solvents.

Researchers have developed a roadmap for industrial cellulose gasoline.

Phys.org, 24 September 2018

http://phys.org

Ready-to-use recipe for turning plant waste into gasoline

2018-10-02

Bioscience engineers at KU Leuven, Belgium, already knew how to make gasoline in the laboratory from plant waste such as sawdust. Now the researchers have developed a roadmap, as it were, for industrial cellulose gasoline. In 2014, at KU Leuven's Centre for Surface Chemistry and Catalysis, researchers succeeded in converting sawdust into building blocks for gasoline. A chemical process made it possible to convert the cellulose - the main component of plant fibres - in the sawdust into

hydrocarbon chains. These hydrocarbons can be used as an additive in gasoline. The resulting cellulose gasoline is a second-generation biofuel, explains Professor Bert Sels. "We start with plant waste and use a chemical process to make a product that is a perfect replica of its petrochemical counterpart. In the end product, you can only tell the difference with fossil gasoline using carbon dating." For this type of bio-refining, the researchers built a chemical reactor in their lab, with which they can produce cellulose gasoline on a small scale. "But the question remained how the industry can integrate this and could produce it in large quantities. Our researcher, Aron Deneyer, has now investigated this. He examined in which section of the existing petroleum refining process the cellulose is best added to the petroleum to obtain a strongly bio-sourced gasoline. In other words, we now have a ready-to-use recipe for cellulose gasoline that the industry can apply directly: without loss of quality for the gasoline and making maximum use of existing installations." Cellulose gasoline must be seen as a transitional phase, Professor Sels emphasises. "The cellulose is still mixed with petroleum: this gasoline will never be sourced 100 percent from renewable raw materials. Current consumption is too high to produce all gasoline from plant waste. However, our product does already offer the possibility of using greener gasoline while a large proportion of the vehicles on our roads still run on liquid fuel. In the future, we will remain dependent on liquid fuels, albeit to a lesser extent, and then they may indeed be fully bio-based. We therefore suspect that the industry will show interest in this process."

EurekAlert, 24 September 2018

http://www.eurekalert.org

Researchers in Japan have found a way to create innovative materials by blending metals with precision control.

Breakthrough in blending metals

2018-10-02

Researchers in Japan have found a way to create innovative materials by blending metals with precision control. Their approach, based on a concept called atom hybridization, opens up an unexplored area of chemistry that could lead to the development of advanced functional materials. Multimetallic clusters -- typically composed of three or more metals -- are garnering attention as they exhibit properties that cannot be attained by single-metal materials. If a variety of metal elements are freely blended, it is expected that as-yet-unknown substances are discovered and highly-functional materials are developed. So far, no one had reported the multimetallic clusters blended with more than four metal elements so far because of unfavourable separation of different metals.

One idea to overcome this difficulty is miniaturisation of cluster sizes to one-nanometre scale, which forces the different metals to be blended in a small space. However, there was no way to realise this idea. A team, including Takamasa Tsukamoto, Takane Imaoka, Kimihisa Yamamoto and colleagues, has developed an atom hybridisation method, which has realised the first-ever synthesis of multimetallic clusters consisting of more than five metal elements with precise control of size and composition. This method employs a dendrimer template that serves as a tiny "scaffold" to enable controlled accumulation of metal salts. After precise uptake of the different metals into the dendrimer, multimetallic clusters are obtained by chemical reduction. In contrast, a conventional method without the dendrimer yields enlargement of cluster sizes and separation of different metals. The team successfully demonstrated the formation of five-element clusters composed of gallium (Ga), indium (In), gold (Au), bismuth (Bi) and tin (Sn), as well as iron (Fe), palladium (Pd), rhodium (Rh), antimony (Sb) and copper (Cu), and a six-element cluster consisting of Ga, In, Au, Bi, Sn and platinum (Pt). Additionally, they hint at the possibility of making clusters composed of eight metals or more. This atom hybridisation method using the dendrimer template can synthesise ultra-small multimetallic clusters with precise control of size and composition. There are more than 90 metals in the periodic table. With infinite combinations of metal elements, atomicity and composition, this method will open up a new field in chemistry on a one-nanometre scale. The current study marks a major step forward in creating such as-yet-unknown innovative materials.

EurekAlert, 24 September 2018

http://www.eurekalert.org

Digging through the sediment layer by layer reveals nearly everything the planet has ever experienced, a veritable history book of life and death on Earth.

The Earth's Memory Is Locked In Ancient Seafloor Muck

2018-10-02

The Earth does not forget. Meteor impacts, nuclear detonations, ice ages, earthquakes: The memories of them all are imprinted in the muck at the bottom of the ocean. Digging through the sediment layer by layer reveals nearly everything the planet has ever experienced, a veritable history book of life and death on Earth. You just have to learn how to speak in the language of shells, dust, and chemical compounds, which is exactly what Earth scientists probing the muck have learned to do. The memories they translate into English are ones we can all learn from. Scientists have a few ways to access the planetary memory system, but one ubiquitous technique is through cores extracted from the seabed. To

get these cores, they use lower what's called a piston corer up to 8.05km below the waves. When it hits the bottom, a piston drives a tube into the mud as far as it will go before the line is drawn back up to the surface. The cores of mud — which are up to 9.14m long — are then brought back to land where they're stored in archives around the world. One of the biggest repositories of the Earth's memories is at Columbia University's Lamont-Doherty Earth Observatory. There, scientists have been collecting cores for decades. In the 1950s and 1960s, there was a "core a day" policy for the Vema and the Conrad, two research ships that Lamont operated. Both ships travelled over 1.85 million kilometres, which adds up to a lot of cores. Though the policy has died, scientists from Columbia and other institutions continue to send their cores to the Lamont Core Repository, whose archives include some 19,800 samples. "The entire history of Earth's climate, over 100 million years, is recorded in these cores," Maureen Raymo, the head of Lamont's Core Repository, told Gizmodo. "We know what that looks like, and we can see what's happening now is not natural, it's driven by [human] CO2." To extract memories from mud, scientists split their cores in manageable chunks, each 1.52m in length. The piston corer has a PVC pipe insert to keep the goop in place. Those are then split in half, creating two records that scientists can pluck samples from. The cores were originally stored at room temperature, but that caused them to dry and shrink. Still serviceable, but not ideal. Now, all new cores are stored in a refrigerator, which helps keep them in a state closer to fresh modelling clay. All cores are marked and numbered in 10cm increments with the same tabs used to pin your car's upholstery to the roof. "They've been repurposed," Nichole Anest, the repository's curator, told Gizmodo laughing. "We get them luckily in batches of over a thousand so we don't have to order them very often." But while the labels are low tech, the ways scientists analyse the cores is decidedly high tech. Scientists once photographed cores on boats in black and white and used a mix of descriptive words, letters, and numbers called the Munsell Colour System to help identify the types of sediment. Now, they use carefully calibrated machines that can image cores in colour, take x-rays, and spin samples. Radioactive signs were all over the equipment and Anest told me I shouldn't spend too much time standing next to the machines. I asked Raymo if she had a favourite core. She immediately volunteered an answer: DSDP-607. "I did most of my thesis on it," she said. "I generated the first long record of northern hemisphere Ice Ages that show how and where the Ice Ages begin. It's such a cool site, they went out and re-drilled it 20 years later." Claire Jasper, a technician at the lab, told me there's one core that shows a more recent event. Walking into the refrigerator where all the new cores are stored, she pulled out a smooth pinkish-brown one

from a trip to the Caribbean. The core ended in a turbulent jumble of mud flecked with rocks, showing the imprint of the 2010 Haiti earthquake. The frenzied-looking end of the core reflects how the Earth's shaking jostled sediment and sent underwater landslides cascading into the muck. These natural events are intermingled with humanity's imprint. Though not visible to the naked eye, the radioactive legacy of nuclear bomb testing is stored in sediment, too. So are more pedestrian forms of pollution. Hudson River mud shows a spike in lead starting in the early 1900s, which continues until unleaded gasoline was introduced in the 1970s. And our current carbon polluting bonanza will also leave its mark. Carbon dioxide makes seawater more acidic. The increasingly acidic oceans of today are dissolving and deforming the calcium carbonate shells that tiny sea creatures call forams create. As these creatures die and tumble down to the ocean floor, their shells become part of the Earth's memory. "Say in another thousand years if we're still studying marine ocean cores, it'll be like 'oh, what happened there?'" Anest said. Indeed, even if we get a handle on our carbon emissions, the planet's memories of our atmospheric polluting spree will last long after we're gone.

Gizmodo, 30 September 2018

http://gizmodo.com

This New Lithium Battery Tech Can Simply Suck Up CO2 to Power Itself

2018-10-02

A team at MIT has come up with a lithium-based battery system that soaks up carbon dioxide directly from inside power plants, converting the waste steam into a (CO2-loaded) electrolyte.

Everybody knows the world's got a serious carbon dioxide problem, but an ingenious and potentially cost-effective way of dealing with our surplus CO2 could provide the means of tomorrow's battery technology. For years scientists have looked at ways of capturing carbon and storing it underground or even potentially in the ocean. But a new system might offer a powerful advantage over these efforts. The problem with conventional carbon capture and sequestration (CCS) systems, according to researchers at MIT, is that while they're good at preventing CO2 emissions from entering the atmosphere and trapping heat, they require a lot of energy to do so. A study in 2014 estimated CCS uses up to 30 percent of a power plant's generating capacity, and in the end, many such systems only then store the capture CO2 in solid form, but don't actually repurpose it. A separate branch of CO2 science looks at ways of converting the chemical into other kinds of materials that we could potentially use as a viable fuel source, which many researchers think is a preferable strategy, since it gives back something at the same time. In that vein, a team at MIT

has come up with a lithium-based battery system that soaks up carbon dioxide directly from inside power plants, converting the waste steam into a (CO2-loaded) electrolyte – one of the three main parts of a battery. Lithium-carbon-dioxide batteries typically require metal catalysts to function, because carbon dioxide is not very reactive. The problem is, the catalysts can be expensive to source, and the chemical reactions involved can be difficult to control. To get around this, a team led by mechanical engineer Betar Gallant achieved electrochemical carbon dioxide conversion without the metallic catalyst, using only a carbon electrode. The answer was to use CO2 in a liquid state, incorporating it into an amine solution. "What we've shown for the first time is that this technique activates the carbon dioxide for more facile electrochemistry," Gallant says. "These two chemistries — aqueous amines and nonaqueous battery electrolytes — are not normally used together, but we found that their combination imparts new and interesting behaviours that can increase the discharge voltage and allow for sustained conversion of carbon dioxide." The research so far is not ready for commercial use just yet, but the experiments show that the amine technique is competitive with other methods for lithium-gas batteries, although there are definite areas for improvement. Chiefly, the battery system is currently limited to 10 charge-discharge cycles – a severe restriction that will need to be dramatically boosted if we are to use these lithium-carbon batteries for any serious purpose. "Future challenges will include developing systems with higher amine turnover to approach near-continuous operation or long cycle life, and to increase the capacity attainable at higher powers," the authors write in their paper. Ultimately, they acknowledge, it will be years before this kind of battery technology can be used to power things people actually need. But with every minor hurdle we pass we're getting closer to that end goal – while helping to solve one of today's key environmental dilemmas (and in a way that's more useful than just transplanting it underground and out of sight). "Lithium-carbon dioxide batteries are years away," Gallant explains, but at least if we can turn CO2 into something like a battery component, it's "one way to sequester it as a useful product." The findings are reported in Joule.

Science Alert, 30 September 2018

http://www.sciencealert.com.au

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Remember Solar Roadways? We Finally Have Data on Whether They Actually Work

2018-10-02

Four years ago, a viral campaign wooed the world with a promise of fighting climate change and jump-starting the economy by replacing tarmac on the world's roads with solar panels. The bold idea has undergone some road testing since then. The first results from preliminary studies have recently come out, and they're a bit underwhelming. A solar panel lying under a road is at a number of disadvantages. As it's not at the optimum tilt angle, it's going to produce less power and it's going to be more prone to shading, which is a problem as shade over just 5 percent of the surface of a panel can reduce power generation by 50 percent. The panels are also likely to be covered by dirt and dust, and would need far thicker glass than conventional panels to withstand the weight of traffic, which will further limit the light they absorb. Unable to benefit from air circulation, it's inevitable these panels will heat up more than a rooftop solar panel too. For every 1 degree Celsius over optimum temperature you lose 0.5 percent of energy efficiency. As a result, a significant drop in performance for a solar road, compared to rooftop solar panels, has to be expected. The question is by how much and what is the economic cost? One of the first solar roads to be installed is in Tourouvre-au-Perche, France. This has a maximum power output of 420 kW, covers 2,800 metres squared and cost €5 million to install. This implies a cost of €11,905 per installed kW. While the road is supposed to generate 800 kilowatt hours per day (kWh/day), some recently released data indicates a yield closer to 409 kWh/day, or 150,000 kWh/yr. For an idea of how much this is, the average UK home uses around 10 kWh/day. The road's capacity factor – which measures the efficiency of the technology by dividing its average power output by its potential maximum power output – is just 4 percent. In contrast, the Cestas solar plant near Bordeaux, which features rows of solar panels carefully angled towards the sun, has a maximum power output of 300,000 kW and a capacity factor of 14 percent. And at a cost of €360 million, or €1,200 per installed kW, one-tenth the cost of our solar roadway, it generates three times more power. In America, a company called Solar Roadways has developed a smart highway with solar panels, including sensors and LED lights to display traffic warnings about any upcoming hazards, such as a deer. It also has heating pads to melt snow in winter. Several of their SR3 panels have been installed in a small section of pavement in Sandypoint, Idaho. This is 13.9 metres squared in area, with an installed capacity of 1.529 KW. The installation cost is given as US$48,734, which implies a cost per installed kW of €27,500, more than 20

Four years ago, a viral campaign wooed the world with a promise of fighting climate change and jump-starting the economy by replacing tarmac on the world's roads with solar panels.

times higher than the Cestas powerplant. Solar Roadway's own estimates are that the LED lights would consume 106 MWh per lane mile, with the panels generating 415 MWh – so more than 2 5 percent of the useful power is consumed by the LEDs. This would reduce performance even further. The heating plates are also quoted as drawing 2.28 MW per lane mile, so running them for just six days would cancel out any net gain from the solar panels. And this is before we look at the actual data from the Sandypoint installation, which generated 52.397 kWh in 6 months, or 104.8 kWh over a year. From this we can estimate a capacity factor of just 0.782 percent, which is 20 times less efficient than the Cestas power plant. That said, it should be pointed out that this panel is in a town square. If there is one thing we can conclude, it's that a section of pavement surrounded by buildings in a snowy northern town is not the best place to locate a solar installation. However, perhaps there's a bigger point – solar roads on city streets are just not a great idea. Roads don't actually represent as large an area as we assume. The UK department of transport gives a breakdown of the length of the UK's different road types. Assuming we can clad these in solar panels, four lanes of every motorway, two lanes on the A & B roads and half a lane for C & U roads (a lot are single track roads and just won't be suitable) we come up with a surface area of 2 billion metres squared. Which sounds like a lot, until you realise that buildings in the UK's urban areas occupy an area of 17.6 billion metres squared. So just covering a fraction of the UK's rooftops with solar panels would immediately yield more power than putting them on roads. That's quite apart from the benefits that a more elevated position would yield for greater power generation. All of this suggests that only a small fraction of the road network would actually be suitable. And, given the relatively small size of the road network, solar roads could only ever become a niche source of power and never the shortcut to our future energy supply.

Science Alert, 29 September 2018

http://www.sciencealert.com.au

Personal care companies are looking to food preservatives, synergists, and plant-derived options to keep their products clean

The search is on for new cosmetic preservatives

2018-10-02

In May, Bocchi Laboratories recalled its Medline Remedy Essentials No-Rinse Cleansing Foam, used to wash hospital patients. Burkholderia cepacia, a Gram-negative bacteria complex that can lead to serious respiratory infections in immune-compromised individuals, had contaminated the preparation. The U.S. Food & Drug Administration warned of a possible life-threatening infection, and the Centres for Disease

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Control & Prevention confirmed 15 illnesses in hospitalised patients. FDA's cosmetic recall database lists a half-dozen other cases of contaminated cosmetics since June. The recalls involved batches of baby wash, body care products, and tattoo inks with high levels of potentially harmful microbial organisms. Among the contaminants were infection-causing Enterobacter aerogenes and Pseudomonas aeruginosa. FDA doesn't disclose the reasons for the contamination, but faulty preservatives could be involved. Without preservatives, many personal care products would be hospitable breeding grounds for bacteria, fungi, and mould. At a minimum, these bad actors can make shampoos and skin creams look unappealing and smell bad. More seriously, they can cause eye, skin, and respiratory infections. However, many of the preservatives that prevent the growth of harmful microorganisms in personal care products are themselves accused of irritating skin, causing allergic reactions, and disrupting the human endocrine system. Last year, European authorities banned the use of methylisothiazolinone in cosmetics, such as lotions that remain on the skin, because the ingredient can be irritating. European regulators also put restrictions on paraben preservatives such as propylparaben, fearing they might be endocrine disruptors. Though the government-sanctioned body reviewing parabens did not come to a definitive conclusion on their endocrine disruption potential, it agreed to cut back how much formulators could use in a product. Separately, environmental groups are lobbying against formaldehyde-releasing agents, such as DMDM hydantoin, because they might evoke an allergic response. Large personal care product makers take the criticisms seriously. In recent years, for example, Johnson & Johnson has removed formaldehyde donors and parabens from its baby products. Yet a J&J advertorial in the Sept. 9 issue of the New York Times Magazine points out that personal care preservatives are not necessarily harmful and that synthetic chemicals are not automatically inferior to natural ingredients. Caught in a similar bind, traditional preservative suppliers such as Lonza and Clariant are turning to food preservatives and to naturally derived synergists to make a little bit of a preservative go a long way. They are also pursuing new technology and seeking out academic and government experts who can help them find biobased alternatives to dependable, low-cost synthetic preservatives. But making the change isn't easy. Some food preservatives have always found use in personal care products, but the current brouhaha means makers of food preservatives are experiencing an uptick in demand. Edward Gotch, CEO of Emerald Kalama Chemical, a maker of benzoates—including benzoic acid, sodium benzoate, and benzyl alcohol—says the number of personal care products launched containing benzoates is rising 7% annually. Benzoates have been used safely for years in foods and

beverages, he points out. They are a readily available alternative to those biocides now under fire, Gotch says. Benzoic acid produced via toluene oxidation is no different than the benzoic acid found in cranberries, he notes. What's more, certification agencies such as Ecocert accept benzoic acid in products labelled organic, he says. The firm recently completed an expansion of benzoic acid capacity in Rotterdam, the Netherlands, and it plans to add more sodium benzoate capacity at the site within the next two years. Another food preservative, cetylpyridinium chloride (CPC), is also expanding its presence in personal care. CPC "has been a trusted ingredient for over 50 years," says Jessica Byrd, a marketing manager for CPC maker Vertellus. CPC prevents bacteria growth in meat and poultry processing plants, she says. In addition, many mouthwash makers use CPC as their active ingredient. CPC still awaits a listing on Annex V, the European list of approved cosmetic preservatives. The ingredient is effective against most microbial contaminants, with the exception of some types of Aspergillus fungi in some types of cosmetic formulations, Byrd says. For those formulations, Vertellus offers a blend of CPC with benzoic acid to give broad-spectrum coverage. Nicolas Lasbistes, a personal care technical marketing manager for Clariant, calls the growing use of food preservatives in cosmetics the "skin-food trend." The idea is that "if it's good to eat, it should be good for my skin," he says. That way of thinking cuts across cultural differences and is attractive to consumers across the globe, he notes. That wide appeal is partly the reason Clariant incorporates food preservatives into its Nipaguard range of preservatives intended to replace parabens. Benzoic acid and benzyl alcohol are among the ingredients used. The line also includes potassium sorbate, a food preservative widely used to inhibit mould and yeast in foods such as cheese, yogurt, and apple cider.

Key to the effectiveness of the Nipaguard line, Lasbistes says, is the inclusion of the preservative booster sorbitan caprylate, which is made by reacting sorbitan from wheat or corn with caprylic acid derived from palm or coconut oil. Sorbitan caprylate acts like a surfactant to crack open bacteria and cell membranes. The preservatives can then penetrate the microorganisms and kill them. Other preservative suppliers are also using boosters to enhance the effectiveness of both traditional and newer preservatives. Phil Hindley, marketing head for preservation at Lonza, says his firm is working with booster technology to keep an effective traditional preservative, phenoxyethanol, in the formulator's toolbox. Critics now attack phenoxyethanol, which has been in use since the 1950s, as a skin irritant. Even though European authorities reviewed phenoxyethanol two years ago and reaffirmed that cosmetic formulators can safely use

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it at 1% concentration, Hindley thinks questions raised by critics about the preservative have damaged its long-term prospects. One way to allay consumer and regulatory concerns, he says, is to add a booster that allows phenoxyethanol to work effectively at concentrations below 1%. Lonza offers a blend of phenoxyethanol and chlorphenesin with the booster caprylyl glycol. But formulating some of the new blends can be tricky. Traditional preservatives such as parabens "were built as biocides and had minimal impact on formulation properties," Hindley says. Cosmetic makers typically need to add a higher percentage of the alternative blends to do the work of a traditional preservative. The larger preservative load can affect cosmetic properties such as skin feel. "As we move away from the era of traditional chemical preservatives, the art of preservation can no longer be an afterthought," Hindley says. As formulators make the move, they should think long and hard about the alternatives, says Nava Dayan, a skin research consultant to personal care and pharmaceutical firms. "You can't just assume that if you can safely swallow a preservative it will also be safe on your skin," she says. A person's gastrointestinal system is well equipped to break down chemicals in food that the liver then neutralises, Dayan explains. "This doesn't happen when you apply preservative-containing cosmetics on your skin," she says. And Dayan says she can understand why some people may be concerned about traditional preservatives as well. "We are limited in our ability to understand long-term cumulative exposure to preservatives," she says. "Are they absorbed in the blood? Are they metabolised or excreted? Or do they accumulate in the body, and could they be harmful, and to what extent?" Questions like these apply to new preservatives under development too. A competition under the aegis of the Green Chemistry & Commerce Council (GC3) turned up a few new preservative options this summer. Consumer product companies, major retailers, and preservative makers including Lonza and Dow Chemical backed the challenge, in which winners shared $175,000 in prize money. Among the winners was the Safer Preservation Project, led by the U.S. Department of Agriculture. Project members William Hart-Cooper, a USDA research chemist; Heather Buckley, a University of Victoria assistant professor; Kaj Johnson, a product development director at cleaning products maker Method, and others developed what Hart-Cooper calls a non-irritating, low eco-toxic, broad-spectrum preservative made from two nontoxic components. When diluted in water treatment plants, the preservative molecule dissociates into benign biodegradable components, he says. Because USDA hasn't received a patent yet, Hart-Cooper won't reveal details, other than to say that the ingredients are mostly from common agricultural products. But formulators will want to know a whole lot more about the new preservatives before they consider putting them

into a product. When they use a preservative, formulators are essentially investing in an insurance policy, Dayan says. Their goal is to protect cosmetic formulas from contamination and shield users from harm. "So, they must do a thorough assessment of the preservatives they use," Dayan says, to be sure they choose the right insurance vehicle.

Chemical & Engineering News, 30 September 2018

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

New, highly stable catalyst may help turn water into fuel

2018-10-02

Breaking the bonds between oxygen and hydrogen in water could be a key to the creation of hydrogen in a sustainable manner, but finding an economically viable technique for this has proved difficult. Researchers report a new hydrogen-generating catalyst that clears many of the obstacles—abundance, stability in acid conditions and efficiency. In the journal Angewandte Chemie, researchers from the University of Illinois at Urbana-Champaign report on an electrocatalytic material made from mixing metal compounds with substance called perchloric acid. Electrolyzers use electricity to break water molecules into oxygen and hydrogen. The most efficient of these devices use corrosive acids and electrode materials made of the metal compounds iridium oxide or ruthenium oxide. Iridium oxide is the more stable of the two, but iridium is one of the least abundant elements on Earth, so researchers are in search of an alternative material. "Much of the previous work was performed with electrolyzers made from just two elements—one metal and oxygen," said Hong Yang, a co-author and professor of chemical and biomolecular engineering at Illinois. "In a recent study, we found if a compound has two metal elements—yttrium and ruthenium—and oxygen, the rate of water-splitting reaction increased." Yao Qin, a co-author and former member of Yang's group, first experimented with the procedure for making this new material by using different acids and heating temperatures to increase the rate of the water-splitting reaction. The researchers found that when they used perchloric acid as a catalyst and let the mixture react under heat, the physical nature of the yttrium ruthenate product changed. "The material became more porous and also had a new crystalline structure, different from all the solid catalysts we made before," said Jaemin Kim, the lead author and a postdoctoral researcher. The new porous material the team developed—a pyrochlore oxide of yttrium ruthenate—can split water molecules at a higher rate than the current industry standard. "Because of

Researchers report a new hydrogen-generating catalyst that clears many of the obstacles—abundance, stability in acid conditions and efficiency.

the increased activity it promotes, a porous structure is highly desirable when it comes electrocatalysts," Yang said. "These pores can be produced synthetically with nanometre-sized templates and substances for making ceramics; however, those can't hold up under the high-temperature conditions needed for making high-quality solid catalysts." Yang and his team looked at the structure of their new material with an electron microscope and found that it is four times more porous than the original yttrium ruthenate they developed in a previous study, and three times that of the iridium and ruthenium oxides used commercially. "It was surprising to find that the acid we chose as a catalyst for this reaction turned out to improve the structure of the material used for the electrodes," Yang said. "This realization was fortuitous and quite valuable for us." The next steps for the group are to fabricate a laboratory-scale device for further testing and to continue to improve the porous electrode stability in acidic environments, Yang said. "Stability of the electrodes in acid will always be a problem, but we feel that we have come up with something new and different when compared with other work in this area," Yang said. "This type of research will be quite impactful regarding hydrogen generation for sustainable energy in the future." Graduate student Pei-Chieh Shih, Zaid Al-Bardanand and Argonne National Laboratory researcher Cheng-Jun Sun also contributed to this research.

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http://phys.org

Researchers from Aarhus University have developed an improved method for following the transport of chemicals through the soil.

Following the path of chemicals through the soil

2018-10-02

Where do pesticides and their degradation products go once they enter the soil? And how long does it take them to get to groundwater or drainage systems? That depends on a number of factors, but researchers at Aarhus University have come a step closer to finding quick answers. For the first time ever, they have used visible/near-infrared spectroscopy to predict the transport of dissolved chemicals through intact soil. The ability of soils to transport dissolved chemicals depends on the soil's texture and structure. Tracking the travel time of these solutes is usually carried out in the laboratory by measuring breakthrough curves, where the application of a solute at the soil surface and its appearance over time at the bottom are recorded. Obtaining breakthrough curves from laboratory studies is extremely expensive as well as time consuming and labour intensive, so the team of scientists from Aarhus University and Aalborg University

decided to think out of the box and use visible/near-infrared (vis–NIR) spectroscopy to predict breakthrough curves – for the first time ever.

Applying technology in new way

Vis–NIR spectroscopy is well recognised for its measurement speed and its low data acquisition cost. It can be used for quantitative estimation of basic soil properties such as clay and organic matter. The team of scientists used vis–NIR spectroscopy to predict the breakthrough curves of the solutes on a large variety of intact soil columns from six representative fields in Denmark. Averaged across the individual field, the new technology estimated the breakthrough curves with a high degree of accuracy. "We found that we could measure the mass transport of dissolved chemicals quite accurately with vis–NIR spectroscopy. Our findings can pave the way for next-generation measurements and monitoring of dissolved chemical transport by spectroscopy," says Professor Lis Wollesen de Jonge, one of the scientists on the team and co-author of their article in Scientific Reports.

Understanding chemical leaching through the soil is important

The intensification of agricultural production to meet the growing demand for agricultural commodities is increasing the use of chemicals. The extensive use of agrochemicals causes pollution of water resources. This, in turn, poses serious threats to aquatic ecosystems, human health, and the environment. The occurrence of agrochemicals and their degradation products above the permissible limits in drinking water wells has forced numerous wells to be shut down and the implementation of strict regulations on the use of agrochemicals in the EU. Understanding the leaching of solutes to groundwater and being able to measure and model their transport times are therefore important for our health and the environment. Soil plays an important role in this regard because of its many functions. Soil is fundamental for agricultural production, for its ability to filter nutrients and pollutants, and for storing and recycling organic material. Soil is also the most important transport pathway for agrochemicals to groundwater. The soil's ability to filter dissolved agrochemicals is dependent on the soil's properties and the interaction between the dissolved solutes and the soil properties, and is influenced by how soils are used and managed. Soil structure is a very dynamic property since it is influenced by basic soil properties such as texture, organic matter, carbonates and metal oxides, climate, and land use and management practices. Depending on the soil structure, at close to saturation, water and dissolved chemicals can either be transported

evenly through the soil, or rapidly through specific pathways in the soil with various degrees of mass exchange between the soil matrix and the transporting pathways.

Future avenues for exploration

Various solute transport models have been developed to account for different transport processes and facilitate the prediction of the transport of dissolved chemicals through soils. "Major challenges when it comes to risk assessment are obtaining an accurate estimation of a range of parameters which are used as input in solute transport models and to accounting for the spatial differences in those transport properties," Lis Wollesen de Jonge explains. Even though there is a slight underestimation of the within-field variances with vis–NIR spectroscopy, the efficiency of this technology in terms of cost and speed of measurement may outweigh expensive and precise measurements using conventional methods of soil properties that usually have large spatial variability. In order to hone the technology, approaches for reducing the estimation error resulting from differences in soil structure that cannot be captured by vis–NIR spectroscopy should be investigated. Another avenue of exploration in order to improve the prediction accuracies could be integration of vis–NIR spectroscopy with other readily available information, such as soil structure information based on soil surveys or quick field tests.

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http://phys.org

Purdue University associate professor Julie Liu, at left, and doctoral student Sydney Hollingshead helped create a glue that could make medical procedures safer.

New glue could make millions of medical procedures safer, less invasive for patients

2018-10-02

More than 230 million invasive surgeries are performed worldwide each year – and nearly all of those procedures create additional tissue damage from stitches and staples. Researchers at Purdue University are hoping to significantly decrease that damage with a new surgical adhesive technology. The Purdue team is working to solve one of the major challenges in the biomedical technology field – most adhesives do not work well in moist environments because water interferes with the adhesion process. That means they cannot work inside the human body. Glue developed by the Purdue team uses a family of proteins and a modified amino acid to form a strong elastic bond between the soft tissues being joined. "We are taking a giant leap in health care research

by creating something totally new," said Julie Liu, an associate professor of chemical engineering and biomedical engineering at Purdue, who led the research team. "There are currently no viable surgical glues that work inside the body." The Purdue researchers were inspired by natural glues that are created using the proteins produced by underwater organisms such as mussels and sandcastle worms. "This research presented a whole new set of challenges for me," Liu said. "Our team had to come up with ways to bond soft tissues within a wet environment that are non-toxic and biocompatible." The Purdue glue has several advantages over sutures and staples, including reduced patient discomfort, lower risk of infection and less damage to surrounding healthy tissue. The technology aligns with Purdue's "giant leaps" celebration of the university's global advancements made in health, space, artificial intelligence and sustainability as part of Purdue's 150th anniversary. Those are the four themes of the year-long celebration's Ideas Festival, designed to showcase Purdue as an intellectual centre solving real-world issues. "It is exciting to work on such innovative and impactful research as a student," said Sydney Hollingshead, a chemical engineering doctoral student, who assisted with the research. "We are going to help a lot of people by turning our engineering discoveries into medical advances." Liu also said that commercial glues sold as liquid bandages for cuts and scrapes do not work for surgeries because the chemical makeup of those glues is toxic when used inside the body.

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Researchers identify a metal that withstands ultra-high temperature and pressure

2018-10-02

Japanese scientists have identified a metal that can stand up to constant forces in ultrahigh temperatures, offering promising applications including in aircraft jet engines and gas turbines for electric power generation.

The first-of-its-kind study, published in the open-access journal Scientific Reports in July 2018, describes a titanium carbide (TiC)-reinforced, molybdenum-silicon-boron (Mo-Si-B)-based alloy, or MoSiBTiC, whose high-temperature strength was identified under constant forces in the temperature ranges of 1400oC-1600oC. "Our experiments show that the MoSiBTiC alloy is extremely strong compared with cutting-edge Nickel-based single crystal superalloys, which are commonly used in hot sections of heat engines such as jet engines of aircrafts and gas turbines for electric power generation," said lead author Professor Kyosuke Yoshimi of Tohoku

Japanese scientists have identified a metal that can stand up to constant forces in ultrahigh temperatures, offering promising applications including in aircraft jet engines and gas turbines for electric power generation.

Gossip

University's Graduate School of Engineering. "This work suggests that the MoSiBTiC, as ultrahigh temperature materials beyond Nickel-based superalloys, is one promising candidate for those applications," added Yoshimi. Yoshimi and colleagues report several parameters that highlight the alloy's favourable ability to withstand disruptive forces under ultrahigh temperatures without deforming. They also observed the alloy's behaviour when exposed to increasing forces and when cavities within MoSiBTiC formed and grew, resulting in to microcracks and final rupturing. The performance of heat engines is key to future harvest of energy from fossil fuel and the subsequent conversion to electric power and propulsion force. The enhancement of their functionality may determine how efficient they are at energy conversion. Creep behaviour—or the material's ability to withstand forces under ultrahigh temperatures—is an important factor since increased temperatures and pressures lead to creep deformation. Understanding the material's creep can help engineers construct efficient heat engines that can withstand the extreme temperature environments. The researchers assessed the alloy's creep in a stress range of 100-300 MPa for 400 hours. (MPa, or megapascal, is a unit used to measure extremely high pressure. One MPa equals approximately 145psi, or pound per square inch). All experiments were performed in a computer-controlled test rig under vacuum in order to prevent the material from oxidising, or reacting with the any potential air moisture, which could ultimately result in rust formation. Furthermore, the study reports that, contrary to previous studies, the alloy experiences larger elongation with decreasing forces. This behaviour, they write, has so far only been observed with superplastic materials that are capable of withstanding against unexpected premature failure. These findings are an important indicator for MoSiBTiC's applicability in systems that function at extremely high temperatures, such as energy conversion systems in automotive applications, power plants, and propulsion systems in aircraft engines and rockets. The researchers say that several additional microstructural analyses are needed in order to fully understand the alloy's mechanics and its ability to recover from exposure of high stresses such as large forces under high temperatures. They hope to keep refining their findings in their future endeavours. "Our ultimate goal is to invent a novel ultrahigh temperature material superior to Nickel-based superalloys and replace high-pressure turbine blades made of Nickel-based superalloys with new turbine blades of our ultrahigh temperature material," said Yoshimi. "To go there, as the next step, the oxidation resistance of the MoSiBTiC must be improved by alloy design

without deteriorating its excellent mechanical properties. But it is really challenging."

Phys.org, 28 September 2018

http://phys.org

Polymer coating cools down buildings

2018-10-02

With temperatures rising and heat-waves disrupting lives around the world, cooling solutions are becoming ever more essential. This is a critical issue especially in developing countries, where summer heat can be extreme and is projected to intensify. But common cooling methods such as air conditioners are expensive, consume significant amounts of energy, require ready access to electricity, and often require coolants that deplete ozone or have a strong greenhouse effect. An alternative to these energy-intensive cooling methods is passive daytime radiative cooling (PDRC), a phenomenon where a surface spontaneously cools by reflecting sunlight and radiating heat to the colder atmosphere. PDRC is most effective if a surface has a high solar reflectance (R) that minimises solar heat gain, and a high, thermal emittance (ε) that maximises radiative heat loss to the sky. If R and ε are sufficiently high, a net heat loss can occur, even under sunlight. Developing practical PDRC designs has been challenging: many recent design proposals are complex or costly, and cannot be widely implemented or applied on rooftops and buildings, which have different shapes and textures. Up to now, white paints, which are inexpensive and easy to apply, have been the benchmark for PDRC. White paints, however, usually have pigments that absorb UV light, and do not reflect longer solar wavelengths very well, so their performance is only modest at best. Researchers at Columbia Engineering have invented a high-performance exterior PDRC polymer coating with nano-to-microscale air voids that acts as a spontaneous air cooler and can be fabricated, dyed, and applied like paint on rooftops, buildings, water tanks, vehicles, even spacecraft—anything that can be painted. They used a solution-based phase-inversion technique that gives the polymer a porous foam-like structure. The air voids in the porous polymer scatter and reflect sunlight, due to the difference in the refractive index between the air voids and the surrounding polymer. The polymer turns white and thus avoids solar heating, while its intrinsic emittance causes it to efficiently lose heat to the sky. The study is published online today in Science. The team—Yuan Yang, assistant professor of materials science and engineering; Nanfang Yu, associate professor of applied physics; and Jyotirmoy Mandal, lead

When exposed to the sky, the porous polymer PDRC coating reflects sunlight and emits heat to attain significantly cooler temperatures than typical building materials or even the ambient air.

author of the study and a doctoral student in Yang's group (all department of applied physics and applied mathematics)—built upon earlier work that demonstrated that simple plastics and polymers, including acrylic, silicone, and PET, are excellent heat radiators and could be used for PDRC. The challenges were how to get these normally transparent polymers to reflect sunlight without using silver mirrors as reflectors and how to make them easily deployable. They decided to use phase-inversion because it is a simple, solution-based method for making light-scattering air-voids in polymers. Polymers and solvents are already used in paints, and the Columbia Engineering method essentially replaces the pigments in white paint with air voids that reflect all wavelengths of sunlight, from UV to infrared. "This simple but fundamental modification yields exceptional R and ε that equal or surpass those of state-of-the-art PDRC designs, but with a convenience that is almost paint-like," says Mandal. The researchers found their polymer coating's high solar reflectance (R > 96%) and high thermal emittance (ε ~ 97%) kept it significantly cooler than its environment under widely different skies, e.g. by 6 C in the warm, arid desert in Arizona and 3 C in the foggy, tropical environment of Bangladesh. "The fact that cooling is achieved in both desert and tropical climates, without any thermal protection or shielding, demonstrates the utility of our design wherever cooling is required," Yang notes. The team also created coloured polymer coatings with cooling capabilities by adding dyes. "Achieving a superior balance between colour and cooling performance over current paints is one of the most important aspects of our work," Yu notes. "For exterior coatings, the choice of colour is often subjective, and paint manufacturers have been trying to make coloured coatings, like those for roofs, for decades." The group took environmental and operational issues, such as recyclability, bio-compatibility, and high-temperature operability, into consideration, and showed that their technique can be generalised to a range of polymers to achieve these functionalities. "Polymers are an amazingly diverse class of materials, and because this technique is generic, additional desirable properties can be conveniently integrated into our PDRC coatings, if suitable polymers are available," Mandal adds. "Nature offers many ways for heating and cooling, some of which are extremely well known and widely studied and others that are poorly known. Radiative cooling—by using the sky as a heat sink—belongs to the latter group, and its potential has been strangely overlooked by materials scientists until a few years ago," says Uppsala University Physics Professor Claes-Göran Granqvist, a pioneer in the field of radiative cooling, who was not involved with the study. "The publication by Mandal et al. highlights the importance of radiative cooling and represents an important breakthrough by demonstrating

that hierarchically porous polymer coatings, which can be prepared cheaply and conveniently, give excellent cooling even in full sunlight." Yang, Yu, and Mandal are refining their design in terms of applicability, while exploring possibilities such as the use of completely biocompatible polymers and solvents. They are in talks with industry about next steps. "Now is a critical time to develop promising solutions for sustainable humanity," Yang notes, "This year, we witnessed heat waves and record-breaking temperatures in North America, Europe, Asia, and Australia. It is essential that we find solutions to this climate challenge, and we are very excited to be working on this new technology that addresses it." Yu adds that he used to think that white was the most unattainable colour: "When I studied watercolour painting years ago, white paints were the most expensive. Cremnitz white or lead white was the choice of great masters, including Rembrandt and Lucian Freud. We have now demonstrated that white is in fact the most achievable colour. It can be made using nothing more than properly sized air voids embedded in a transparent medium. Air voids are what make snow white and Saharan silver ants silvery." The study is titled "Hierarchically Porous Polymer Coatings for Highly Efficient Passive Daytime Radiative Cooling."

Phys.org, 27 September 2018

http://phys.org

Liquid metal discovery to make toxic water safe and drinkable

2018-10-02

Researchers have discovered a revolutionary and cheap way to make filters that can turn water contaminated with heavy metals into safe drinking water in a matter of minutes.

UNSW and RMIT researchers have discovered a revolutionary and cheap way to make filters that can turn water contaminated with heavy metals into safe drinking water in a matter of minutes. Recent UNSW SHARP hire Professor Kourosh Kalantar-zadeh and his former colleagues at RMIT showed that nano-filters made of aluminium oxide could be cheaply produced using virtually no energy from a fixed amount of liquid metal gallium. In a paper published in Advanced Functional Materials, lead author Dr Ali Zavabeti (RMIT) and Professor Kalantar-zadeh explained that when a chunk of aluminium is added to the core of liquid gallium at room temperature, layers of aluminium oxide are quickly produced at the surface of the gallium. The authors discovered that these aluminium oxide nano-sheets were highly porous and went on to prove they were suitable for filtering both heavy metal ions and oil contamination at unprecedented, ultra-fast rates. Professor Kalantar-zadeh, who was recently awarded an ARC Australian Laureate Fellowship soon after

joining UNSW's School of Chemical Engineering, said that low cost and portable filters produced by this new liquid metal-based manufacturing process could be used by people without access to clean drinking water to remove substances like lead and other toxic metals in a matter of minutes. "Because it's super porous, water passes through very rapidly," Professor Kalantar-zadeh said. "Lead and other heavy metals have a very high affinity to aluminium oxide. As the water passes through billions of layers, each one of these lead ions get attracted to one of these aluminium oxide sheets. "But at the same time, it's very safe because with repeated use, the water flow cannot detach the heavy metal ions from the aluminium oxide." Professor Kalantar-zadeh believes the technology could be put to good use in Africa and Asia in places where heavy metal ions in the water are at levels well beyond safe human consumption. It is estimated that 790 million people, or one in 10 of the Earth's population, do not have access to clean water. "If you've got bad quality water, you just take a gadget with one of these filters with you," he said. "You pour the contaminated water in the top of a flask with the aluminium oxide filter. Wait two minutes and the water that passes through the filter is now very clean water, completely drinkable. "And the good thing is, this filter is cheap." There are portable filtration products available that do remove heavy metals from water, but they are comparatively expensive, often costing more than $100. By contrast, aluminium oxide filters produced from liquid gallium could be produced for as little as 10 cents, making them attractive to prospective manufacturers. "Up until now, to produce aluminium oxide, you need to process aluminium at above 1000 degrees or use other energy intensive processes," Professor Kalantar-zadeh said. "It would normally consume so much energy to make anything like this filter, making it hugely expensive. "Now we're talking about something you can do even under the sun in summer at 35 degrees." While aluminium is a plentiful and cheap metal, gallium is relatively expensive. But what makes gallium the hero in the process is the fact that it remains pure and unchanged after each production of aluminium oxide. "You just add aluminium to the gallium and out comes aluminium oxide when its surface is exposed to water. You can use gallium again and again. Gallium never participates in the reaction," Professor Kalanter-zadeh said. Professor Kalantar-zadeh said the manufacture process is so cheap and requiring such low expenditure of energy, these filters could even be made out of a kitchen. "We are publishing this concept and releasing it to the public domain, so people around the world can use the idea for free and implement it for enhancing the quality of their lives," he said. "This is all about a new paradigm. We haven't even begun to explore how we can use liquid metals as a base for manufacturing things that are cheap, green and safe for humans." The

work led by Professor Kalantar-zadeh and Dr Zavabeti was funded by The ARC Centre for Future Low-Energy Electronics Technologies (FLEET).

Science Daily, 25 September 2018

http://www.sciencedaily.com

Smart devices could soon tap their owners as a battery source

2018-10-02

The world is edging closer to a reality where smart devices are able to use their owners as an energy resource, say experts from the University of Surrey. In a study published by the Advanced Energy Materials journal, scientists from Surrey's Advanced Technology Institute (ATI) detail an innovative solution for powering the next generation of electronic devices by using Triboelectric Nanogenerators (TENGs). Along with human movements, TENGs can capture energy from common energy sources such as wind, wave, and machine vibration. A TENG is an energy harvesting device that uses the contact between two or more (hybrid, organic or inorganic) materials to produce an electric current. Researchers from the ATI have provided a step-by-step guide on how to construct the most efficient energy harvesters. The study introduces a "TENG power transfer equation" and "TENG impedance plots," tools which can help improve the design for power output of TENGs. Professor Ravi Silva, Director of the ATI, said: "A world where energy is free and renewable is a cause that we are extremely passionate about here at the ATI (and the University of Surrey) -- TENGs could play a major role in making this dream a reality. TENGs are ideal for powering wearables, internet of things devices and self-powered electronic applications. This research puts the ATI in a world leading position for designing optimized energy harvesters." Ishara Dharmasena, PhD student and lead scientist on the project, said: "I am extremely excited with this new study which redefines the way we understand energy harvesting. The new tools developed here will help researchers all over the world to exploit the true potential of triboelectric nanogenerators, and to design optimised energy harvesting units for custom applications."

The world is edging closer to a reality where smart devices are able to use their owners as an energy resource, say experts.

Science Daily, 28 September 2018

http://www.sciencedaily.com

Gossip

Spheres can make concrete leaner, greener

2018-10-02

Rice University scientists have developed micron-sized calcium silicate spheres that could lead to stronger and greener concrete, the world's most-used synthetic material. To Rice materials scientist Rouzbeh Shahsavari and graduate student Sung Hoon Hwang, the spheres represent building blocks that can be made at low cost and promise to mitigate the energy-intensive techniques now used to make cement, the most common binder in concrete. The researchers formed the spheres in a solution around nanoscale seeds of a common detergent-like surfactant. The spheres can be prompted to self-assemble into solids that are stronger, harder, more elastic and more durable than ubiquitous Portland cement. "Cement doesn't have the nicest structure," said Shahsavari, an assistant professor of materials science and nanoengineering. "Cement particles are amorphous and disorganised, which makes it a bit vulnerable to cracks. But with this material, we know what our limits are and we can channel polymers or other materials in between the spheres to control the structure from bottom to top and predict more accurately how it could fracture." He said the spheres are suitable for bone-tissue engineering, insulation, ceramic and composite applications as well as cement. The research appears in the American Chemical Society journal Langmuir. The work builds on a 2017 project by Shahsavari and Hwang to develop self-healing materials with porous, microscopic calcium silicate spheres. The new material is not porous, as a solid calcium silicate shell surrounds the surfactant seed. But like the earlier project, it was inspired by how nature coordinates interfaces between dissimilar materials, particularly in nacre (aka mother of pearl), the material of seashells. Nacre's strength is a result of alternating stiff inorganic and soft organic platelets. Because the spheres imitate that structure, they are considered biomimetic. The researchers discovered they could control the size of the spheres that range from 100 to 500 nanometres in diameter by manipulating surfactants, solutions, concentrations and temperatures during manufacture. That allows them to be tuned for applications, Shahsavari said. "These are very simple but universal building blocks, two key traits of many biomaterials," Shahsavari said. "They enable advanced functionalities in synthetic materials. Previously, there were attempts to make platelet or fibre building blocks for composites, but this works uses spheres to create strong, tough and adaptable biomimetic materials. "Sphere shapes are important because they are far easier to synthesize, self-assemble and scale up from chemistry and large-scale manufacturing standpoints." In tests, the researchers used two common surfactants to make spheres

Scientists have made micron-sized calcium silicate spheres that could lead to stronger and greener concrete, the world's most-used synthetic material.

and compressed their products into pellets for testing. They learned that DTAB-based pellets compacted best and were tougher, with a higher elastic modulus, than either CTAB pellets or common cement. They also showed high electrical resistance. Shahsavari said the size and shape of particles in general have a significant effect on the mechanical properties and durability of bulk materials like concrete. "It is very beneficial to have something you can control as opposed to a material that is random by nature," he said. "Further, one can mix spheres with different diameters to fill the gaps between the self-assembled structures, leading to higher packing densities and thus mechanical and durability properties." He said increasing the strength of cement allows manufacturers to use less concrete, decreasing not only weight but also the energy required to make it and the carbon emissions associated with cement's manufacture. Because spheres pack more efficiently than the ragged particles found in common cement, the resulting material will be more resistant to damaging ions from water and other contaminants and should require less maintenance and less-frequent replacement.

Science Daily, 26 September 2018

http://www.sciencedaily.com

Transforming carbon dioxide

2018-10-02

A new technique to increase the efficiency of carbon dioxide (CO2) electrolysis that may lead to the production of new chemicals and fuels.

A team of researchers at the University of Delaware's Centre for Catalytic Science and Technology (CCST) has discovered a novel two-step process to increase the efficiency of carbon dioxide (CO2) electrolysis, a chemical reaction driven by electrical currents that can aid in the production of valuable chemicals and fuels. The results of the team's study were published 20 August in Nature Catalysis. The research team, consisting of Feng Jiao, associate professor of chemical and biomolecular engineering, and graduate students Matthew Jouny and Wesley Luc, obtained their results by constructing a specialised three-chambered device called an electrolyser, which uses electricity to reduce CO2 into smaller molecules. Compared to fossil fuels, electricity is a much more affordable and environmentally-friendly method for driving chemical processes to produce commercial chemicals and fuels. These can include ethylene, which is used in the production of plastics, and ethanol, a valuable fuel additive. "This novel electrolysis technology provides a new route to achieve higher selectivities at incredible reaction rates, which is a major step towards commercial applications," said Jiao, who also serves as associate director of CCST. Whereas direct CO2 electrolysis is the standard

method for reducing carbon dioxide, Jiao's team broke the electrolysis process into two steps, reducing CO2 into carbon monoxide (CO) and then reducing the CO further into multi-carbon (C2+) products. This two-part approach, said Jiao, presents multiple advantages over the standard method. "By breaking the process into two steps, we've obtained a much higher selectivity towards multi-carbon products than in direct electrolysis," Jiao said. "The sequential reaction strategy could open up new ways to design more efficient processes for CO2 utilisation." Electrolysis is also driving Jiao's research with colleague Bingjun Xu, assistant professor of chemical and biomolecular engineering. In collaboration with researchers at Tianjin University in China, Jiao and Xu are designing a system that could reduce greenhouse gas emissions by using carbon-neutral solar electricity. "We hope this work will bring more attention to this promising technology for further research and development," Jiao said. "There are many technical challenges still be solved, but we are working on them!"

Science Daily, 25 September 2018

http://www.sciencedaily.com

Composite significantly reduces electromagnetic pollution

2018-10-02

In a paper published in NANO, a group of researchers from Anhui University of Science and Technology have synthesised PANI/Zn ferrite composites which have shown excellent microwave absorption performance.

In a paper published in NANO, a group of researchers from Anhui University of Science and Technology have synthesised PANI/Zn ferrite composites which have shown excellent microwave absorption performance. PANI/Zn ferrite composites were synthesised by a two-step hydrothermal and in-situ polymerisation method. Zn ferrite was used to adjust the impedance matching and improve PANI magnetic loss capability. The synergy of fluffy structure, dielectric loss, magnetic loss, interfacial polarisation and phase cancellation effect lead to the attenuation of microwave energy. Furthermore, the fluffy structure enhanced the microwave transmission path and attenuation efficiency. These factors make this composite a good microwave absorber and an ideal material in the electromagnetic wave absorption field. Microwave absorption materials with reflection loss (RL) values less than -10 dB represent that 90% of microwave was absorbed. The minimum RL values of this composite can reach -54.4 dB with coating thickness of 1.4 mm. The bandwidth about RL below -10 dB was 4.8 GHz at 1.6 mm. The excellent microwave absorption performance of PANI/Zn ferrite composites suggested that it can be used as an excellent absorber

with thin coating thickness, strong absorption and broad bandwidth. Microwave absorption materials have been studied by many workers to reduce or eliminate microwave pollution. Because of rapid popularity and development of electronic devices, especially mobile phones, computers and wireless routers, microwave pollution has been intensified in recent years. These materials have great potential applications in information security, healthcare, electronic countermeasures and so on. The functional materials of PANI/Fe ferrite with lightweight, thin coating thickness, high efficiency and broadband absorption properties are also easy to synthesize, which is beneficial to industrial mass production.

EurekAlert, 27 September 2018

http://www.eurekalert.org

Curiosities

Antifungal agent found to be possible treatment for porphyria

2018-10-03

A large team of researchers from Spain, France and the U.S. has found that a common antifungal agent might be useful as a treatment for a rare type of porphyria. In their paper published in the journal Science Translational Medicine, the group describes screening thousands of compounds for a treatment for congenital erythropoietic porphyria (CEP)—a rare type of the disease—and what they found. Porphyria is a name for a broad category of metabolic disorders that are characterised by errors in heme biosynthesis. Each type of the disorder results from a deficiency of a certain type of enzyme in the heme pathway, and each causes a different group of symptoms in the people who have it. One particularly rare type is CEP—it is caused by a deficiency in production of an enzyme called uroporphyrinogen III synthase (UROIIIS). That deficiency leads to a build-up of type 1 porphyrins. People who have it can experience symptoms such as sensitivity to sunlight, scaring, anaemia and an enlarged spleen. As with other types of porphyria, there is no cure and treatments for it typically are palliative—patients are told to stay out of the sun, avoid skin irritants, etc. In this new effort, the researchers report that they believe they may have found a treatment for CEP that reduces symptoms. The work by the team involved poring over thousands of compounds looking for a material that would interact with UROIIIS and then testing those they found. They report finding one such candidate, called ciclopirox, that was able to bind to the enzyme. Ciclopirox is a synthetic antimicrobial that is currently used as an antifungal agent to treat skin disorders. Encouraged by their findings, the team began testing the therapeutic value of ciclopirox using CEP mouse models. They report that use of the agent in such models resulted in mice exhibiting normal levels of UROIIIS. They also found that its use resulted in lowered levels of porphyrin in red blood cells, urine and in the liver. It also led to an increase in a heme precursor, reductions in enlarged spleens and natural repair of tissues damaged by CEP. The next step for the team will be looking into whether it would be safe to use ciclopirox continuously for treatment of CEP, followed by clinical trials.

A large team of researchers from Spain, France and the U.S. has found that a common antifungal agent might be useful as a treatment for a rare type of porphyria.

Medical Xpress, 24 September 2018

http://medicalxpress.com

Curiosities

Why Doesn't Your Vision 'Go Dark' When You Blink?

2018-10-03

There's a saying that goes, "Blink and you'll miss it." But generally, we don't miss a thing when we blink; in fact, we don't even notice when we're doing it. Indeed, even though adults blink about 15 times per minute, on average, our vision appears seamless and uninterrupted. But how does that work, exactly? Experts have proposed that the brain fills in these gaps, maintaining a "snapshot" that bridges the brief moments during blinks when visual input is paused. But those explanations limited this activity to certain areas in the brain; namely, the sensory areas found in the back. But researchers have recently questioned if other brain regions were involved as well, and they found one — in the front of the brain. In a new, small study, published online today (Sept. 24) in the journal Current Biology, scientists found that the prefrontal cortex, a brain region involved in decision making and short-term memory, links what we see between blinks or other interruptions of our vision. In this way, the prefrontal cortex plays a pivotal role in perceptual memory, a type of long-term memory that stores sensory input. In previous research, the study authors examined brain activity using magnetic resonance imaging (MRI), and found several brain regions — including the prefrontal cortex — that were active during the formation of perceptual memory, lead study author Caspar Schwiedrzik, a neuroscientist at the German Primate Centre and the University Medical Centre Göttingen in Germany, told Live Science in an email. When they compared results across multiple subjects, activity in the prefrontal cortex was the most consistent — and the most promising as a factor in perceptual memory, Schwiedrzik said. In the new study, the researchers set out to replicate their MRI results, and did so "with a more direct, electrophysiological technique," he said. Specifically, they measured brain activity in six people with epilepsy who had electrodes implanted in their brains to treat the condition; this allowed the scientists to directly record the subjects' brain activity, according to the study. In a graphical representation of the human brain, the medial prefrontal cortex is highlighted in green, showing the places where brain activity was measured.

Scientists have shed light on why vision is uninterrupted by blinking.

Which way is up?

When a person blinks, whatever they're looking at is retained by the brain, then visually connected to what they see when the eyelid lifts again. For the study, scientists devised an experiment that would demonstrate a similar visual connection between two images. At the same time, the electrodes would show them which brain areas were firing while this visual

interpretation was taking place. In the experiment, researchers showed the study participants patterns whose orientation could be interpreted in different ways, such as vertical or horizontal. The participants looked at patterns in pairs — one after the other — and picked the orientation of the two images. During this activity, the scientists recorded brain activity in the prefrontal cortex. They noted that perceptual memory was being activated if the orientation selected for the second image matched the orientation of the first image; this hinted that the sight of the first pattern influenced how the subjects saw the second one. Activity in the prefrontal cortex during these experiments told them that this brain region is involved when perceptual memory is underway, the study authors reported. What's more, they also found that one subject who was missing part of her prefrontal cortex due to an earlier surgery, was unable to store information to form perceptual memories in the experiments, suggesting that the prefrontal cortex is necessary for this type of memory to function at all. These findings demonstrate that the prefrontal cortex actively "calibrates" new input with earlier visual data, "and thus enables us to perceive the world with more stability — even when we briefly close our eyes to blink," Schwiedrzik said in a statement.

Live Science, 24 September 2018

http://www.livescience.com

You are never alone: With every step you take, a bubble of particles follows.

Your Personal Bubble Isn't Empty Space, It's Actually Teeming with Tiny Guests

2018-10-03

Microbes, chemicals, fungi, microscopic animals and other little biological crumbs constantly move around us and form what's called an "exposome" — or everything we're exposed to in the moment. Researchers recently conducted a personal-bubble census by using a small air-monitoring device. They found that one person's exposome could be vastly different from another's, even if they live close to one another. They reported their findings online in the journal Cell. "Human health is influenced by two things: your DNA and the environment," senior author Michael Snyder, professor and chair of genetics at Stanford University, said in a statement. "People have measured things like air pollution on a broad scale, but no one has really measured biological and chemical exposures at a personal level." "No one really knows how vast the human exposome is or what kinds of things are in there," he added. The researchers recruited 15 participants to wear a small device strapped to their arm wherever they went. Some wore it for a month, some for a week, and one — Snyder

himself — wore it for two years. The device acts like a vacuum, trapping particles directly from a person's surrounding. As participants travelled around, the device captured data from over 66 different locations. The researchers then analysed the DNA and RNA from the captured particles and did chemical profiling to identify what sorts of microbial and fungal guests the participants had been hosting. They created a database of over 40,000 species to cover the extent of environmental exposures they found — capturing moments participants spent with pets, around household chemicals and walking near flowers. They found over 2,500 different species that surrounded the participants. And "it turns out, even at very close distances, we have very different exposure profiles or 'signatures,'" Snyder said. In one portion of the study, four participants, including Snyder, wore the device for a month — but each participant lived in different region of the San Francisco Bay Area. One participant had high levels of "sludge bacteria" that are typically found in wastewater or sewage treatments, according to the statement. Snyder himself consistently had "fungal" particles around him, which he suspects could be due to the use of an environmentally friendly paint in his house, which lacks a certain substance that combats fungi, according to the statement. Because Snyder wore the device for two years, he had the most data among the participants — his device recorded traces of his pet exposures and traces of eucalyptus trees in the spring, for example. One use of the device could be monitoring what a person is exposed to throughout the year to figure out what exactly someone is allergic to, according to the statement. The researchers did find that sometimes our personal bubbles are occupied by similar particles. Traces of DEET, the insect repellent, and some carcinogens such as diethylene glycol (DEG) were frequently found around the participants, according to the statement. Though the device picked up disease-causing microbes, it's difficult to differentiate between the dangerous ones and similar ones that aren't harmful, Snyder said. As for carcinogens, he said the device measures individual instances of exposure, not absolute levels that people have been exposed through across their lifetime. But since these chemicals could fit through the holes of the filter, they could also potentially reach the lower respiratory tract and interact with the lungs, according to the paper. By revealing more and more of our exposomes, Snyder wants to understand how all these little invisible particles influence our health. He also hopes to simplify the device such that "everyone can be out there measuring their own personal

exposures — perhaps [with] something like an exposome-detecting smartwatch."

Live Science, 20 September 2018

http://www.livescience.com

Water Droplets Don't Just Hover on a Hot Pan. They Roll.

2018-10-03

Drip water on a hot pan, and the droplets will skitter around the pan, speeding like tiny mad hovercraft on cushions of steam. This is the Leidenfrost effect, which you've probably experienced while cooking. Johann Gottlob Leidenfrost, a German doctor and theologian, described the phenomenon in 1756 in a book about the properties of water. But French scientists have now figured out something new about those skittering drops. When they are small enough — about a millimetre in diameter — the roiling of heat in the liquid will cause the droplet to tilt and rotate. That, in turn, propels the droplet to roll. It was already known that the droplets, levitating on top of a layer of vapor, move easily, but the presumption was that they were sliding down a slope or pushed by air currents. The new research shows that they can move all by themselves. "It's embarrassingly simple," David Quéré, a scientist at the École Polytechnique and ESPCI Paris, said of the discovery. "The drop is running away," he said. "It has a little motor inside, which is surprising. From this view, it's amazingly different from usual drops, which, of course, stay where you place them." Dr. Quéré and his colleagues described the research in the journal Nature Physics.

Physicists took a deeper look at the Leidenfrost effect, which you've likely experienced when you've dripped water into a pan to test its temperature.

New York Times, 14 September 2018

http://www.nytimes.com/

How Long Do I Retain Immunity?

2018-10-03

Q. Having had all the common childhood illnesses, such as measles and mumps, 70-plus years ago, how much immunity do I still retain?

A. You are probably immune to some of these illnesses.

But it is difficult to be definitive about the duration of immunity, because definitive studies, known as challenge studies, are rarely conducted. In a challenge study, subjects are intentionally exposed to an infection to which they are thought to be immune. The subjects prove they are

immune by not getting sick. Challenge studies have been conducted for some respiratory viruses, such as influenza and the common cold. But for ethical and safety reasons, challenge studies cannot be conducted for more serious infections, such as meningitis, pneumonia and polio. In the absence of challenge studies, doctors rely on antibody levels as a surrogate marker of immunity. In 2007, doctors at the University of Oregon conducted what may be the best study of antibody levels to common infections. They followed 45 subjects for as long as 26 years, measuring their antibody levels to eight common pathogens: measles, mumps, rubella, Epstein-Barr virus, varicella zoster virus (chickenpox), diphtheria, tetanus and vaccinia (the cowpox virus that eradicated smallpox). The results were remarkable. Antibody half-life — the time required for antibody levels to decrease by 50 percent — was 50 years for varicella zoster virus and, they estimated, more than 200 years for measles and mumps. The half-lives of tetanus and diphtheria were much shorter, 11 years and 19 years, respectively. That's why, for example, it's recommended you get a booster tetanus shot every 10 years. An important caveat about these data is that immunity from natural infection may last longer than immunity from vaccination. As an example, individuals born before 1957, who grew up in a time when measles was "as inevitable as death and taxes," may have more durable protection against measles than those who were born later and got the measles vaccine, which became widely available starting in 1963. This hypothesis is supported by recent outbreaks of mumps. More than 6,000 cases of mumps were reported in the United States in 2016. Most occurred in young people who had been vaccinated as opposed to older people who were born before the introduction of mumps vaccine in 1967. The Advisory Committee on Immunisation Practices, part of the Centres for Disease Control and Prevention, provides comprehensive updates of its recommendations on immunizations, including needed booster vaccines, every year in January.

New York Times, 21 September 2018

http://www.nytimes.com/

A group of industrial chemicals humans started banning decades ago could cause many of the world's orca whale populations to collapse over the next century, an alarming new study has found.

Mass Die-Off Of Orcas Feared Due To Chemicals Banned In The '70s

2018-10-03

A group of industrial chemicals humans started banning decades ago could cause many of the world's orca whale populations to collapse over the next century, an alarming new study has found. Polychlorinated biphenyls, better known as PCBs, are manmade compounds once

used in a range of applications from electrical appliances to household paints. They were widely banned in the 1970s and 1980s after extensive contamination of humans and the environment was uncovered. Research has since linked the chemicals to endocrine and immune system disruption and reproductive failure in vertebrates — a legacy that continues to ripple through the biosphere thanks to PCBs' longevity and their knack for accumulating up the food chain. Nowhere is this more evident than in orca whales, apex predators that have the unfortunate tendency to hoard industrial pollutants in their blubber. PCB concentrations above 50 milligrams per kilogram of tissue are a health concern for marine mammals, yet in some orca populations numbers in the hundreds are more common. Mother whales pass the chemicals to their babies in the placenta and in their milk, transferring the toxic heritage from generation to generation. Despite all this, nobody had systematically investigated what PCBs could mean for orca whales' futures. The new study, published in Science, did just that, and the results aren't pretty: Out of 19 populations examined, 10 appear to be at "high risk of collapse" over the next 100 years due to PCB exposure alone. "It really was quite shocking to all of us," lead study author Jean-Pierre Desforges, a biologist at Aarhus University, told Gizmodo. To arrive at their depressing conclusion, Desforges and his colleagues built a global database of PCB concentrations in orca whale blubber, and used prior studies of how PCBs impact reproduction and immune deficiency in whales (they used data on minke whales for reproductive effects, owing to a lack of data from orcas). This was all fed into models to look at the accumulation and loss of PCBs in the 19 populations over the next 100 years, and to project population-level trends. Not surprisingly, orcas living near highly industrialised areas where PCBs have leached into soil and waterways tended to be most contaminated and have a grimmer future outlook. But diet also plays an important role, as illustrated by the fact that whale populations dining primarily on marine mammals tended to have much higher PCB exposure than neighbouring populations that preferred a lower food chain, fish-based diet. Five populations — the Northeast Pacific Bigg's whales, orcas in the Strait of Gibraltar, and those in waters off Japan, Brazil, and the United Kingdom — "tend[ed] towards complete collapse" in the researchers' models. Five more groups were also projected to decline over the next century thanks to PCBs, to say nothing of other stressors from noise pollution to overfishing. Marine ecologist Olivia Lee of the University of Alaska, Fairbanks, said the study's models offered "a sobering potential case of disaster for orcas in a world of persistent PCBs." She did point out a few caveats, including the fact that the authors chose to keep the effect of PCBs on calves the same from generation to generation, something

which "really helped drive population trends downwards." "I don't think this is a bad approach, but it leaves no scenarios for adaptation in the 100-year simulation," Lee said. Desforges also said that prey switching, which can happen when one food source becomes more or less abundant, could alter whales' exposure into the future. If rapid Arctic warming drives more whales north, for instance, that could affect their diets with untold impacts on PCB exposure. Nothing is set in stone, but the findings certainly underscore the need to rid the world of these chemicals for good. The Stockholm Convention, an international treaty to reduce and eliminate persistent organic pollutants like PCBs, went into effect back in 2004. But the treaty doesn't compel nations to stop using PCB-laden equipment until 2025, and globally, an estimated 80 per cent of old PCBs have yet to be destroyed via incineration, waste-kilns, or one of many chemical decontamination methods. The pervasive use of these chemicals in paints and sealants in the 1950s and 1960s means lots of old buildings remain contaminated, too. "In reality, countries aren't really getting rid of equipment as fast as they should be," Desforges said. "We're trying to make sure people understand this crisis isn't over."

Gizmodo, 30 September 2018

http://gizmodo.com

Children Who Get Less Screen Time Think Better, Study Finds

2018-10-03

Keeping your kid's mind sharp might involve making sure they don't spend all day on their smartphone or other screen devices, suggests yet more research published recently.

Keeping your kid's mind sharp might involve making sure they don't spend all day on their smartphone or other screen devices, suggests yet more research published recently. Canadian researchers looked at the first bits of data from a 10-year-long US project meant to study how children's brains develop over time, called the Adolescent Brain Cognitive Development study (or more cleverly, the ABCD study). As part of the project, funded by the National Institutes of Health, researchers across the US interviewed children and their parents about their lifestyle habits. That included how much time they spent exercising, sleeping and watching screens on an average day. The children also took questionnaires, provided spit samples, and completed puzzles that measured their cognitive functions. The current study looked at the results from 4524 children from the ages of eight to 11 who took part in the ABCD study from September 2016 to 2017. In Canada, as well as the US, doctors generally recommend that kids over the age of six spend no more than two hours watching screens a day. But only 37 per cent of children in the study met this

criterion. And these children, the researchers found, were more likely to score better on their cognitive tests. The findings were published in Lancet Child & Adolescent Health. "We need to pay attention to how long we are on the screens for," lead author Jeremy Walsh, a postdoctoral fellow at the University of British Columbia, told The Washington Post. "This study is showing that less than two hours of recreational screen time is beneficial for children." Screen time wasn't the only possible reason for children's worse thinking skills. Only 50 per cent of the group reported getting the nine to 11 hours of sleep recommended by doctors, while just 18 per cent got the recommended amount of exercise, at least 60 minutes a day. And children who didn't meet these guidelines also performed worse on average. The study is also only observational, meaning it can't prove a direct link between more screen time and poorer thinking. But compared to children who didn't meet any of the three guidelines, the researchers found, children with less screen time performed better on these same tests. A similar pattern was seen with children who both got enough sleep and less screen time, further supporting a link between poor sleep and screens. According to the researchers, more studies need to be done to confirm if and how exactly too much screen time can hurt children's cognition. Elsewhere, the American Academy of Paediatrics has stopped focusing on a hard guideline of a maximum two hours a day of screen time for children over the age of six, instead calling for "consistent limits" set by parents that make sure children are spending enough time on sleep and other healthy behaviours. For children between 18 months and age six, however, the AAP still recommends no more than an hour of screen time, while children younger should get none at all. But some studies have suggested that the potential for damage is more about the type of content on these screens and whether parents are involved than about the amount of time using them. The ABCD study plans to enrol more than 10,000 children by the time it's over.

Gizmodo, 30 September 2018

http://gizmodo.com

Your Environment Could Be Changing Your IQ on a Genetic Level, Study Finds

2018-10-03

The nature-versus-nurture argument of intelligence just got a lot more complicated with the discovery that the environment can modify the expression of a key gene in the brain, affecting intelligence far more than we previously thought. Such a finding may not come as a surprise

The nature-versus-nurture argument of intelligence just got a lot more complicated with the discovery that the environment can modify the expression of a key gene in the brain, affecting intelligence far more than we previously thought.

if you remember that numerous genes influence our IQ and stressful experiences can lock and unlock genes in our brains. Yet having hard evidence of the link will no doubt stir debate on just what it means to be "smart". Researchers from the Charité - Universitätsmedizin Berlin analysed the characteristics of a number of genes among a group of healthy adolescents, and compared the results with intelligence scores and various neurological traits. Ideally, the team would have cast a wide net and looked at the whole genome. But with barely 1,500 subjects in their sample, they had to pull their focus in on a smaller handful of genes that deal with reward anticipation in the decision-making part of ours brains, the corpus striatum. The researchers found a strong relationship between the epigenetic modifications of one particular gene and general IQ, suggesting our experiences not only affect the wiring of our brain, but the very way our genes function at a basic level. Epigenetics has become big news in genetics in recent years, as it allows us to explore the fascinating link between genetic functions and environmental change. For example, in times of high stress, such as a persistent threat of violence or poor nutrition, physiological changes in the organism can tweak your genes by adding or removing a chemical group that effectively locks them down or opens them up. These edits can also go the other way. It's possible that showing infants ample affection, such as frequent cuddles, just might modify the expression of their genes in the same way. In turn, such changes can subtly influence a range of characteristics that can have drastic knock-on effects, altering the course of everything from how your immune system functions to how much you earn. In this case, the team discovered that where a gene named DRD2 had an epigenetic lock attached, IQ rates fell. The gene is usually responsible for building part of a receptor for the neurotransmitter dopamine. Inheriting a broken or mutated version is usually bad news, leading to various neurological and muscular disorders. But if modified in isolated spots of the brain, such as the striatum, it could have less profound effects, limiting communication involved with planning and motivation. The researchers found further evidence for this potential link - tissue in this area of the brains of individuals with modified DRD2 wasn't quite as dense as for people without this epigenetic tweak. While the changes are there, it's impossible to say exactly what made them happen in the first place. Stress during childhood is known to affect cognition later, though how much comes down to neurological changes and how much might be epigenetic will be a challenge to tease apart. It's a stretch to say any single epigenetic change destines us to a life of wealth, illness, or – in this case – intellectual superiority; but small nudges could have some far-reaching effects. Unlike other environmental influences, epigenetic changes in the right tissues

can hypothetically be passed onto future generations. "Environmentally-induced gene activity now joins the ranks of other factors known to influence IQ test performance, such as poverty and genetic constitution," says the study's first author, Jakob Kaminski. "In this study, we were able to observe how individual differences in IQ test results are linked to both epigenetic changes and differences in brain activity which are under environmental influences." Intelligence testing and controversy have long gone hand-in-hand, often with valid reason. Questionable tools, inappropriate interpretations, and its role in racial vilification have left us with a bad taste in our mouth when it comes to asking if human intelligence is inherited, moulded by upbringing, or the result of effort and diligence. It's clearly a complicated topic, but as the evidence piles up, we're developing a clearer picture of the ways our brains work to learn and solve problems. This research was published in Translational Psychiatry.

Science Alert, 1 October 2018

http://www.sciencealert.com.au

Heart disease common among firefighters who die of cardiac arrest

2018-10-03

Most firefighters who die from cardiac arrest turn out to have narrowing of the heart arteries or structural damage in their hearts, a recent study suggests. When firefighters become suddenly incapacitated on the job, it endangers their lives. It may also put other lives at risk as they work to rescue people from burning buildings or douse flames before they spread, researchers note in the Journal of the American Heart Association. Despite this obvious risk, research to date hasn't offered a clear picture of why so many firefighters killed on the job die of cardiac arrest rather than from fire-related injuries. "Fire service statistics had long indicated that sudden cardiac events were a leading cause of line of duty death among firefighters," said study leader Denise Smith. Research shows that firefighters are more likely to suffer a cardiac event after fire-fighting versus station duties, added Smith, who directs the First Responder Health and Safety Lab at Skidmore College in Saratoga Springs, New York. To see why these heart-related deaths occur, researchers examined autopsy data from 627 male firefighters, ages 18 to 65, who died between 1999 and 2014, including 276 cardiac cases and 351 trauma cases. Surprisingly, less than one in five cardiac cases were heart attack deaths, Smith said by email. Instead, 82 percent of those who died had evidence of coronary heart disease - narrowing of the heart arteries - or enlarged hearts. Having

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an enlarged heart or evidence of a prior heart attack were each tied to a six-fold increase in risk of sudden cardiac death, the study found, while having a coronary artery that was 75 percent narrowed was tied to a nine-fold rise in risk. While the study can't prove whether or how working as a firefighter might make heart disease more likely, several aspects of the job could explain the connection, Smith said. Exposure to smoke, soot and chemicals in the air, as well as disrupted sleep patterns and high levels of occupational stress might all contribute to heart problems, Smith noted. It's not clear whether firefighters' risk of heart disease, is higher or lower than other people in different lines of work. "However, the research clearly shows that the stress of firefighting - the heavy muscular work, heat stress, sympathetic nervous system activation, and exposure to smoke - can trigger a cardiac event in individuals with underlying disease," Smith said. One limitation of the study is that the autopsies didn't have uniform descriptions of heart disease or criteria for defining an enlarged heart, the authors note. Researchers also lacked data on certain risk factors for heart disease like smoking or high blood pressure. Still, the results offer fresh evidence of the dangers of high-stress, physically demanding jobs for people with underlying heart disease, noted Dr. Stefanos Kales, a researcher at Harvard Medical School and the Harvard TH Chan School of Public Health in Boston who wasn't involved in the study. "In essence, for persons who have developed underlying heart disease, it is dangerous to perform heavy work, especially in stressful situations that produce a surge of adrenaline and related hormones that challenge the cardiovascular system through a variety of mechanisms," Kales said by email. "Therefore, while firefighter screening has traditionally focused on coronary artery disease (cardiac risk factors and stress tests), it should also include imaging such as an echocardiogram to identify possible heart enlargement, increased wall thickness or the presence of an old heart attack," Kales said.

Reuters Health, 29 September 2018

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

Heavy drinkers and teetotalers alike may have heightened dementia risk

2018-10-03

Middle-aged adults who avoid alcohol altogether, and those who consume the equivalent of seven glasses of wine or more a week are both more likely than light drinkers to develop dementia in their later years, a long-term study suggests.

Middle-aged adults who avoid alcohol altogether, and those who consume the equivalent of seven glasses of wine or more a week are both more likely than light drinkers to develop dementia in their later years, a long-term study suggests. With heavy drinking, the increased risk of dementia may be directly caused by nutritional deficits and the toxic

effects of alcohol in the brain, and indirectly caused by disorders that are common among heavy drinkers like diabetes, high blood pressure and stroke, said lead study author Severine Sabia of Paris-Saclay University in France and University College London in the UK. Abstinence is also associated with a higher likelihood of having heart disease or diabetes, which explains part of the increased dementia risk for teetotalers, the study found. Abstinence may also be tied to dementia in people who stopped drinking due to misuse or addiction, Sabia said by email. "Findings on abstainers should not motivate people who do not drink to start drinking alcohol due to the adverse effects of alcohol on mortality, cirrhosis of the liver and cancer," Sabia noted. "In addition, given the detrimental effect of alcohol for several health outcomes, people who drink in an excessive manner should be encouraged to reduce their alcohol consumption." Globally, an estimated 3.3 million people a year die as a result of alcohol misuse, accounting for about 6 percent of all deaths, according to the World Health Organization (WHO). For the study, Sabia's team used a standard UK measurement, units of alcohol, where each unit contains 8 grams of pure alcohol. So, a medium glass of wine (175 ml or about 6 oz) would contain about 2 units of alcohol, half an imperial pint (9.6 fluid ounces) of beer would contain 1 to 3 units of alcohol, depending on its strength, and a standard measure (25 ml or about 1 oz) of spirits would equal one unit of alcohol. The researchers followed 9,087 adults participating in a long-term study in the UK for an average of 23 years with five assessments of alcohol consumption between 1985 and 2004. They also looked at data from questionnaires to assess problem drinking and at medical records of alcohol-related diseases between 1991 and 2017. During the study, 397 people developed dementia, at an average age of 76, the study team reports in The BMJ. Compared with people who had 1 to 14 units of alcohol a week in middle age, teetotalers were 47 percent more likely to develop dementia. Among people having more than 14 units a week, each 7-unit increase in alcohol consumption was associated with a 17 percent increase in the risk of dementia. The study also looked at how any shifts in drinking patterns after middle age might impact the risk of dementia, and they found the lowest risk among people who consistently consumed 1 to 14 units of alcohol a week. Compared to these consistent light-to-moderate drinkers, people who maintained long-term abstinence were 74 percent more likely to develop dementia. Those who kept up a heavy drinking habit were 40 percent more likely to develop dementia. When people cut back after middle age, they were 55 percent more likely than the consistent occasional or moderate drinkers to develop dementia. The study wasn't designed to prove whether or how drinking habits might impact the development of dementia. However, the results

suggest that guidelines in many countries that set the bar for problem drinking at much higher than 14 units a week may need to be revised to account for the potential dementia risk, the study authors conclude. "The study provides important support for another downside to heavy alcohol use," said Dr. Rebecca Gottesman of Johns Hopkins University School of Medicine in Baltimore. "Regarding the other end of the spectrum, several other studies have suggested that very modest alcohol consumption may be protective from cardiovascular disease, and this study further supports that idea, but I don't think we understand enough about how it might do so," Gottesman, who wasn't involved in the study, said by email.

Reuters Health, 26 September 2018

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

Zapping your guts with electricity can help relieve constipation

2018-10-03

Constipation is an uncomfortable and often painful condition that affects up to 15 per cent of the population. Eating fibre, exercising and taking laxatives can help, but some people find that nothing works. Judith Moore at Monash University in Melbourne, Australia, and her colleagues recently tested a new constipation treatment designed to increase bowel motions by stimulating nerves in the gut. They asked 33 women aged 18 to 75 with chronic constipation to use an electrical stimulation device at home for one hour a day for 6 weeks. The device works by sending two medium-frequency electric currents diagonally through the torso via two electrodes stuck to the abdomen and two to the back. As the currents cross internally, they interfere with each other and generate a low-frequency electric current that is optimal for stimulating nerve cells in the gut. Half the participants were assigned to the active treatment and half to a sham treatment, in which the electric currents were directed in parallel so that they were unable to cross over and create the therapeutic current.

Researchers recently tested a new constipation treatment designed to increase bowel motions by stimulating nerves in the gut.

Getting things moving

By the end of the 6 weeks, 58 per cent of participants in the active electrical stimulation group were able to pass more than two spontaneous bowel movements per week, compared to 18 per cent in the sham group. The active intervention group also reported less dependence on laxatives and improved quality of life. These benefits persisted for at least 3 months after they stopped using the device. Some of the participants found

the procedure time-consuming, but they didn't experience any pain or serious side-effects. "It just feels like a mild tingly, buzzing sensation," says Moore, who presented the findings at the annual scientific meeting of the Gastroenterological Society of Australia earlier this month. The researchers are now hoping to confirm the effectiveness of the device in larger groups of patients.

New Scientist, 21 September 2018

http://www.newscientist.com/

Could we be facing a 'chocapocalypse'?

2018-10-03

Global chocolate market value keeps reaching new highs, potentially doubling by 2025 compared to its 2015 level. Consumption is mainly driven by perceived health benefits such as anti-aging, antioxidant effects, stress relieve, blood pressure regulation and others. So where are the biggest chocoholics located? Traditionally, more than half of all chocolate produced is eaten in Western Europe and North America. The country with the "sweetest tooth" in the world is Switzerland, with more than 8kg per capita of chocolate consumed in 2017.

No more chocolate by 2050? Several articles have pointed recently that we are heading to a major chocolate crisis.

New chocolate markets

But even though developed markets are at the forefront of chocolate indulgence, future growth opportunities could be elsewhere. One way to look is toward China and India, with populations over one billion people each. Rapid urbanisation, a growing middle class and changing consumer tastes have triggered increasing appetite for chocolate. Rapid urbanisation, a growing middle class and changing consumer tastes have triggered increasing appetite for chocolate. India is currently one of the fastest-growing chocolate markets, with demand steadily rising over the past years. In 2016, over 228,000 tonnes were consumed, an increase of 50% in comparison to 2011. Indians have a fling for anything sweet and chocolate has become one of their favourite treats as some perceive it as healthy and do not hesitate when it comes to snacking. As for China, in the wake of economic reforms in early 1980, chocolate was considered as a rare delicacy. Since then, the country has lagged behind others in chocolate consumption, with less than 1kg consumed per year by an average Chinese consumer. But things are changing as new trends like "coffee culture" emerge, affecting ways chocolate is used and consumed. Also, millions of affluent Chinese shop online for high quality foreign

delicacies, pushing retailers such as Alibaba to rethink their business models in order to stay on top of their game.

Endangered chocolate production

Yet chocolate producers are struggling. Cocoa, the delicate plant behind chocolate needs humid tropical climates and shades of rainforests, which limits areas where you can grow it. Leading regions are found in West Africa, with Ivory Coast and Ghana alone contributing to more than 50% of the entire world's production. However, as a result of global warming, cocoa cultivation in these areas is expected to literally move uphill to maintain optimal growing conditions. The challenge remains in the limited areas of land available, as many of these locations are currently banned from cultivation or might not be suitable for it.

Contagion and alternative products

Enemies of cocoa trees come in different shapes and sizes, two being disease and pests. Estimates indicate that these nuisances cause yearly losses of 30% to 40% of the total global cocoa production. In June of this year, Ivory Coast announced it will have to take out an entire cocoa plantation of 100,000 hectares contaminated by swollen-shoot plant virus to stop it from spreading further. It will take at least five years before the area can be it replanted again. As a result of "natural" hazards coupled with price fluctuations, cocoa farmers consider switching to alternatives potentially more profitable and easier to produce. Indonesia, the world's third largest cocoa producer, experienced declining cocoa output since 2010 due to poor weather and ageing cocoa trees. Consequently, some farmers shifted production to crops such as corn, rubber or palm oil.

Producers look east and south

These general threats and high demands from new markets send a clear signal to major cocoa producers. Ghana, world's second largest cocoa supplier, has its eyes on Asia and specifically China as the next "big thing". To boost its yearly cocoa production, Ghana is trying to secure a $1.5 billion loan from Chinese Eximbank. Collaboration is backed by governments of both countries as mutual interest is obvious, reflected in the potential the Chinese chocolate market. The United Arab Emirates and Saudi Arabia are leaders in chocolate spend per person, well above the regional average. Other "hot" destinations are found across the Middle East and Africa. The United Arab Emirates and Saudi Arabia are leaders in chocolate spend per person, well above the regional average. Consumers in these markets perceive chocolate as a wealth symbol,

driving demand for premium brands. Chocolate confectionery in Algeria has a healthy performance as well, driven by different rationale. According to Euromonitor, Algerians consider chocolate to be an energy booster, making individual consumption thrive, particularly among the youth, while it is less present in gift giving.

Is sustainable chocolate real?

The largest chocolate producers take active part in sustainability initiatives such as Rainforest Alliance, UTZ and Fairtrade. US-based Mars Wrigley Confectionary, leading global sweets maker by net sales in 2017, dedicated $1 billion of funding to help create more heat-resistant cocoa. Moreover, in 2009 Mars was the first major chocolate company to commit to 100% certified cocoa by 2020, followed later by its competitors Hershey's, Ferrero and Lindt. Mondelez International wants all of its cocoa sustainable as well. Milka is the latest one of its brands to join Cocoa Life, launched in 2012, aiming to empower cocoa farmers. A UTZ-certified cocoa farmer will only earn approximately 16% more in comparison to the non-certified one. While these initiatives are a great leap forward, main supply-chain stakeholders admit that they're not sufficient to bring cocoa farmers out of poverty, which is one of the major problems they face. An example is Ivory Coast, a primary cocoa producing country. A UTZ-certified cocoa farmer will only earn additional yearly income of 84-134 euros ($99-$158) – approximately 16% more in comparison to the non-certified one. Other constraints emerge, such as limited reach of certification. Farmers should be members of cooperatives to benefit fully from the process. In the case of Ivory Coast, only around 30% of them are currently in cooperatives. Another difficulty is to ensure that no child labour is used over the entire supply chain – something that's basically impossible to control. Local cocoa producers in Africa have plans of their own, with an announced OPEC-like initiative. They want to have more influence over global cocoa prices by better coordinating production levels and sales policies between countries. This could better protect small cocoa farmers who are vulnerable to price swings in global market. While claims of a looming "chocapocalypse" might be overblown for the time being, risks are real and we need to be mindful of them. It is optimistic to see that main stakeholders in the process of chocolate manufacture are pitching in with their own contribution. Whether it will be enough to secure the future of chocolate remains to be seen.

BBC News, 26 September 2018

http://news.bbc.co.uk

Curiosities

EpiPen users told they can use some devices past normal expiry date

2018-10-03

The medicines regulator said it had agreed to extend the use-by date of some 0.3mg EpiPens by four months. It comes as parents told the BBC their children's supplies were due to expire in a few days, and they had been unable to get replacements. The government says it is working with EpiPen's makers to resolve the issue. EpiPens are the most common adrenaline auto-injectors (AAIs) and are prescribed to people with potentially serious allergies, such as to nuts, milk, fish, shellfish, eggs and some fruits. People are recommended to keep two of the devices with them at all times for cases of anaphylaxis - a severe and sometimes life-threatening reaction often caused by allergies - as one is not always enough. They can only be used once and usually have an expiry date that lasts for a minimum of 12 months. There have been shortages of EpiPens in the UK and other countries for months. There has also been a shortage of the alternative AAIs prescribed in the UK - Jext and Emerade - amid a surge in demand for them. In response to the shortages, the Medicines and Healthcare Products Regulatory Agency (MHRA) said it had agreed to a request by Mylan, the company behind EpiPen, to extend the expiry date of some batches of the 0.3mg version of the device. The MHRA said it made the decision after it was given evidence that showed the shelf life of the 0.3mg pen was 20 months from the date it was manufactured. It said the devices would work "just as effectively" during the extended expiry period. But the extension does not apply to the 0.15mg version, given to children under 30kg. EpiPens should not be used if the solution is discoloured, brown, there are solid particles, or signs of leakage or damage. Other AAIs should never be used after their expiry date without first checking with your medical practitioner.

People with severe allergies have been told they can use their EpiPens past their normal expiry date, amid a continuing shortage of the devices.

'At my wits' end'

Lynne Riles said she had been trying to get an EpiPen prescription for her seven-year-old daughter for the past six weeks. "The pens we have now expire at the end of September, and I just feel at my wits' end." Sal Smith said her four-year-old's EpiPens were also due to expire at the end of the month, after she had tried for four weeks to get more. "Still no sign of them... I'm getting worried now." Mylan has no stock of the 0.15mg pens left, the Department of Health and Social Care said in guidance to healthcare professionals. More of these pens are due in October but this is not expected to meet normal demand, the department said. Emma Cummings, whose 10-year-old son Loui has severe allergies, said if supply

problems continued and she had no AAIs left that were in date, she would be forced to keep her son indoors, as he is at risk from airborne allergens. "Loui wouldn't be allowed out of the four walls of our own house, where I can categorically state that there is nothing in the house to trigger any allergies for him. "That will restrict his education, his after-school activities, but you would. "Parents such as ourselves, with a childlike Loui, would have no choice." The DHSC guidance said that if people were left with nothing but expired AAIs they should keep them - until they get replacements - and be prepared to use them. While AAIs lose their potency and become less effective after their expiry date, they are not harmful, and it is better to use an expired AAI than none at all, it said. It said at present it was believed that "careful management" of existing supplies would prevent the need for using expired pens. Health minister Lord O'Shaughnessy told the BBC: "We are doing everything we can to ensure patients continue to access the medications they need, and we have issued detailed guidance to healthcare professionals." Mylan said Pfizer (which manufactures the drug) was "working hard" to increase production, and supply would stabilise between October and December this year.

BBC News, 29 September 2018

http://news.bbc.co.uk

Yoghurts (even organic ones) 'full of sugar'

2018-10-03

Many yoghurts are full of sugar and the public should not be lulled into thinking they are eating healthy products, researchers say.

Many yoghurts are full of sugar and the public should not be lulled into thinking they are eating healthy products, researchers say. The conclusion comes after a study of almost 900 yoghurts on sale in UK supermarkets. The Leeds University-led research found that organic yoghurts were among the most sugary types - containing more sugar per 100g than cola. Only natural and Greek-style yoghurts could be classed as low in sugar. The study - published in BMJ Open - comes as government health officials are encouraging manufacturers to reduce the amount of sugar consumed by the public. Yoghurts have been identified as one of the food types on which Public Health England wants to see progress. This research was undertaken shortly after the launch of the sugar-reduction program. Unsurprisingly, yoghurt desserts contained the most sugar - an average of 16.4g per 100g. This category also included some products that did not contain yoghurt, such as chocolate mousse and creme caramel. The second most sugary product was organic yoghurts with a typical 13.1g per 100g. Children's yoghurts typically contained 10.8g per 100g, the equivalent of more than two sugar cubes, the study found. By comparison

Curiosities

a 100g serving of a typical cola contains 9g of sugar. The NHS recommends that children aged four to six have no more than 19g of sugar, or five sugar cubes a day, and it is advised that those aged seven to 10 consume less than 24g daily. To be classed as low sugar there needs to be no more than 5g per 100g. Only 9% of products surveyed were below this threshold. Since the fieldwork for the study was carried out - at the end of 2016 - progress has been made on reducing sugar consumption from yoghurts. A report published in May showed sugar content in yoghurts had been reduced by 6% in the first year, making it the only food category to exceed the 5% target. By 2020, it is expected sugar will be reduced by 20%. PHE chief nutritionist Dr Alison Tedstone said this showed "positive steps" were being made. But Dr Bernadette Moore, lead researcher of this study, said: "Even if we take the reduction into account, most of these yoghurts will still not be low in sugar. "I think people, including parents, will be surprised to know just how much sugar there is in yoghurt. "My advice would be to buy natural yoghurt and mix in your own fruit."

BBC News, 19 September 2018

http://news.bbc.co.uk

Exercise-induced bronchoconstriction, or why I can't stop wheezing after a run

2018-10-03

Do you feel wheezy and breathless after you finish exercising? You might have exercise-induced bronchoconstriction.

Each ragged breath burned as I wheezed and strained to fill my lungs. It was the final quarter of a particularly intense netball match, and to say I was struggling is a massive understatement. I assumed I was unfit, but my teammate — who also happened to be a GP — thought otherwise. It turned out I had exercise-induced bronchoconstriction or EIB, a condition that appears with intense exercise and produces asthma-like symptoms, even after you have stopped the activity. The diagnosis was a huge surprise to me. I don't have asthma, nor do I have a family history of respiratory issues. But I am far from alone, said Norbert Berend, head of respiratory research at George Institute for Global Health in Sydney. "No-one really knows how common EIB is because it's under-diagnosed, but it's probably between 10 and 20 per cent of people without asthma." Up to half of competitive athletes get it. And EIB is super common in people with asthma, affecting about 90 per cent, Professor Berend added. EIB is not to be confused with general breathlessness, either. A feature of EIB is the timing of the symptoms, which can peak after you finish exercising. That made sense in my netball match. I had sat the third quarter out, so when

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I came on for the final quarter, my wheezing and chest tightness had well and truly kicked in.

It's dry air, not cold, that triggers EIB

As you're reading this, you're probably breathing through your nose. Even if it's chilly outside, your nasal passages warm up and humidify air you inhale and filter out a lot of irritants such as pollen. But start exercising hard, and you begin to breathe through your mouth. You might be sucking in more oxygen, but you lose the humidifying benefits of nose breathing, said Mehra Haghi, a respiratory pharmaceutical scientist at University of Technology Sydney. As dry air whooshes down into your lungs and out again, it whisks water away from cells lining your lower airways. Those cells release inflammatory molecules. The smooth muscle wrapping around your airways constricts, like a belt being cinched in. "That's when you feel the tightness and the feeling of being unable to breathe," Dr Haghi said. And other environmental triggers, such as pollution and pollen, can intensify EIB. I tend to notice symptoms more in cold weather, but that's not because of the temperature: it's because cold air can't hold as much water as warm air. Far more winter Olympians have the condition compared to their summer counterparts. It seems our furry friends get EIB of sorts, too. A 2002 study of "canine winter athletes" found more airway inflammation in elite Alaskan racing sled dogs than sedentary pooches.

Diagnosing EIB can be straightforward

If you suspect you have EIB, get yourself to a GP. You might also need to see a specialist. While there's no questionnaire or tool to diagnose the condition, Professor Berend said the first thing to do is to rule out asthma. For some people, like me, diagnosing EIB is pretty straightforward. For others, though, it's not so clear cut. "Under those circumstances you do tests," Professor Berend said. "A common one is you blow in a device as hard as you can, which registers your peak flow. "Classically, with EIB, immediately after exercise you see a drop. And if that drop is more than 10 per cent, then you have EIB." Some people have this drop in peak flow without any symptoms, so while they technically have EIB, it doesn't make them feel unwell. "Of course, there are other people who feel bad, but that's not because they have EIB — it's because they're not fit," Professor Berend said. "And there are other causes of feeling breathless when you exercise, like heart disease and any number of lung diseases." Still, EIB is generally under-diagnosed or mis-diagnosed. And because EIB can feel awful — believe me, I know — those who unknowingly have the condition might simply stop exercising, Professor Berend said.

Prevention is treatment

There are a few things you can do to stop or alleviate EIB symptoms. If you can't exercise indoors or in a more humid climate, warm up as much as possible before exercise, Dr Haghi said. You can also try to build up your cardiovascular fitness so you can breathe through your nose instead of your mouth. There's limited evidence that EIB can be helped if you eat less sodium, or up your intake of fish oil or vitamin C, but she added, "these are small studies, and certainly not conclusive". In terms of pharmaceuticals, a short acting beta agonist can be used to relax the bands of smooth muscle that encircle your airways. You may know a beta agonist by its brand name, Ventolin. It will usually do the trick for people who don't have asthma, Professor Berend said. "The vast majority get good relief from taking the Ventolin, but you have to take it before the exercise." You can become used to the drug's effects, though, so it should only be used sparingly: three or four times a week is fine. For those with asthma, even though almost all will have some degree of EIB, they may not feel it if their asthma is well controlled, Professor Berend said. "So, if it happens in asthmatics, it's usually a sign that their asthma's not well controlled and needs additional treatment." In my case, I bought a puffer and I have a couple of puffs about 15 minutes before sport or exercise. On a long run, I take it with me, and try to breathe through my nose. I've started swimming more too. Even though I still end up breathing hard, the air I inhale is warmer and more humid, thanks to the pool water. And my lungs and airways are definitely feeling better for it.

ABC News, 28 September 2018

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

Recovering ice addicts treated with ADHD medication in Australian trials

2018-10-03

A drug prescribed to treat an attention deficit disorder is being used to help methamphetamine users kick their addictions in trials across New South Wales, South Australia and Victoria. The drug lisdexamfetamine, also known as lisdex, is often used to treat Attention Deficit Hyperactivity Disorder (ADHD), but researchers believe it could help people reduce their dependence to the drug ice. Trials are already underway in New South Wales and South Australia, and soon Victoria will join them with a trial of 25 people, after funding was provided by the Andrews Government. The Victorian trial will be run by Melbourne-based addiction treatment

A drug prescribed to treat an attention deficit disorder is being used to help methamphetamine users kick their addictions in trials across New South Wales, South Australia and Victoria.

centre Turning Point, and will involve a daily treatment of lisdex in a bid to help avoid the major mood swings often associated with users fighting addiction. "The idea is that [lisdex] will reduce the withdrawal symptoms and cravings they often experience if they don't use their methamphetamine," Turning Point director Professor Dan Lubman said. He compared the use of lisdex to nicotine patches for those quitting cigarettes or methadone for heroin dependence. "Unfortunately, in the treatment of methamphetamine we currently don't have a medication that we can give people to help them if they are struggling with psychological treatments alone," he said. Professor Lubman said under the trial, some participants will be given lisdex while others will receive a placebo drug. All participants will receive drug counselling throughout the trial. "The idea is that replaces the methamphetamine they take, they get on with their lives, they get their lives with more stability, they can get treatment and counselling," he said.

Trial design a 'world-first'

Sydney's St Vincent's Hospital began its set of trials a few months ago, and its clinical director of alcohol and drug service, Dr Nadine Ezard, said the research was world-leading. "It's a world-first in the way that we're doing it as an outpatient medication," Dr Ezard said. If the trials are successful, she said the drug could fill a gap in treatment options for the heaviest users of ice. "As far as we're aware at the moment, the only effective treatment is counselling-based therapy, and that does work for people, but it works for people earlier in their use, before they are using more frequently and at higher doses," she said. "So, we really have, as clinicians, very little to offer people that are using at higher doses." Victorian Minister for Mental Health Martin Foley said breaking the cycle of drug abuse was critical, including stopping anti-social behaviour linked to drug use. "[The hope is]...that we can break the connection between addiction and poor social outcomes, poor health outcomes, and potentially crime and anti-social behaviour," Mr Foley said. "This trial could be an absolute game-changer … offering non-invasive treatment to what has become one of the most dangerous and prolific drugs in our community."

ABC News, 25 September 2018

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

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Physical exercise improves the elimination of toxic proteins from muscles

2018-10-03

A study published in Scientific Reports by researchers at the University of São Paulo (USP) in Brazil, in partnership with colleagues in the United States and Norway, shows that the lack of muscle stimulus results in a build-up of inadequately processed proteins in muscle cells and consequently leads to muscle weakness or wasting. This is a typical muscle dysfunction condition that affects the elderly or individuals suffering from sciatic nerve injury, something usually verified in bedridden patients or workers who spend long hours sitting. From tests with rats with induced sciatic nerve injury—which, therefore, stopped receiving stimuli—researchers found that this build-up was caused by the impairment of autophagy, the cellular machinery responsible for identifying and removing damaged proteins and toxins. The analysis of a group of rats subjected to a regime of aerobic exercise training previous to the injury allowed the scientists to demonstrate that physical exercise can keep the autophagic system primed and facilitate its activity when necessary, as in the case of muscle dysfunction due to the lack of stimulus. "Daily exercise sensitizes the autophagic system, facilitating the elimination of proteins and organelles that aren't functional in the muscles. Removal of these dysfunctional components is very important; when they accumulate, they become toxic and contribute to muscle cell impairment and death," said Julio Cesar Batista Ferreira, a professor in the university's Biomedical Science Institute (ICB-USP) and principal investigator for the study. Ferreira offered an analogy to help explain muscle cell autophagy. "Imagine the muscles working in a similar manner to a refrigerator, which needs electricity to run. If this signal ceases because you pull the plug on the fridge or block the neurons that innervate the muscles, before long, you find that the food in the fridge and the proteins in the muscles will start to spoil at different speeds according to their composition," told the researcher, who was supported by the São Paulo Research Foundation—FAPESP. "At this point, an early warning mechanism, present in cells but not yet in fridges, activates the autophagic system, which identifies, isolates and 'incinerates' the defective material, preventing propagation of the damage. However, if the muscle does not receive the right electric signal for long periods, the early warning mechanism stops working properly, and this contributes to cell collapse." Spoiled food in a broken fridge corresponds to proteins that instead of performing their proper function form toxic aggregates, which start killing cells. Autophagy can isolate these proteins and destroy them in lysosomes, intracellular organelles that

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degrade and recycle waste. "Without autophagy, a cascade effect occurs, leading to cell death," said Juliane Cruz Campos. Campos developed part of the study described in Scientific Reports during her Ph.D. research. First author of the article, she is currently engaged in postdoctoral research under Ferreira's supervision with a scholarship from FAPESP.

Experiment—method

In the latest study, rats were submitted to sciatic nerve ligation surgery, creating an effect equivalent to that of sciatic nerve compression in humans. The pain it causes prevents the individual from using the affected leg, and eventually the muscles concerned weaken and atrophy. Before the surgical procedure, the rats were divided into two groups. One remained sedentary, and the other was given exercise training that consisted of running at 60% of maximum aerobic capacity for an hour a day, five days a week. After four weeks of exercise training, the surgery was performed, and the muscular dysfunction induced by sciatic nerve injury was found to be less aggressive in the aerobic exercise group than in the sedentary group. Functional and biochemical parameters in the affected muscles were also evaluated at that time. "The exercise training increased autophagic flux and hence reduced dysfunctional protein levels in the muscles of the animals. At the same time, the exercise improved the muscle tissue's contractility properties," said the FAPESP scholarship holder. "Exercise is a transient stress that leaves a memory in the organism, in this case via the autophagic system," Ferreira explained. "When the organism is subjected to other kinds of stress, it's better prepared to respond and combat the effects."

Proof of concept

The researchers performed two other experiments designed to investigate the link between exercise and autophagy more deeply. One experiment used mice in which the autophagy-related gene ATG7 was silenced in the skeletal muscle. ATG7 encodes a protein responsible for synthesising a vesicle called the autophagosome that forms around dysfunctional organelles and transports them to the lysosome, where they are broken down and digested. This experiment validated the importance of autophagy in muscle biology because ATG7 knockout mice that had not been subjected to sciatic nerve ligation nevertheless displayed muscular dysfunction. In the other experiment, muscles from rats with sciatic nerve injury and control rats (without the injury) were treated with a drug called chloroquine, which inhibits autophagy by raising the lysosomal pH (alkalinity) and hence prevents the degradation of defective proteins.

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"The tests showed less muscle strength in the control animals treated with the drug than in the untreated group. Chloroquine had no effect on the muscles of rats with sciatic nerve injury, proving that the inhibition of autophagy is critical to muscular dysfunction caused by the lack of stimulus," Ferreira said. The researchers stress that their studies do not aim to find a treatment for sciatica, one of the most common types of pain. The idea is to use the experimental model in further research to understand the cellular processes involved in muscle dysfunction. This will facilitate the development of new drugs and nonpharmacological interventions capable of minimizing or reversing an increasingly serious problem in contemporary societies, namely, muscle weakness and atrophy due to a lack of movement, especially among the elderly. "If we can identify a molecule that selectively keeps the autophagic system on alert, in a similar manner to what happens during physical exercise, we may be able to develop a drug that can be given to people with muscle dysfunction due to a lack of stimulus, such as patients with immobilized limbs, people who are bedridden for long periods, and even patients with [degenerative] muscular diseases," Ferreira said.

Medical Xpress, 28 September 2018

http://medicalxpress.com

Remediating oil sludge via nanoparticlces made from green mango peel

Green mango peel: A slick solution for oil-contaminated soils

2018-10-03

Nanoparticles derived from green mango peel could be the key to remediating oil sludge in contaminated soil according to new research from the University of South Australia. For the petroleum industry remediating oil sludge is a costly and an ongoing challenge, particularly when 3-7 per cent of oil processing activities are irreversibly lost as oily or sludge waste. Lead researcher, UniSA's Dr Biruck Desalegn says without treatment oil contaminated soil presents a massive risk to ecosystems and the environment. "Last year, global oil production reached a new record of 92.6 million barrels per day, but despite improvements in control technologies, oil refineries unavoidably continue to generate large volumes of oil sludge," Dr Desalegn says. "Oil contamination can present cytotoxic, mutagenic and potentially carcinogenic conditions for all living things, including people, "What's more, the toxicity and physical properties of oil change over time, which means the process of weathering can expose new, and evolved toxins." The new nanoparticles, synthesised from green mango peel extract and iron chloride, provide a novel and

effective treatment for oil contaminated soil. They work by breaking down toxins in oil sludge through chemical oxidation, leaving behind only the decontaminated materials and dissolved iron. Dr Desalegn says the new plant-based nanoparticles can successfully decontaminate oil-polluted soil, removing more than 90 per cent of toxins. "Plant extracts are increasingly used to create nanomaterials," Dr Desalegn says. "In this study, we experimented with mango peel to create zerovalent iron nanoparticles which have the ability to breakdown various organic contaminants. "With mango peel being such a rich source of bioactive compounds, it made sense that zerovalent iron made from mango peel might be more potent in the oxidation process. "As we discovered, the mango peel iron nanoparticles worked extremely well, even outperforming a chemically synthesized counterpart by removing more of contaminants in the oil sludge." Dr Desalegn says this discovery presents a sustainable, green solution to address the significant pollution generated by the world's oil production. "Ever since the devastation of the 2010 Deepwater Horizon oil spill, the petroleum industry has been acutely aware of their responsibilities for safe and sustainable production processes," Dr Desalegn says. "Our research uses the waste part of the mango - the peel - to present an affordable, sustainable and environmentally friendly treatment solution for oil sludge. "And while the world continues to be economically and politically reliant on oil industries as a source of energy working to remediate the impact of oil pollution will remain a serious and persistent issue." This research was conducted as part of Dr Desalegn's PhD with support from CRC CARE.

EurekAlert, 28 September 2018

http://www.eurekalert.org

Junk-food lovers who try to cut back on fries or chocolate may experience symptoms similar to drug withdrawal, a new study suggests.

Quitting Junk Food May Trigger Withdrawal-Like Symptoms

2018-10-03

Junk-food lovers who try to cut back on fries or chocolate may experience symptoms similar to drug withdrawal, a new study suggests. Researchers found that people attempting to cut down on eating highly processed foods experience some of the same physical and psychological symptoms — such as mood swings, cravings, anxiety, headaches and poor sleep — as those quitting smoking cigarettes or using marijuana, according to the study, which was published online Sept. 15 in the journal Appetite. The new study offers the first evidence that these withdrawal-like symptoms can occur when people cut down on highly processed foods,

said lead study author Erica Schulte, a doctoral candidate in psychology at the University of Michigan. Based on the participants' self-reported symptoms, withdrawal symptoms were most intense between the second and fifth days after attempting to reduce junk-food consumption, which parallels the time span people live through during drug withdrawal, Schulte told Live Science. The idea that food may be addictive after "heavy" use by some individuals is a controversial subject, Schulte said. Although prior research studies in animals and humans have shown some biological and behavioural similarities between substance-use disorders and addictive-like consumption of highly processed foods, no studies have looked at whether reducing junk food can trigger withdrawal symptoms in people, she noted.

Addictive potential of junk food

In the study, the researchers developed a new tool modelled after the withdrawal scales that are used to assess symptoms that occur after people quit smoking or stop using marijuana. This modified questionnaire was given to more than 200 adults who had dieted during the past year by attempting to cut down on junk food. The results showed that the symptoms people experience during withdrawal from tobacco or marijuana may also be relevant to cutting out highly processed foods from the diet, Schulte said. Withdrawal is a key feature of addiction and showing that it may also occur when reducing junk-food consumption provides more support for the hypothesis that highly processed foods may be addictive, she added. Indeed, the new "study fills an important missing piece in [the] research on food addiction," said Nicole Avena, an assistant professor of neuroscience at the Icahn School of Medicine at Mount Sinai in New York City, who was not involved in the new study. Up until now, there hasn't been a reliable way to measure withdrawal symptoms tied to food in humans, and the new tool used in the study provides a valid measure that can be useful in understanding more about the addictive nature of highly processed foods, said Avena, who's done research on food addiction. More and more research has suggested that the foods we eat, which are often highly processed and contain excessive amounts of sugar, could cause changes in the brain that are similar to those seen with addictions to drugs, like alcohol and tobacco, Avena told Live Science. The new study adds to the growing literature that suggests that highly processed foods can produce addiction-like responses in humans. Practically speaking, raising awareness that people may experience irritability or headaches when cutting down on junk food can help individuals prepare coping strategies in advance, Schulte noted. The

findings may also shed light on the barriers people face when changing eating habits — barriers that may play a role in people dropping out of treatments, she said. A limitation of the study is that it asked participants to recall their withdrawal symptoms, but a next step would be to measure these effects in real time, while people were actually reducing their junk-food consumption, Schulte said. In addition, researchers did not measure the intensity of withdrawal symptoms compared to drug withdrawal symptoms, nor did they consider what methods — such as going cold turkey or gradually eliminating foods — people used to change their eating habits.

Live Science, 27 September 2018

http://www.livescience.com

Technical Notes

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

ENVIRONMENTAL RESEARCH

Synthesis, characterisation and application of green seaweed mediated silver nanoparticles (AgNPs) as antibacterial agents for water disinfection.

Introducing a new standardized nanomaterial environmental toxicity screening testing procedure, ISO/TS 20787: aquatic toxicity assessment of manufactured nanomaterials in saltwater lakes using Artemia sp. nauplii.

Highly efficient triazolone/metal ion/polydopamine/MCM-41 sustained release system with pH sensitivity for pesticide delivery

Actinomycetes: an unexplored microorganisms for plant growth promotion and biocontrol in vegetable crops

Mercury contamination in the sludge of drinking water treatment plants dumping into a reservoir in Rio de Janeiro, Brazil

MEDICAL RESEARCH

Blood Levels of Cadmium and Lead in Relation to Breast Cancer Risk in Three Prospective Cohorts

Protective Effect of Rosamultin against H2O2-Induced Oxidative Stress and Apoptosis in H9c2 Cardiomyocytes

Leukopenia and lack of ribavirin predict poor outcomes in patients with haematological malignancies and respiratory syncytial virus infection

Impact of abiraterone acetate plus prednisone or enzalutamide on fatigue and cognition in patients with metastatic castration-resistant prostate cancer: initial results from the observational AQUARiUS study

Dose modification and dose intensity during treatment with pirfenidone: analysis of pooled data from three multinational phase III trials

OCCUPATIONAL RESEARCH

Improving the knowledge and behaviour of workplace chemical exposures in Vietnamese-American nail salon workers: a randomized controlled trial

Technical Notes

Choosing the number of images and image position when analysing the UNC Passive Aerosol Sampler for occupational exposure assessment

Andrographolide prevented toluene diisocyanate-induced occupational asthma and aberrant airway E-cadherin distribution via p38 MAPK-dependent Nrf2 induction

A qualitative study on alcohol consumption and HIV treatment adherence among men living with HIV in Ugandan fishing communities

Occupational Health Risk Assessment in the Electronics Industry in China Based on the Occupational Classification Method and EPA Model

PUBLIC HEALTH RESEARCH

Pollution and Global Health – An Agenda for Prevention

Microplastics in Seafood and the Implications for Human Health

Personal care products use and phthalate exposure levels among pregnant women

Cigarette smoking and thyroid cancer risk: a cohort study

Metal concentrations in pregnant women and neonates from informal electronic waste recycling