

# Bulletin Board

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## CHEMICAL EFFECTS

**Mitigation of harmful chemical formation from pyrolysis of tobacco waste using CO<sub>2</sub>**

2020-07-07

Global consumption of tobacco has been continuously increasing. This results in the considerable generation of toxic waste materials from the tobacco industry and daily life. Conventional disposal methods for them (incineration and landfilling) could be a potential hazard for releasing carcinogens and toxins into our eco-system. Accordingly, an eco-friendly disposal platform for converting tobacco waste (TW) into syngas was mainly studied in this present work. To realize this, pyrolysis of two commercial cigarette products (Marlboro and HEETS (electronic cigarette)) was done under the CO<sub>2</sub>/N<sub>2</sub> conditions. One of the main findings from the present study was that CO<sub>2</sub> reacted with volatile matters (VMs) obtained from the thermolysis of TW through the gas phase reactions (GPRs), which provided a strategic measure to manipulate carbon rearrangement of all pyrolysates. In particular, the GPRs expedited the carbon rearrangement of harmful chemical species, converting toxic chemicals into syngas. When the fraction of VMs in TWs increased, the GPR were more effective. Therefore, the introduced eco-friendly method using CO<sub>2</sub>-mediated thermochemical process could be beneficial for energy recovery from TWs while mitigating the formations of harmful chemical species.

Authors: Taewoo Lee, Sungyup Jung, Kun-Yi Andrew Lin, Yiu Fai Tsang, Eilhann E Kwon

Full Source: Journal of hazardous materials 20

**Power-to-chemicals: Low-temperature plasma for lignin depolymerisation in ethanol**

2020-07-29

Lignin valorisation into renewable fuels and platform chemicals is desirable but still encounters major challenges due to lignin's recalcitrant structure, and the lack of cost-, energy-, and material efficient conversion processes. Herein, we report a low-temperature plasma-based route to lignin depolymerisation at mild conditions. The discharge over ethanol surface locally creating a high-energy and reactive environment rich in free electrons, energetic H radicals, and other reactive species, is well suited for lignin depolymerisation. Furthermore, assisted with a Fenton reaction (by adding Fe<sub>2</sub>O<sub>3</sub> and H<sub>2</sub>O<sub>2</sub>) to sustain a more oxidative environment,

**Global consumption of tobacco has been continuously increasing.**

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the lignin conversion yield increases from 42.6% to 66.0%. Thus-obtained renewable chemicals are rich in aromatics and dicarboxylic acid derivatives. The proposed strategy on intensifying reactive chemistry by high-power plasmas enables an effective power-to-chemicals conversion of lignin and may provide useful guidelines for modern biorefineries.

Authors: Rusen Zhou, Renwu Zhou, Sen Wang, U G Mihiri Ekanayake, Zhi Fang, Patrick J Cullen, Kateryna Bazaka, Kostya Ken Ostrikov

Full Source: Bioresource technology 2020 Jul 29;123917. doi: 10.1016/j.biortech.2020.123917.

**Multi-organ toxicity attenuation by cerium oxide and yttrium oxide nanoparticles: comparing the beneficial effects on tissues oxidative damage induced by sub-acute exposure to diazinon**

2020-08-08

Background: Excessive use of diazinon as an organophosphate pesticide (OP), contributes to cytotoxic and pathologic cellular damage and in particular oxidative stress. However, metal-oxide nanoparticles (NPs) such as cerium oxide (CeO<sub>2</sub>) and yttrium oxide (Y<sub>2</sub>O<sub>3</sub>) with the property of free radical scavenging demonstrated beneficial effects in alleviation of oxidative stress biomarkers.

Objective: The aims of this study include to evaluate beneficial effects of CeO<sub>2</sub> NPs, Y<sub>2</sub>O<sub>3</sub> NPs and their combination against diazinon-induced oxidative stress in different tissues consisting of brain, heart, lung, kidney, liver and spleen.

Methods: Eight randomized groups of 6 adult male Wistar rats were formed. Each group of rats administered different combination of diazinon, CeO<sub>2</sub> and Y<sub>2</sub>O<sub>3</sub> NPs daily and levels of oxidative stress markers such as reactive oxygen species (ROS), lipid peroxidation (LPO), total thiol molecules (TTM) and total antioxidant power (TAP) and catalase enzyme were measured after 2 weeks of the treatment.

Results: Measurements of the mentioned markers in brain, heart, lung, kidney, liver and spleen showed that administration of NPs can significantly alleviate the oxidative stress induced by diazinon. However, findings of this study illustrated that the combination of both CeO<sub>2</sub> and Y<sub>2</sub>O<sub>3</sub> NPs led to better reduction in oxidative stress markers.

Conclusion: Sub-acute exposure of diazinon in rats led to increased levels of oxidative stress markers in pivotal tissues such as brain, heart, lung, kidney, liver and

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spleen. CeO<sub>2</sub> and Y<sub>2</sub>O<sub>3</sub> NPs neutralize the oxidative stress to compensate diazinon-induced tissue damages.

Authors: Mohammad Reza Khaksar, Mona Navaei-Nigjeh, Marzieh Daniali, Mahban Rahimifard

Full Source: *Pharmaceutical nanotechnology* 2020 Aug 8. doi: 10.2174/211738508666200808135226.

## ENVIRONMENTAL RESEARCH

## Leisure craft sacrificial anodes as a source of zinc and cadmium to saline waters

2020-09

Sacrificial anodes are attached to the hulls of boats and marine structures to prevent corrosion. Their use inevitably leads to release of zinc as well as impurities in the zinc alloy such as cadmium to the saline environment. Risk assessments and source apportionment exercises require accurate assessments of the potential loads of chemicals into the environment. This research has surveyed a wide variety of zinc anodes for their composition to compare against a reported industry standard as well as using differing methodologies to determine the dissolution rate of zinc and cadmium from anodes. A zinc dissolution rate of 477 g/yr/kg of anode is proposed. Although most anodes tested had concentrations of cadmium within the prescribed limits set by the reported standard, calculated leaching rates from laboratory dissolution experiments suggested as much as 400 g per year of cadmium could leach from zinc anodes used on leisure vessels within UK waters.

Authors: Aldous B Rees, Anthony Gallagher, Laurance A Wright, Jonathan Wood, Timothy Cathery, Bradley Harrison, Chloe Down, Sean Comber

Full Source: *Marine pollution bulletin* 2020 Sep;158:111433. doi: 10.1016/j.marpolbul.2020.111433.

## Release kinetics as a key linkage between the occurrence of flame retardants in microplastics and their risk to the environment and ecosystem: A critical review

2020-07-29

The widely occurring debris of plastic materials, particularly microplastics, can be an important source of flame retardants, which are one of the main groups of chemicals added in the production of plastics from polymers. This review provides an overview on the use of flame retardants in plastic manufacturing, the kinetics of their releases from microplastics, the

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factors affecting their releases, and the potential environmental and ecosystem risk of the released flame retardants. The releases of flame retardants from microplastics typically involve three major steps: internal diffusion, mass transfer across the plastic-medium boundary layer, and diffusion in the environmental medium, while the overall mass transfer rate is commonly controlled by diffusion within the plastic matrix. The overall release rates of additive flame retardants from microplastics, which are dependent on the particle's geometry, can often be described by the Fick's Law. The physicochemical properties of flame retardant and plastic matrix, and ambient temperature all affect the release rate, which can be predicted with empirical and semi-empirical models. Weathering of microplastics, which reduces their particle sizes and likely disrupts their polymeric structures, can greatly accelerate the releases of flame retardants. Flame retardants could also be released directly from the microplastics ingested by aquatic organisms and seabirds, with physical and chemical digestion in the bodies significantly enhancing their release rates. Limited by the extremely slow diffusion in plastic matrices, the fluxes of flame retardants released from microplastics are very low, and are unlikely to pose significant risk to the ecosystem in general. More research is needed to characterize the mechanical, chemical, and biological processes that degrade microplastics and accelerate the releases of flame retardants and to model their release kinetics from microplastics, while efforts should also be made to develop environmentally benign flame retardants to ultimately minimize their risk to the environment and ecosystem.

Authors: Hefa Cheng, Hang Luo, Yuanan Hu, Shu Tao

Full Source: *Water research* 2020 Jul 29;185:116253. doi: 10.1016/j.watres.2020.116253.

## OCCUPATIONAL

## Study of occupational exposure to brick kiln emissions on heavy metal burden, biochemical profile, cortisol level and reproductive health risks among female workers at Rawat, Pakistan

2020-08-04

The present study was planned to understand the heavy metal burden and its possible actions in blood of occupational females working at brick kilns at Rawat, Pakistan. A total of 232 women were included in the study, of which 114 presented control subjects. Apart from collection of

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demographic data, fertility indicators and body mass index (BMI), blood was collected from subjects that was later used for the determination of heavy metal concentrations using atomic absorption spectroscopy and haematological profile. Blood was centrifuged and plasma was obtained and stored at - 20° to study biochemical variables (sodium dismutase, peroxidase, reactive oxygen species, thiobarbituric acid reactive species, protein estimation), lipid profile and cortisol concentrations among the two groups. Analysis of heavy metal in blood showed elevated levels of cadmium ( $3.09 \pm 0.01 \mu\text{g}/\text{dl}$ ), chromium ( $4.20 \pm 0.02 \mu\text{g}/\text{dl}$ ) and nickel ( $5.59 \pm 0.03 \mu\text{g}/\text{dl}$ ) in worker's group as compared with control. Increased platelet count; decreased antioxidant enzyme and increased oxidants level; increased total cholesterol, low-density lipoprotein (LDL) and triglyceride (TG); decreased total protein and high-density lipoprotein (HDL); and increased cortisol levels were evident among workers as compared with the control group. The study concluded that occupational workers experience increased heavy metals burden in blood and, therefore, pose a risk to human health by causing reduction in antioxidant enzymes concentration and increase in stress conditions.

Authors: Mehwish David, Qurat-UI-Ain, Muhammad Afzal, Muhammad Shoaib, Faiza Aman, Karen J Cloete, Naheed Turi, Sarwat Jahan  
Full Source: Environmental science and pollution research international 2020 Aug 4. doi: 10.1007/s11356-020-10275-4.

### Assessing BTEX exposure among workers of the second largest natural gas reserve in the world: a biomonitoring approach

2020-08-08

Urinary benzene, toluene, ethylbenzene, and xylenes (BTEX) can be used as a reliable biomarker of exposure to these pollutants. This cross-sectional study aimed to employ biomonitoring to assess BTEX exposure among South Pars Gas Field (SPGF) workers in Assaluyeh, Iran. Forty employees who were working on the site were recruited as the case group. Besides, 31 administrative employees were recruited as the control group. Pre-shift and post-shift spot urine samples were collected from the subjects in the case group, while the subjects in the control group provided mid-morning urine samples. Overall, 111 urine samples, including 80 samples from the case group and 31 samples from the controls, were collected. Gas chromatography-mass spectrometry (GC/MS) was used to determine the urinary levels of BTEX compounds. The median urinary levels of benzene, toluene, ethylbenzene, m,p-xylene, and o-xylene in the post-shift samples of the exposed group were 1.24, 2.28, 0.5, 1.32, and 1.5  $\mu\text{g}/\text{l}$ ,

**Urinary benzene, toluene, ethylbenzene, and xylenes (BTEX) can be used as a reliable biomarker of exposure to these pollutants.**

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respectively. Significant differences were observed in urinary BTEX levels among smokers and non-smokers in both studied groups ( $p < 0.05$ ). Accordingly, the median urinary BTEX concentrations in smokers were 2 to 6.5 times higher than the corresponding values in non-smoker subjects. Smoking status was the only predictor of the urinary BTEX concentration. Our findings revealed that refinery workers are exposed to significant levels of BTEX compounds. Considering the health risks associated with BTEX exposure for refinery workers, implementation of suitable control strategies, such as using appropriate personal protective equipment and improving on-site ventilation systems, are recommended reducing their exposure to BTEX via the inhalation.

Authors: Mehdi Moridzadeh, Samaneh Dehghani, Ata Rafiee, Mohammad Sadegh Hassanvand, Mansooreh Dehghani, Mohammad Hoseini  
Full Source: Environmental science and pollution research international 2020 Aug 8. doi: 10.1007/s11356-020-10379-x.

### Quantitative microbial risk assessment of occupational and public risks associated with bioaerosols generated during the application of dairy cattle wastewater as biofertilizer

2020-07-12

The reuse or recycling of wastewater provides environmental and economic benefits, representing a sustainable and circular alternative for the management of liquid waste. However, the application of effluents to agricultural crops via spraying creates a potentially dangerous situation for individuals exposed to airborne pathogens. This study used Quantitative Microbial Risk Assessment (QMRA) tools to quantitatively assess the microbial risks of occupational and public exposures to bioaerosols in fertigation scenarios by spraying untreated and treated dairy cattle wastewater. Analyses of Escherichia coli (EC) and spores of Clostridium perfringens (CpSP) in raw and treated effluents as well as pathogen / indicator ratios from the literature were used to estimate the concentrations of Escherichia coli O157:H7 [EC O157:H7] and Cryptosporidium spp. (Crypto) in the air, and the results were applied to an atmospheric microbiological dispersion model. From the concentrations of pathogens in the air, infectious risks for downwind receptors were calculated. The risks of infection by EC O157:H7 to workers at 10 m and 50 m away from the emission source ranged between  $3.81 \times 10^{-1}$  and  $2.68 \times 10^{-3}$  pppy (per person per year), whereas to residents at 100 m and 500 m ranged from  $4.59 \times 10^{-1}$  to  $1.51 \times 10^{-4}$  pppy. Peak values (95th percentile) of occupational and public risks associated with the

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exposure to Crypto were  $3.41 \times 10^3$  and  $6.84 \times 10^4$  pppy at 10 m and 50 m from the source, respectively, and were lower than  $1.48 \times 10^6$  pppy regarding exposures to CpSP. Anaerobic digestion reduced risks by approximately one order of magnitude. The distance from the source was inversely proportional to the risk of exposure. It is recommended that wastewater is treated prior to its reuse and the adoption of application methods with low aerosolization potential. In addition, the need for workers to use personal protective equipment (PPE) is highlighted.

Authors: Andressa de Matos Nascimento, Vanessa Romário de Paula, Edgard Henrique Oliveira Dias, Jailton da Costa Carneiro, Marcelo Henrique Otenio

Full Source: The Science of the total environment 2020 Jul 12;745:140711. doi: 10.1016/j.scitotenv.2020.140711.

## PHARMACEUTICAL/TOXICOLOGY

### Primary results from CECILIA, a global single-arm phase II study evaluating bevacizumab, carboplatin and paclitaxel for advanced cervical cancer

2020-08-04

Objective: Adding bevacizumab to cisplatin-paclitaxel for advanced cervical cancer significantly improves overall and progression-free survival. We evaluated bevacizumab with a widely used carboplatin-paclitaxel backbone. Methods: Patients with metastatic/recurrent/persistent cervical cancer not amenable to curative surgery and/or radiotherapy received 3-weekly bevacizumab 15 mg/kg, paclitaxel 175 mg/m<sup>2</sup>, and carboplatin AUC 5 until progression or unacceptable toxicity. Maintenance bevacizumab was allowed. Patients with ongoing bladder/rectal involvement, prior cobalt radiotherapy, a history of fistula/gastrointestinal perforation, or recent bowel resection/chemoradiation were excluded. The primary objective was to determine incidences of gastrointestinal perforation/fistula, gastrointestinal-vaginal fistula, and genitourinary fistula.

Results: Among 150 treated patients, disease at study entry was persistent in 21%, recurrent in 56%, and newly diagnosed metastatic in 23%. After 27.8 months' median follow-up, median bevacizumab duration was 6.7 months; 57% received maintenance bevacizumab. Seventeen patients (11.3%; 95% CI: 6.7-17.5%) experienced  $\geq 1$  perforation/fistula event: gastrointestinal perforation/fistula in 4.7% (1.9-9.4%), gastrointestinal-vaginal fistula in 4.0% (1.5-8.5%), and genitourinary fistula in 4.7% (1.9-9.4%). Of these, 16 were previously irradiated, several with

**Objective: Adding bevacizumab to cisplatin-paclitaxel for advanced cervical cancer significantly improves overall and progression-free survival.**

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ongoing radiation effects. The most common grade 3/4 adverse events were neutropenia (25%), anemia (19%), and hypertension (14%). Five patients (3%) had fatal adverse events. Objective response rate was 61% (95% CI: 52-69%), median progression-free survival was 10.9 (10.1-13.7) months, and median overall survival was 25.0 (20.9-30.4) months. Conclusions: Bevacizumab can be combined with carboplatin-paclitaxel in the CECILIA study population. The fistula/gastrointestinal perforation incidence is in line with GOG-0240; efficacy results are encouraging. Trial registration number: NCT02467907 (ClinicalTrials.gov).

Authors: Andres Redondo, Nicoletta Colombo, Mary McCormack, Lydia Dreosti, Angelica Nogueira-Rodrigues, Giovanni Scambia, Domenica Lorusso, Florence Joly, Michael Schenker, Paul Ruff, Maria Estevez-Diz, Natsumi Irahara, Margarita Donica, Antonio Gonzalez-Martín  
Full Source: Gynecologic oncology 2020 Aug 4;S0090-8258(20)33661-1. doi: 10.1016/j.ygyno.2020.07.026.

### A polycyclic aromatic hydrocarbon-enriched environmental chemical mixture enhances AhR, antiapoptotic signaling and a proliferative phenotype in breast cancer cells

2020-07-25

Emerging evidence suggests the role of environmental chemicals, in particular endocrine-disrupting chemicals (EDCs), in progression of breast cancer and treatment resistance, which can impact survival outcomes. However, most research tends to focus on tumor etiology and the effect of single chemicals, offering little insight into the effects of realistic complex mixture exposures on tumor progression. Herein, we investigated the effect of a polycyclic aromatic hydrocarbon (PAH)-enriched EDC mixture in a panel of normal and breast cancer cells and in a tumor organoid model. Cells or organoids in culture were treated with EDC mixture at doses estimated from US adult intake of the top four PAH compounds within the mixture from the National Health and Nutrition Examination Survey database. We demonstrate that low-dose PAH mixture (6, 30 and 300 nM) increased aryl hydrocarbon receptor (AhR) expression and CYP activity in estrogen receptor (ER) positive but not normal mammary or ER-negative breast cancer cells, and that upregulated AhR signaling corresponded with increased cell proliferation and expression of antiapoptotic and antioxidant proteins XIAP and SOD1. We employed a mathematical model to validate PAH-mediated increases in AhR and XIAP expression in the MCF-7 ER-positive cell line. Furthermore, the PAH mixture caused significant growth increases in ER-negative breast

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cancer cell derived 3D tumor organoids, providing further evidence for the role of a natural-derived PAH mixture in enhancing a tumor proliferative phenotype. Together, our integrated cell signaling, computational and phenotype analysis reveals the underlying mechanisms of EDC mixtures in breast cancer progression and survival.

Authors: Larisa M Gearhart-Serna, John B Davis, Mohit Kumar Jolly, Nishad Jayasundara, Scott J Sauer, Richard T Di Giulio, Gayathri R Devi  
Full Source: *Carcinogenesis* 2020 Jul 25;bgaa047. doi: 10.1093/carcin/bgaa047.