CHEMWATCH

Bulletin Board

Contents

OCT. 02, 2020

(click on page numbers for links)

CONTACT US

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

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

CHEMICAL EFFECTS

Norm index-based QSAR models for acute toxicity of organic compounds toward zebrafish embryo

2020-10-15

Zebrafish embryos are highly sensitive to toxicant exposure and have been used to evaluate the potential eco-toxicity caused by organic pollutants in the aquatic environment. This study was to develop four quantitative structure-activity relationship (QSAR) models based on norm descriptors for acute toxicity of different exposure times toward zebrafish embryo of organic compounds with various structures. Norm descriptors were obtained by calculating the norm index of the atomic distribution matrix, which was composed of atomic spatial distribution and atomic properties. These norm index-based QSAR models presented satisfactory results with R^2 of 0.8549, 0.9162, 0.8335 and 0.8119 for 48, 96, 120 and 132 h, respectively. Validation results including cross validation, external validation, Y-randomized test and applicability domain analysis indicated that the proposed models were stable, robust and reliable. Accordingly, these norm descriptors might be effective in predicting the acute toxicity of various organics to zebrafish embryos, which might be useful for evaluating the potential hazards of organic pollutants to aquatic environment.

Authors: Ting Liu, Fangyou Yan, Qingzhu Jia, Qiang Wang
Full Source: Ecotoxicology and environmental safety 2020 Oct 15;203:110946. doi: 10.1016/j.ecoenv.2020.110946.

Valorization of CO 2 through lithoautotrophic production of sustainable chemicals in Cupriavidus necator

2020-09-19

Coupling recent advancements in genetic engineering of diverse microbes and gas-driven fermentation provides a path towards sustainable commodity chemical production. Cupriavidus necator H16 is a suitable species for this task because it effectively utilizes H2 and CO2 and is genetically tractable. Here, we demonstrate the versatility of C. necator for chemical production by engineering it to produce three products from CO2 under lithotrophic conditions: sucrose, polyhydroxyalkanoates (PHAs), and lipochitooligosaccharides (LCOs). We engineered sucrose production in a co-culture system with heterotrophic growth 30 times that of WT C. necator. We engineered PHA production (20-60% DCW) and selectively altered product composition by combining different thioesterases and phaCs to produce copolymers directly from CO2. And, we engineered C.

> **Zebrafish embryos are highly sensitive to toxicant exposure and have been used to evaluate the potential eco-toxicity caused by organic pollutants in the aquatic environment.**

necator to convert CO2 into the LCO, a plant growth enhancer, with titers of ~1.4 mg/L-equivalent to yields in its native source, Bradyrhizobium. We applied the LCOs to germinating seeds as well as corn plants and observed increases in a variety of growth parameters. Taken together, these results expand our understanding of how a gas-utilizing bacteria can promote sustainable production.

Authors: Shannon N Nangle, Marika Ziesack, Sarabeth Buckley, Disha Trivedi, Daniel M Loh, Daniel G Nocera, Pamela A Silver
Full Source: Metabolic engineering 2020 Sep 19;62:207-220. doi: 10.1016/j.ymben.2020.09.002.

[ALLERGIC CONTACT DERMATITIS DUE TO NITRILE RUBBER GLOVES: ETHYL ISOTHIOCYANATE AND BUTYL ISOTHIOCYANATE AS POSSIBLE CAUSATIVE CHEMICALS]

2020

Background: The causative chemicals responsible for nitrile rubber glove-induced allergic contact dermatitis have not been fully elucidated. Subject: This case involved a 36-year-old female, who developed an erythematous rash on her hands after one and a half months of wearing nitrile rubber gloves at her workplace. Methods: Patch tests were performed using the gloves as is, and the Japanese standard allergen 2008 and their components. The gloves were chemically analyzed and several detected substances were subjected to further patch testing. Results: The patient exhibited positive patch test reactions to nitrile rubber gloves as is, as well as to the dithiocarbamate mix and thiuram mix in the Japanese standard allergen 2008. Further patch testing revealed positive reactions to zinc diethyldithiocarbamate (ZDEC) and tetraethylthiuram disulfide (TETD) and weak positive reactions to zinc dimethyldithiocarbamate (ZDMC) and tetramethylthiuram monosulfide (TMTM). Chemical analysis revealed that ethyl isothiocyanate (EITC) and butyl isothiocyanate (BITC), which might have been produced from dithiocarbamate-type accelerators (DTCs) or thiuram-type accelerators (thiurams) during the vulcanization process, were present in the nitrile rubber gloves the patient used at her workplace, as was ZDBC. No other DTCs or thiurams were detected. Patch testing of the detected materials produced positive reactions to EITC and BITC, but not to ZDBC. Conclusion: We diagnosed the patient with allergic contact dermatitis due to the EITC and BITC present in nitrile rubber gloves, and considered that alkyl isothiocyanate might also have played a causative role. We propose

> **Background: The causative chemicals responsible for nitrile rubber glove-induced allergic contact dermatitis have not been fully elucidated.**

that nitrile rubber gloves should be produced without using vulcanization accelerators.
Authors: Shigeruko Iijima, Mitsuru Numata, Kazumi Sasaki
Full Source: Arerugi = [Allergy] 2020;69(8):669-677. doi: 10.15036/arerugi.69.669.

ENVIRONMENTAL RESEARCH

Ready biodegradability ring testing of 4-isopropylphenol in different laboratories for critical evaluation of a biodegradable reference substance

2020-09-24
Ready biodegradability is a key property for studying the environmental and ecological risks posed by chemicals, and a reference substance is used to check the reliability of the test results. Traditional reference substances such as aniline, sodium benzoate, and ammonium acetate rapidly degrade even in test systems without inoculum. In this study, 4-isopropylphenol was investigated as a reference candidate. Aerobic biodegradation of 4-isopropylphenol was studied using different methods and repeatability tests were performed in multiple laboratories. 4-Isopropylphenol met the ready biodegradability passing level in a closed bottle test (OECD 301D) and manometric respirometry test (OECD 301F). No obvious toxicity was found in activated sludge respiration inhibition and biodegradable toxicity control tests. The results of 301F tests performed in 15 Chinese laboratories were compared using statistical robustness analyses and Z-scores. The robust average 28 day biodegradability rate for 4-isopropylphenol was 80.3%, and the relative standard deviation was 9.20%. The data from the 15 laboratories consistently indicated that 4-isopropylphenol was readily biodegradable, except for an "unsatisfactory" outlier result from one laboratory. The degradation kinetics of 4-isopropylphenol were derived from a logistic model, which had a good fit for the degradation curve. The biodegradation lag phase was 2.3 days (range 2-5 days), and the pass level was attained at 6.5 days on average (range 2-9 days), which met the 10-day window requirement. The biodegradation rate at 28 days was 75.3% (range 64.0%-95.1%). The ready biodegradability of 4-isopropylphenol indicates that it will be more appropriate as a reference chemical than other reference compounds

Ready biodegradability is a key property for studying the environmental and ecological risks posed by chemicals, and a reference substance is used to check the reliability of the test results.

used for investigating the biodegradability of chemicals. This article is protected by copyright. All rights reserved.
Authors: Wen Gu, Linjun Zhou, Zhen Wang, Chunjun Lin, Jining Liu, Haihong Ge, Lili Shi
Full Source: Integrated environmental assessment and management 2020 Sep 24. doi: 10.1002/ieam.4347.

OCCUPATIONAL

Data on occupational health and safety strategies influencing the reduction of coronavirus in South Africa

2020-10
This data article describes raw statistics on occupational health and safety strategies influencing the reduction of coronavirus in South Africa. The purpose of this research was to investigate factors that could potentially influence the reduction of the spread of COVID-19 in a municipality setting. The following independent constructs are explored: physical wellness, psychological wellness, Intellectual wellness, intellectual wellness, emotional wellness and social wellness. In addition to the individual dependent variables, the influence of these constructs on the reduction of COVID-19 transmission and employee performance at a selected municipality was tested. Hypotheses emerged from the proposed influence of each of these constructs on reduction of COVID-19 transmission at a municipality. Smart PLS was used to measure the impact of the proposed hypotheses of the research. In order to describe data on the respondents' characteristics, SPSS and SMART PLS was used to generate the relevant statistics. The data generated for this research could potentially advise on how healthy and safety strategies could contribute to lowering the transmission of COVID-19 at a municipality.
Authors: Tarisai Fritz Rukuni, Eugine Tafadzwa Maziriri, Tinashe Chuchu
Full Source: Data in brief 2020 Oct;32:106300. doi: 10.1016/j.dib.2020.106300.

Creatinine Fluctuations Forecast Cross-Harvest Kidney Function Decline Among Sugarcane Workers in Guatemala

2020-07-12
Background: Chronic kidney disease of unknown origin (CKDu) is an epidemic that disproportionately affects young agriculture workers in hot

This data article describes raw statistics on occupational health and safety strategies influencing the reduction of coronavirus in South Africa.

regions. It has been hypothesized that repeated acute kidney injury (AKI) may play a role in the development of disease.

Methods: Latent class mixed models were used to identify groups of Guatemalan sugarcane harvesters based on their daily changes in creatinine over 6 consecutive days in 2018. Exponential smoothing state space models were used to forecast end-of-season creatinine between the identified groups. Percent change in estimated glomerular filtration rate (eGFR) across the harvest was compared between groups.

Results: Twenty-nine percent (n = 30) of the 103 workers experienced repeated severe fluctuations in creatinine across shift. The model with multiplicative error, multiplicative trend, and multiplicative seasonality was able to accurately forecast end-of-season creatinine in the severe group (mean percentage error [MPE]: -4.7%). eGFR of workers in the severe group on average decreased 20% across season compared to 11% decline for those in the moderate group (95% confidence interval for difference: -17% to 0%). Conclusions: Daily fluctuations in creatinine can be used to forecast end-of-season creatinine in sugarcane harvesters. Workers who experience repeat severe daily fluctuations in creatinine, on average, experience a greater reduction in kidney function across the season.

Authors: Miranda Dally, Jaime Butler-Dawson, Richard J Johnson, Lyndsay Krisher, Diana Jaramillo, Kira L Newman, Lee S Newman
Full Source: Kidney international reports 2020 Jul 12;5(9):1558-1566. doi: 10.1016/j.ekir.2020.06.032.

A Quantitative Retrospective Exposure Assessment for Former Chrysotile Asbestos Miners and Millers from Baie Verte, NL, Canada

2020-09-22

Despite numerous studies of asbestos workers in the epidemiologic literature, there are very few cohort studies of chrysotile asbestos miners/millers that include high-quality retrospective exposure assessments. As part of the creation of the Baie Verte Miners' Registry in 2008, a two-dimensional job exposure matrix (JEM) was developed for estimating asbestos exposures for former chrysotile asbestos miners/millers. Industrial hygiene data collected between 1963 and 1994 were analysed to assess validity for use in a retrospective exposure assessment and epidemiologic study. Registered former employees were divided into 52 exposure groups (EGs) based on job title and department and mean asbestos concentrations were calculated for each EG. The resulting exposure estimates were linked to individual registrants' work histories

Despite numerous studies of asbestos workers in the epidemiologic literature, there are very few cohort studies of chrysotile asbestos miners/millers that include high-quality retrospective exposure assessments.

allowing for the calculation of cumulative asbestos exposure for each registrant. The distribution of exposure for most EGs (82.6%) could be described as fitting a log-normal distribution, although variability within some EGs (55%) exceeded a geometric standard deviation (GSD) of 2.5. Overall, the data used to create EGs in the development of the JEM were deemed to be of adequate quality for estimating cumulative asbestos exposures for the former employees of the Baie Verte asbestos mine/mill. The variability between workers in the same job was often high and is an important factor to be considered when using estimates of cumulative asbestos exposure to adjudicate compensation claims. The exposures experienced in this cohort were comparable to those of other chrysotile asbestos miners/millers cohorts, specifically Italian and Québec cohorts.

Authors: Tina Giles Murphy, Stephen Bornstein, John Oudyk, Paul A Demers
Full Source: Annals of work exposures and health 2020 Sep 22;wxaa092. doi: 10.1093/annweh/wxaa092.

PHARAMACEUTICAL/TOXICOLOGY

Tumorigenic response in lung tumor susceptible A/J mice after sub-chronic exposure to calcium chromate or iron (III) oxide

2020-09-19

Iron oxides are Group 3 (not classifiable as to its carcinogenicity to humans) according to the International Agency for Research on Cancer (IARC). Occupational exposures during iron and steel founding and hematite underground mining as well as other iron predominant exposures such as welding are Group 1 (carcinogenic to humans). The objective of this study was to investigate the potential of iron as iron (III) oxide (Fe_2O_3) to initiate lung tumors in A/J mice, a lung tumor susceptible strain. Male A/J mice were exposed by oropharyngeal aspiration to suspensions of Fe_2O_3 (1 mg) or calcium chromate ($CaCrO_4$; 100 µg; positive control) for 26 weeks (once per week). Shams were exposed to 50 µL phosphate buffered saline (PBS; vehicle). Mice were euthanized 70 weeks after the first exposure and lung nodules were enumerated. Both $CaCrO_4$ and Fe_2O_3 significantly increased gross-observed lung tumor multiplicity in A/J mice (9.63 ± 0.55 and 3.35 ± 0.30, respectively) compared to sham (2.31 ± 0.19). Histopathological analysis showed that bronchiolo-alveolar adenomas (BAA) and carcinomas (BAC) were the primary lung tumor types in all groups and were increased in the exposed groups compared to

Iron oxides are Group 3 (not classifiable as to its carcinogenicity to humans) according to the International Agency for Research on Cancer (IARC).

sham. BAC were significantly increased (146 %) in the CaCrO4 group and neared significance in the Fe2O3 group (100 % increase; p = 0.085). BAA and other histopathological indices of toxicity followed the same pattern with exposed groups increased compared to sham control. In conclusion, evidence from this study, in combination with our previous studies, demonstrate that exposure to iron alone may be a potential risk factor for lung carcinogenesis.

Authors: Patti C Zeidler-Erdely, Lauryn M Falcone, James M Antonini, Kelly Fraser, Michael L Kashon, Lori A Battelli, Rebecca Salmen, Taylor Trainor, Lindsay Grose, Sherri Friend, Chengfeng Yang, Aaron Erdely
Full Source: Toxicology letters 2020 Sep 19;S0378-4274(20)30422-7. doi: 10.1016/j.toxlet.2020.09.012.

Organophosphate flame retardants excite arcuate melanocortin circuitry and increase neuronal sensitivity to ghrelin in adult mice

2020-09-22

Organophosphate flame retardants (OPFRs) are a class of chemicals that have become near ubiquitous in the modern environment. While OPFRs provide valuable protection against flammability of household items, they are increasingly implicated as an endocrine disrupting chemical (EDC). We previously reported that exposure to a mixture of OPFRs causes sex-dependent disruptions of energy homeostasis through alterations in ingestive behavior and activity in adult mice. Because feeding behavior and energy expenditure are largely coordinated by the hypothalamus, we hypothesized that OPFR disruption of energy homeostasis may occur through EDC action on melanocortin circuitry within the arcuate nucleus. To this end, we exposed male and female transgenic mice expressing green fluorescent protein in either NPY/AgRP or POMC neurons to a common mixture of OPFRs {triphenyl phosphate, tricresyl phosphate, and tris(1,3-dichloro-2-propyl)phosphate; each 1 mg/kg bw/day} for 4 weeks. We then electrophysiologically examined neuronal properties using whole-cell patch clamp technique. OPFR exposure depolarized the resting membrane of NPY neurons and dampened a hyperpolarizing K + current known as the M-current within the same neurons from female mice. These neurons were further demonstrated to have increased sensitivity to ghrelin excitation, which more potently reduced the M-current in OPFR-exposed females. POMC neurons from female mice exhibited elevated baseline excitability and are indicated in receiving greater excitatory synaptic input when exposed to OPFRs. Together, these data support a sex-selective effect of OPFR to increase neuronal output from the melanocortin circuitry

Organophosphate flame retardants (OPFRs) are a class of chemicals that have become near ubiquitous in the modern environment.

governing feeding behavior and energy expenditure and give reason for further examination of OPFR impact on human health.

Authors: Gwyndolin M Vail, Troy A Roepke
Full Source: Endocrinology 2020 Sep 22;bqaa168. doi: 10.1210/endocr/bqaa168.

Fighting against Drug-Resistant Tumors using a Dual-Responsive Pt(IV)/Ru(II) Bimetallic Polymer

2020-09-22

Drug resistance is a major problem in cancer treatment. Herein, the design of a dual-responsive Pt(IV)/Ru(II) bimetallic polymer (PolyPt/Ru) to treat cisplatin-resistant tumors in a patient-derived xenograft (PDX) model is reported. PolyPt/Ru is an amphiphilic ABA-type triblock copolymer. The hydrophilic A blocks consist of biocompatible poly(ethylene glycol) (PEG). The hydrophobic B block contains reduction-responsive Pt(IV) and red-light-responsive Ru(II) moieties. PolyPt/Ru self-assembles into nanoparticles that are efficiently taken up by cisplatin-resistant cancer cells. Irradiation of cancer cells containing PolyPt/Ru nanoparticles with red light generates 1 O2 , induces polymer degradation, and triggers the release of the Ru(II) anticancer agent. Meanwhile, the anticancer drug, cisplatin, is released in the intracellular environment via reduction of the Pt(IV) moieties. The released Ru(II) anticancer agent, cisplatin, and the generated 1 O2 have different anticancer mechanisms; their synergistic effects inhibit the growth of drug-resistant cancer cells. Furthermore, PolyPt/Ru nanoparticles inhibit tumor growth in a PDX mouse model because they circulate in the bloodstream, accumulate at tumor sites, exhibit good biocompatibility, and do not cause side effects. The results demonstrate that the development of stimuli-responsive multi-metallic polymers provides a new strategy to overcome drug resistance.

Authors: Xiaolong Zeng, Yufei Wang, Jianxiong Han, Wen Sun, Hans-Jürgen Butt, Xing-Jie Liang, Si Wu
Full Source: Advanced materials (Deerfield Beach, Fla.) 2020 Sep 22;e2004766. doi: 10.1002/adma.202004766.

Drug resistance is a major problem in cancer treatment.