

# Bulletin Board

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## CONTACT US

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

1227 Glen Huntly Rd  
Glen Huntly  
Victoria 3163 Australia

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## CHEMICAL EFFECTS

**Persistent organic pollutants in water resources: Fate, occurrence, characterization and risk analysis**

2022-03-24

Persistent organic pollutants (POPs) are organic chemicals that can persist in the environment for a longer period due to their non-biodegradability. The pervasive and bio-accumulative behavior of POPs makes them highly toxic to the environmental species including plants, animals, and humans. The present review specifies the POP along with their fate, persistence, occurrence, and risk analysis towards humans. The different biological POPs degradation methods, especially the microbial degradation using bacteria, fungi, algae, and actinomycetes, and their mechanisms were described. Moreover, the source, transport of POPs to the environmental sources, and the toxic nature of POPs were discussed in detail. Agricultural and industrial activities are distinguished as the primary source of these toxic compounds, which are delivered to air, soil, and water, affecting on the social and economic advancement of society at a worldwide scale. This review also demonstrated the microbial degradation of POPs and outlines the potential for an eco-accommodating and cost-effective approach for the biological remediation of POPs using microbes. The direction for future research in eliminating POPs from the environmental sources through various microbial processes was emphasized.

Authors: J Aravind Kumar, T Krithiga, S Sathish, A Annam Renita, D Prabu, S Lokesh, R Geetha, S Karthik Raja Namasivayam, Mika Sillanpaa

Full Source: The Science of the total environment 2022 Mar 24;154808. doi: 10.1016/j.scitotenv.2022.154808.

**Application of machine learning to predict the inhibitory activity of organic chemicals on thyroid stimulating hormone receptor**

2022-03-26

With the promotion of carbon neutrality, it is also important to synchronously promote the assessment and sustainable management of chemicals so as to protect public health. Humans and animals are possibly exposed to endocrine disruptors that have inhibitory effects on thyroid stimulating hormone receptor (TSHR). As such, it is important to identify chemicals that inhibit TSHR and to develop models to predict their inhibitory activity. In this study, 5952 compounds derived from a cyclic adenosine monophosphate (cAMP) analysis, a key signaling

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pathway in thyrocytes, were used to establish a binary classification model comparing methods that included random forest (RF), extreme gradient boosting (XGB), and logistic regression (LR). The prediction model based on RF showed the highest identification accuracy for revealing chemicals that may inhibit TSHR. For the RF model, recall was calculated at 0.89, balance accuracy was 0.85, and its receiver operating characteristic (ROC) curve-area under (AUC) was 0.92, indicating that the model had very high predictive capacity. The lowest CDocker energy (CE) and CDocker interaction energy (CIE) for chemicals and TSHR were determined and were subsequently introduced into the predictive model as descriptors. A regression model, extreme gradient boosting-Regression (XGBR), was successfully established yielding an  $R^2 = 0.65$  to predict inhibitory activity for active compounds. Parameters that included dissociation characteristics, molecular structure, and binding energy were all key factors in the predictive model. We demonstrate that QSAR models are useful approaches, not only for identifying chemicals that inhibit TSHR, but for predicting inhibitory activity of active compounds.

Authors: Xiaotian Xu, Chen Wang, Bingxin Gui, Xiangyi Yuan, Chao Li, Yuanhui Zhao, Christopher J Martyniuk, Limin Su

Full Source: Environmental research 2022 Mar 26;212(Pt A):113175. doi: 10.1016/j.envres.2022.113175.

**The Role of Exosomes in the Pathophysiology of Autoimmune Diseases I: Toxic Chemicals and Food**

2021-12-18

Autoimmune diseases affect 5-9% of the world's population. It is now known that genetics play a relatively small part in the pathophysiology of autoimmune disorders in general, and that environmental factors have a greater role. In this review, we examine the role of the exosome, an individual's lifetime exposure to external and internal factors, in the pathophysiology of autoimmune diseases. The most common of these environmental factors are toxic chemicals, food/diet, and infections. Toxic chemicals are in our food, drink, common products, the air, and even the land we walk on. Toxic chemicals can directly damage self-tissue and cause the release of autoantigens, or can bind to human tissue antigens and form neoantigens, which can provoke autoimmune response leading to autoimmunity. Other types of autoimmune responses can also be induced by toxic chemicals through various effects at the cellular and biochemical levels. The food we eat every day commonly has colorants, preservatives, or packaging-related chemical contamination. The food itself may be antigenic for susceptible individuals. The most common

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mechanism for food-related autoimmunity is molecular mimicry, in which the food's molecular structure bears a similarity with the structure of one or more self-tissues. The solution is to detect the trigger, remove it from the environment or diet, then repair the damage to the individual's body and health.

Authors: Aristo Vojdani, Elroy Vojdani

Full Source: Pathophysiology : the official journal of the International Society for Pathophysiology 2021 Dec 18;28(4):513-543. doi: 10.3390/pathophysiology28040034.

## ENVIRONMENTAL RESEARCH

### Carcinogenic and health risk assessment of respiratory exposure to Acrylonitrile, 1,3-Butadiene and Styrene (ABS) in a Petrochemical Industry Using the United States Environmental Protection Agency (EPA) Method

2022-04-01

**Purpose:** This study aimed to carcinogenic and health risk assessment of respiratory exposure to acrylonitrile, 1,3-butadiene, and styrene in the petrochemical industry. **Materials and methods:** This cross-sectional study was conducted in a petrochemical plant producing acrylonitrile, butadiene, and styrene (ABS) copolymers. Respiratory exposure with acrylonitrile, 1,3-butadiene and styrene was measured using methods No. 1604, 1024, and 1501 of the National Institute of Occupational Safety and Health, respectively. The US Environmental Protection Agency method was used to assess carcinogenic and health risks. **Results:** The average occupational exposure to acrylonitrile, 1,3-butadiene, and styrene was 560.82  $\mu\text{g. m}^{-3}$  for 1,3-butadiene, 122.8  $\mu\text{g. m}^{-3}$  for acrylonitrile and 1.92  $\mu\text{g. m}^{-3}$  for styrene. The average lifetime cancer risk (LCR) in the present study was  $2.71 \times 10^{-3}$  for 1,3-butadiene,  $2.1 \times 10^{-3}$  for acrylonitrile, and 6.6 for styrene. Also, the mean non-cancer risk (HQ) among all participants for 1,3-butadiene, acrylonitrile, and styrene was  $4.04 \pm 6.93$ ,  $10.82 \pm 14.76$ , and  $0.19 \pm 0.11$ , respectively. **Conclusion:** The values of carcinogenic and health risks in the majority of the subjects were within the unacceptable risk levels due to exposure to 1,3-butadiene,

This study aimed to carcinogenic and health risk assessment of respiratory exposure to acrylonitrile, 1,3-butadiene, and styrene in the petrochemical industry.

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acrylonitrile, and styrene vapors. Hence, corrective actions are required to protect the workers from non-cancer and cancer risks.

Authors: Vahid Ahmadi-Moshiran, Ali Asghar Sajedian, Ahmad Soltanzadeh, Fatemeh Seifi, Rozhin Koobasi, Neda Nikbakht, Mohsen Sadeghi-Yarandi

Full Source: International journal of occupational safety and ergonomics : JOSE 2022 Apr 1;1-21. doi: 10.1080/10803548.2022.2059171.

### Human viruses lurking in the environment activated by excessive use of COVID-19 prevention supplies

2022-03-22

Due to extensive COVID-19 prevention measures, millions of tons of chemicals penetrated into natural environment. Alterations of human viruses in the environment, the neglected perceiver of environmental fluctuations, remain obscure. To decipher the interaction between human viruses and COVID-19 related chemicals, environmental samples were collected on March 2020 from surroundings of designated hospitals and receivers of wastewater treatment plant effluent in Wuhan. The virus community and chemical concentration were respectively unveiled in virtue of virome and ultra-high-performance liquid chromatography-tandem mass spectrometry. The complex relationship between virus and chemical was ulteriorly elaborated by random forest model. As an indicator, environmental viruses were corroborated to sensitively reflect the ecological disturbance originated from pandemic prevention supplies. Chemicals especially trihalomethanes restrained the virus community diversity. Confronting this adverse scenario, Human gammaherpesvirus 4 and Orf virus with resistance to trihalomethanes flourished while replication potential of Macacine alphaherpesvirus 1 ascended under glucocorticoids stress. Consequently, human viruses lurking in the environment were actuated by COVID-19 prevention chemicals, which was a constant burden to public health in this ongoing pandemic. Besides, segments of SARS-CoV-2 RNA were detected near designated hospitals, suggesting environment as a missing link in the transmission route. This research innovatively underlined the human health risk of pandemic prevention supplies from the virus - environment interaction, appealing for monitoring of environmental viruses in long term.

Authors: Zhichao Hu, Lihua Yang, Jian Han, Zishu Liu, Yuxiang Zhao, Yihao Jin, Yaqi Sheng, Lizhong Zhu, Baolan Hu

Full Source: Environment international 2022 Mar 22;163:107192. doi: 10.1016/j.envint.2022.107192.

Due to extensive COVID-19 prevention measures, millions of tons of chemicals penetrated into natural environment.

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### Impact of benzo[a]pyrene with other pollutants induce the molecular alternation in the biological system: Existence, detection, and remediation methods

2022-03-26

The exposure of benzo [a]pyrene (BaP) in recent times is rather unavoidable than ever before. BaP emissions are sourced majorly from anthropogenic rather than natural provenance from wildfires and volcanic eruptions. A major under-looked source is via the consumption of foods that are deep-fried, grilled, and charcoal smoked foods (meats in particular). BaP being a component of poly aromatic hydrocarbons has been classified as a Group I carcinogenic agent, which has been shown to cause both systemic and localized effects in animal models as well as in humans; has been known to cause various forms of cancer, accelerate neurological disorders, invoke DNA and cellular damage due to the generation of reactive oxygen species and involve in multi-generational phenotypic and genotypic defects. BaP's short and accumulated exposure has been shown in disrupting the fertility of gamete cells. In this review, we have discussed an in-depth and capacious run-through of the various origins of BaP, its economic distribution and its impact as well as toxicological effects on the environment and human health. It also deals with a mechanism as a single compound and its ability to synergize with other chemicals/materials, novel sensitive detection methods, and remediation approaches held in the environment.

Authors: Kandasamy Saravanakumar, Sugavaneswaran Sivasantosh, Anbazhagan Sathiyaseelan, Alwarappan Sankaranarayanan, Kumar Vishven Naveen, Xin Zhang, Monica Jamla, Sampathkumar Vijayasathy, Veeraraghavan Vishnu Priya, Davoodbasha MubarakAli, Myeong-Hyeon Wang

Full Source: Environmental pollution (Barking, Essex : 1987) 2022 Mar 26;304:119207. doi: 10.1016/j.envpol.2022.119207.

### Maternal air pollution exposure during the first trimester of pregnancy and markers of inflammation and endothelial dysfunction

2022-03-29

**Background:** Maternal exposure to air pollutants has been associated with pregnancy complications and adverse birth outcomes. Endothelial dysfunction, an imbalance in vascular function, during pregnancy is considered a key element in the development of pre-eclampsia. Environmental exposure to particulate matter (PM) during

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the first trimester of pregnancy might increase maternal inflammatory status thus affecting fetal growth, possibly leading to preterm delivery. **Objectives:** The purpose of the study was to evaluate possible effects of PM10 and PM2.5 exposure on fetal growth in healthy pregnant women at the end of the first trimester of pregnancy by investigating the relationship between circulating biomarkers of inflammation (IL-6), early systemic prothrombotic effects (CRP, plasma fibrinogen, PAI-1) and endothelial dysfunction (sICAM-1 and sVCAM-1). **Methods:** 295 pregnant women were recruited. Individual PM exposure was assigned to each subject by calculating the mean of PM10 and PM2.5 daily values observed during the 30, 60, and 90 days preceding enrolment (long-term) and single lag days back to fourteen days (short-term), and circulating plasma biomarkers were determined. **Results:** For long-term exposure, we observed an increase in sVCAM-1 and a decrease of PAI-1 levels for each 10 µg/m<sup>3</sup> increase in PM10 concentration. Decreases in IL-6 and CRP levels were associated with each 10 µg/m<sup>3</sup> PM2.5 increase. For short-term exposure, the levels of sVCAM-1 and PAI-1 were found to be associated with PM10 exposure, whereas fibrinogen levels were associated with PM2.5 exposure. Maternal plasmatic fibrinogen levels were negatively associated with the crown-rump length (p-value = 0.008). **Discussion:** The present study showed that both long- and short-term exposures to PM are associated with changes in circulating levels of biomarkers in pregnant women reflecting systemic inflammation and endothelial dysfunction/activation. Our findings support the hypothesis that inflammation and endothelial dysfunction might have a central role in modulating the detrimental effects of air pollution exposure during pregnancy.

Authors: Paola Mozzoni, Simona Iodice, Nicola Persico, Luca Ferrari, Silvana Pinelli, Massimo Corradi, Stefano Rossi, Michele Miragoli, Enrico Bergamaschi, Valentina Bollati, INSIDE Consortium investigators, Rossella Alinovi, Annibale Biggeri, Francesca Borghi, Laura Cantone, Dolores Catelan, Andrea Cattaneo, Domenico Cavallo, Laura Dioni, Vincenza Dolo, Ilaria Giusti, Laura Grisotto, Mirjam Hoxha, Benedetta Ischia, Jacopo Mariani, Damiano Monticelli, Federica Rota, Irene Rota, Sabrina Rovelli, Andrea Spinazzè, Giorgia Stoppa, Marco Vicenzi

Full Source: Environmental research 2022 Mar 29;113216. doi: 10.1016/j.envres.2022.113216.

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## PHARMACEUTICAL/TOXICOLOGY

## A simple approach to assess the cancer risk of occupational exposure to genotoxic drugs in healthcare settings

2022-04-01

**Background:** Several drugs for human use possess genotoxic properties as a necessary consequence of their intended therapeutic effect (e.g. antineoplastics). Health workers may be exposed to these chemicals in various occupational settings such as dose preparation and administration. To date, there are no quantitative risk assessment models to estimate the cancer risk of health workers due to the handling of genotoxic drugs. We therefore developed a quantitative risk assessment model to assess the cancer risk of occupational exposure to genotoxic drugs in healthcare settings based on the threshold of toxicological concern (TTC) concept. This model was used to evaluate the cancer risk of health workers due to the handling of genotoxic drugs in modern health care facilities.

**Methods:** We modified the threshold of toxicological concern (TTC) concept to fit the purpose of occupational cancer risk assessment. The risk model underlying ICH guideline M7 (R1): "assessment and control of DNA reactive (mutagenic) impurities in pharmaceuticals to limit potential carcinogenic risk" was used as a starting point for our model. We conducted a short review of studies on the occupational exposure of health workers to genotoxic drugs. These occupational exposure data were compared to the acceptable exposure levels resulting from our TTC based risk model.

**Results:** Based on the threshold of toxicological concern (TTC) concept, we defined an acceptable daily intake (ADI) of 4 µg/day as threshold of no concern for the exposure of health workers to genotoxic drugs. Regarding the dermal exposure of health workers to genotoxic drugs, we derived a corresponding acceptable surface contamination level (ASCL) of 20 ng/cm<sup>2</sup>. Both ADI and ASCL are usually not exceeded in modern healthcare settings. Current safety precautions provide sufficient protection to health workers.

**Conclusions:** The application of our model indicates that workers in modern healthcare facilities are not at risk of developing work related cancer above widely accepted cancer risk levels due to the occupational exposure to genotoxic drugs. Hence, the present study may assist employers and public authorities to make informed

Several drugs for human use possess genotoxic properties as a necessary consequence of their intended therapeutic effect (e.g.

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decisions concerning the need for (further) protective measures and during risk communication to health workers.

Authors: Johannes Gerding, Lea Anhäuser, Udo Eickmann, Albert Nienhaus  
Full Source: Journal of occupational medicine and toxicology (London, England) 2022 Apr 1;17(1):8. doi: 10.1186/s12995-022-00349-z.

## Temporal trend and cross-sectional characterization of urinary concentrations of glyphosate in Japanese children from 2006 to 2015

2022-03-29

**Background:** Over the past two decades, domestic shipments of glyphosate (Gly), in the form of an ionic salt, have been increasing steadily in Japan. This increase has raising concerns about the effects of chemical exposure on children. The International Agency for Research on Cancer classified Gly as a "probably carcinogenic to humans (Group 2A)" in 2015. The purpose of the current study was to analyze Gly in urine samples of Japanese children to determine temporal changes, seasonal changes, and gender differences.

**Method:** First-morning urine samples were obtained from 50 Japanese children (4-6-year-old) in October of 2006, 2011, and 2015 (total = 150) to investigate the temporal trends in urinary Gly concentrations. Additionally, first-morning urine samples were collected from 3-year-old children in August-September of 2012 (summer; n = 42) and in February of 2013 (winter; n = 42) to investigate the seasonal and gender differences, and the correlations between urinary Gly concentrations and insecticide exposure biomarkers. Urine samples were analyzed to measure for Gly using a liquid chromatography with tandem mass spectrometry (LC-MS/MS).

**Results:** Detectable Gly concentrations were found in 41% of the 234 children. The 75th percentile and maximum concentrations of urinary Gly were 0.20 and 1.33 µg/L, respectively. The urinary Gly concentration in 2015 was significantly higher than in 2006, suggesting that the Gly exposure levels have been increasing. No seasonal or gender-specific differences in urinary Gly concentrations were observed, and no correlation with insecticide exposure biomarkers was found.

**Conclusion:** This study revealed that Gly exposure trends show an increase between 2006 and 2015, and that season and gender were not the exposure-determining

Over the past two decades, domestic shipments of glyphosate (Gly), in the form of an ionic salt, have been increasing steadily in Japan.

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factors. Overall, urinary concentrations of Gly were comparable with studies from other countries.

Authors: Hiroshi Nomura, Risa Hamada, Keiko Wada, Isao Saito, Nanami Nishihara, Yugo Kitahara, Satoru Watanabe, Kunihiko Nakane, Chisato Nagata, Takaaki Kondo, Michihiro Kamijima, Jun Ueyama  
Full Source: International journal of hygiene and environmental health 2022 Mar 29;242:113963. doi: 10.1016/j.ijheh.2022.113963.

## OCCUPATIONAL

### Tinnitus, sound intolerance, and mental health: the role of long-term occupational noise exposure

2022-03-31

**Purpose:** Whereas chronic noise exposure (CNE) is a known risk factor for tinnitus, little is known about how a history of CNE impacts tinnitus characteristics and its comorbid symptoms. **Methods:** Seventy-five participants with chronic tinnitus (59m/16f, 22-78 years, 48 with sensory-neural hearing loss, and 27 with a normal audiogram) including 43 individuals with (Tin-CNE group) and 32 without (Tin group) a history of long-term occupational noise exposure were studied. Tinnitus characteristics were rated by a visual analog scale, and tinnitus comorbid symptoms were scored using self-assessment questionnaires. **Results:** The Tin-CNE group showed reduced uncomfortable loudness level (ULL), sound tolerance, and quality of life (QoL), and increased tinnitus loudness, tinnitus handicap, anxiety, depression, insomnia severity, and tinnitus annoyance scores compared to the Tin group. Higher tinnitus loudness and a lower anxiety score were observed in participants with hearing loss relative to those without. Using a stepwise regression model also showed that tinnitus-related characteristics, hyperacusis, and tinnitus comorbid symptoms enhance one another. **Conclusions:** The findings were in support of accumulative evidence indicating the adverse auditory and non-auditory effects of CNE, including exacerbated sound intolerance and tinnitus-related psychiatric symptoms. The results also showed that tinnitus alone can affect mental health regardless of hearing loss.

Authors: Zahra Jafari, Thomas Copps, Glenn Hole, Femi Nyatepe-Coo, Bryan E Kolb, Majid H Mohajerani

Full Source: European archives of oto-rhino-laryngology : official journal of the European Federation of Oto-Rhino-Laryngological Societies (EUFOS) : affiliated with the German Society for Oto-Rhino-Laryngology - Head and Neck Surgery 2022 Mar 31. doi: 10.1007/s00405-022-07362-2.

Whereas chronic noise exposure (CNE) is a known risk factor for tinnitus, little is known about how a history of CNE impacts tinnitus characteristics and its comorbid symptoms.