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CHEMICAL EFFECTS

Investigation of the Effect of Exposure to Liquid Chemicals on the Strength Performance of 3D-Printed Parts from Different Filament Types

2025-06-12

Additive manufacturing (AM), particularly fused deposition modeling (FDM) 3D printing, has emerged as a versatile and accessible technology for prototyping and functional part production across a wide range of industrial applications. One of the critical performance-limiting factors in AM is the chemical resistance of thermoplastic materials, which directly influences their structural integrity, durability, and suitability in chemically aggressive environments. This study systematically investigates the chemical resistance of eight different widely utilized FDM filaments-acrylonitrile butadiene styrene (ABS), acrylonitrile styrene acrylate (ASA), polyamide (PA, Nylon), polycarbonate (PC), polyethylene terephthalate glycol (PETG), polylactic acid (PLA), polypropylene (PP), and polyvinyl butyral (PVB)-by examining their tensile strength and impact resistance after immersion in representative chemical agents: distilled water, ethanol (99.5%), isopropyl alcohol (75% and 99%), acetic acid (8%), hydrochloric acid (37%), hydrogen peroxide (30%), and acetone (99.5%). Quantitative mechanical testing was conducted in accordance with ASTM D638 and ASTM D256 standards, and statistical variability was accounted for using triplicate measurements with standard deviation analysis. The results reveal that PP exhibits the highest chemical resilience, retaining over 97% of its mechanical properties even after 7 days of immersion in aggressive solvents like acetone. PETG and ASA also demonstrated quite successful stability (>90% retention) in mildly corrosive environments such as alcohols and weak acids. In contrast, PLA, due to its low crystallinity and polar ester backbone, and PVB, due to its high amorphous content, showed substantial degradation: tensile strength losses exceeding 70% and impact resistance dropping below 20% in acetone. Moderate resistance was observed in ABS and PC, which maintained structural properties in neutral or weakly reactive conditions but suffered mechanical deterioration (>50% loss) in solvent-rich media. A strong correlation ($r > 0.95$) between tensile and impact strength reduction was found for most materials, indicating that chemical attack affects both static and dynamic mechanical performance uniformly. The findings of this study provide a robust framework for selecting appropriate 3D printing materials in applications exposed to solvents, acids, or oxidizing agents. PP is recommended for harsh chemical environments; PETG and ASA are suitable for moderate exposure scenarios, whereas PLA and PVB should be limited to low-risk, esthetic, or disposable applications.

Authors: Arslan Kaptan

Full Source: Polymers 2025 Jun 12;17(12):1637. doi: 10.3390/polym17121637.

Machine Learning and Large Language Models for Modeling Complex Toxicity Pathways and Predicting Steroidogenesis

2025-06-27

High-throughput screening and computational models have been effective in predicting chemical interactions with estrogen and androgen receptors, but similar approaches for steroidogenesis remain limited. To address this gap, we developed general steroidogenesis modulation models using data from 1,800 chemicals screened in H295R human adrenocortical carcinoma cells. A random forest model was validated using a prospective test set of 20 compounds (14 predicted active, 6 inactive), achieving 80% accuracy with conformal prediction adjustments. In parallel, we built classification and regression models based on IC50 data from ChEMBL for key steroidogenic enzymes, including CYP17A1, CYP21A2, CYP11B1, CYP11B2, 17β-HSD (1/2/3/5), 5α-reductase (1/2), and CYP19A1 (126-9,327 compounds per target). These models enable predictions of both general steroidogenesis inhibition and potential molecular targets. Additionally, we developed a transformer-based model (MolBART) to predict all end points simultaneously and validated this performance. Combined, these models may offer a rapid and scalable system for assessing chemical impacts on steroidogenesis, supporting chemical risk assessment, product stewardship, and regulatory decision-making.

Authors: Thomas R Lane, Patricia A Vignaux, Joshua S Harris, Scott H Snyder, Fabio Urbina, Sean Ekins

Full Source: Environmental science & technology 2025 Jun 27. doi: 10.1021/acs.est.5c04054.

Machine Learning Models Based on Enlarged Chemical Spaces for Screening Carcinogenic Chemicals

2025-06-27

Machine learning (ML) models for screening carcinogenic chemicals are critical for the sound management of chemicals. Previous models

were built on small-scale datasets and lacked applicability domain (AD) characterization that is necessary for regulatory applications of the models. In the current study, an enlarged dataset containing 1697 compounds (940 carcinogens and 757 non-carcinogens) was curated and employed to construct screening models based on 12 types of molecular fingerprints, four ML algorithms, and two graph neural networks. The AD of the optimal model was defined by a state-of-the-art characterization methodology (ADSAL) based on the analysis of structure-activity landscapes (SALs). Results showed that an optimal model based on the random forest algorithm with the PubChem fingerprints outperformed previous ones, with an area under the receiver operating characteristic curve of 86.2% on the validation set imposed with the ADSAL. The optimal model, coupled with the ADSAL, was employed to screen carcinogenic chemicals in the Inventory of Existing Chemical Substances of China (IECSC) and plastic additives datasets, identifying 1282 chemicals from the IECSC and 841 plastic additives as carcinogenic chemicals. The screening model coupled with ADSAL may serve as a promising tool for prioritizing chemicals of carcinogenic concern, facilitating the sound management of chemicals.

Authors: Chao Wu, Jingwen Chen, Yuxuan Zhang, Zhongyu Wang, Zijun Xiao, Wenjia Liu, Haobo Wang

Full Source: Chemical research in toxicology 2025 Jun 27. doi: 10.1021/acs.chemrestox.4c00523.

ENVIRONMENTAL RESEARCH

Assessment of vape shop built environment: airborne nicotine, particulate matter, ventilation, hazard identification, workplace practices, and safety perceptions

2025-06-19

Vape shops are established to sell electronic cigarette (EC) devices, e-liquids or e-juices, and other related accessories. EC use is prominent in vape shops and indoor EC use has been associated with elevated levels of nicotine and particulate matter (PM). This study assessed health and safety conditions, practices, building characteristics, nicotine, and PM concentrations in vape shops during business hours. Sixty-four vape shops were visited but only 15 vape shops consented to participate in this study. The majority of the vape shops had general ventilation (100%) and lounge areas (60%). No workers were observed not to use any personal protective equipment (PPE) such as gloves, aprons, face masks, etc. The mean and

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standard deviation of the shop volume, air flowrate, and air exchange rate were 12.361 ± 12.990 ft3, 1.203 ± 1.584 ft3/min, and 5.8 ± 2.8 h-1, respectively. The mean and standard deviation of the time-averaged concentration of nicotine, PM2.5, respirable PM, and total PM were 3.92 ± 3.73, 32.01 ± 25.85, 36.03 ± 30.91, and 43.67 ± 34.78 ug/m3, respectively. The nicotine, PM2.5, respirable PM, and total PM levels were significantly below their respective occupational or ambient guideline limits ($P < 0.05$). The vape shop environments in this study did not appear to pose a significant risk of second-hand exposure to elevated levels of airborne nicotine and PM during business hours.

Authors: Toluwanimi M Oni, Balaji Sadhasivam, Evan L Floyd

Full Source: Annals of work exposures and health 2025 Jun 19:wxaf018. doi: 10.1093/annweh/wxaf018.

Exploring the combined toxic effects of tri-n-butyl phosphate and polystyrene micro/nano-plastics on Daphnia magna under environmentally relevant concentrations

2025-06-27

As emerging pollutants prevalent in environments and biota, tri-n-butyl phosphate (TnBP) and microplastics (MPs) are harmful to aquatic organisms. Nevertheless, the combined toxicity of TnBP and MPs to aquatic organisms at environmental concentrations is still unknown. In this study, the co-toxic effects of both TnBP and micro/nano-polystyrene (MNPS) in Daphnia magna (D. magna) at environmental relevant concentrations were investigated for the first time. The results suggested that after 21 days of exposure to TnBP (1 μg/L) and MNPS (1 mg/L) alone or in combination, the expression of genes associated with growth and reproduction significantly decreased compared to the control group ($p < 0.05$), suggesting that MNPS and TnBP exerted growth and reproductive toxicity to D. magna. Moreover, the co-exposure group had lower gene expression levels compared to the single exposure group, implying that combined exposure could exacerbate toxicity impacts on D. magna's development and reproduction. The activities of enzymes related to oxidative stress and MDA levels in co-exposed group were higher than those in TnBP group, indicating that the MNPS enhanced TnBP-induced oxidative damage to D. magna. In addition, NPS might have caused greater oxidative stress and damage to D. magna than MPS, as higher enzyme activities and MDA levels were observed in the NPS groups. This study provided important information for a comprehensive understanding

of the combined aquatic toxicity of MNPS and TnBP at environmental concentrations.
Authors: Lixiang Zhong, Xiaoli Chen, Menghuan Zhang, Mingfu Lin, Jun Wang, Yumei Huang
Full Source: Environmental geochemistry and health 2025 Jun 27;47(8):289. doi: 10.1007/s10653-025-02605-7.

Harnessing Cannabis sativa L. for integrated environmental remediation and circular biomass use

2025-06-26
Cannabis sativa L. is gaining attention as a multifunctional species for environmental remediation due to its high biomass productivity, pollutant tolerance, and versatility. This review synthesizes its application across three environmental media: soil, water, and air. In soil systems, hemp has been investigated for the remediation of heavy metals, organic pollutants (f.ex., PAHs), and radionuclides, via mechanisms such as phytoextraction, rhizodegradation, and phytostabilization. Aquatic applications include biosorption (using raw and chemically modified hemp-derived materials to remove nutrients, heavy metals, dyes, and pharmaceuticals), hydroponic phytoremediation of landfill leachate, and field cultivation with treated wastewater irrigation. The review analysis reveals that hemp-based soil remediation, particularly for heavy metals, is the most developed field, with several experimental and field-scale studies. In contrast, aquatic and especially atmospheric applications remain underexplored and limited to laboratory-scale demonstrations. Most studies have been conducted in Europe, Asia, and North America, while regions such as Africa and South America remain significantly underrepresented. Despite promising laboratory results, large-scale implementation faces challenges such as lack of standardized protocols, uncertainties around post-remediation biomass use, and limited field validation. The review also discusses post-remediation valorization pathways, ranging from bioenergy and construction materials to reusable biosorbents, aligned with circular economy strategies. Key knowledge gaps and implementation barriers are identified, including regulatory constraints, limited field-scale validation, and the importance of aligning remediation goals with post-harvest biomass use. The cross-media perspective highlights hemp's promise as a scalable, sustainable tool for integrated environmental restoration.
Authors: Anna Jurga, Tomasz Rodziewicz, Martyna Grzegorzek, Anna Wdowikowska, Małgorzata Reda, Karol Leluk, Małgorzata Janicka, Bartosz Kaźmierczak
Full Source: The Science of the total environment 2025 Jun 26:992:179976. doi: 10.1016/j.scitotenv.2025.179976.

PHARMACEUTICAL/TOXICOLOGY

Cancer Care Affordability and the Healthcare Team: Expanding an Assessment of Clinical Perceptions and Attitudes in Nursing

2025-06-12
Objectives: To investigate nursing staff perceptions of financial toxicity (FT), its causes, and their role in mitigating it, as well as their prior training in addressing financial concerns.
Sample & setting: 535 RNs, advanced practice providers, and ancillary staff at an urban comprehensive cancer center.
Methods & variables: Respondents completed an online survey, adapted from prior work with physicians, as part of a quality improvement effort.
Results: Most respondents (76%) felt (a) they should play an active role in interventions to minimize FT and (b) they should be aware of a patient's risk of FT. A greater proportion of advanced practice providers felt they should play an active role in interventions compared to RNs (chi-square = 4.1, p = 0.04). Most respondents reported receiving no training on costs of care (87%) or how to have cost conversations (91%). Recommendations for mitigation included offering telehealth visits and changing follow-up intervals.
Implications for nursing: Nursing staff, including RNs and advanced practice providers, want to play an active role in preventing and mitigating FT but often feel they do not have the training to do so. Future efforts should focus on FT education for nursing staff.
Authors: Amy Caramore, Bayley Sharma, Justin O'Leary, Emeline M Aviki, Bridgette Thom
Full Source: Oncology nursing forum 2025 Jun 12;52(4):259-264. doi: 10.1188/25.ONF.259-264.

EARLYBIRD: catching the earliest changes of the bone and intervertebral discs in children at increased risk for scoliosis development with MRI - study protocol of a prospective observational cohort study

2025-06-26

Introduction: Adolescent idiopathic scoliosis (AIS) is an acquired deformity that develops in 2-4% of otherwise healthy children during adolescent growth, substantially reducing their quality of life and creating a life-long burden of disease. Despite many years of dedicated research, the cause and mechanism of AIS are still unknown and no effective curative treatments are available for children suffering from this spinal and chest deformity. To date, all etiological studies focused on children with an already established scoliosis. EARLYBIRD aims to uncover the earliest pathoanatomical changes in AIS, by studying longitudinal spinal growth in children at increased risk for scoliosis development with MRI, starting before adolescence.

Methods and analysis: This prospective observational cohort study will follow two groups: 60 adolescent girls (8-10 years old) who have an older sibling or parent diagnosed with AIS (cohort 1) and 60 adolescents with 22q11.2 deletion syndrome, a genetic microdeletion associated with 50% scoliosis prevalence (cohort 2). Data collection will be completely radiation-free and occur at baseline and yearly during adolescence up to 15 years of age in girls and up to 16 in boys. A comprehensive physical examination, a dedicated spine and chest MRI as well as a standing three-dimensional (3-D) spinal ultrasound will be obtained at each time point. The main parameter will be the longitudinal changes in segmental axial rotation during growth in subjects that do and do not develop AIS. Secondary endpoints are longitudinal changes in 3-D morphology of the bone and intervertebral discs (IVDs) during normal spinal development and during scoliosis development, determining biomarkers for bone growth, implementing radiation-free imaging methods for spinal monitoring in adolescent patients at risk for scoliosis development and use these for spinal skeletal maturity and patient-specific spinal biomechanical analyses.

Ethics and dissemination: This protocol has been approved by the Medical Ethics Committee NedMed and is registered on clinicaltrials.gov (NCT05924347). Written informed consent will be obtained from all parents/legal representatives. Key findings will be disseminated via peer-

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reviewed journals and presentation at conferences. This study is funded by the European Research Council.

Authors: Peter P G Lafranca, Hilde W Stempels, Steven de Reuver, Michiel L Houben, Joeri Kok, Moyo C Kruyt, René M Castelein, Peter R Seevinck, Tijl van der Velden, Yulia M Shcherbakova, Keita Ito, Tom P C Schlösser

Full Source: BMJ open 2025 Jun 26;15(6):e098929. doi: 10.1136/bmjopen-2025-098929.

OCCUPATIONAL

Artisanal Gold Mining in Mongolia: Silica Exposure and Silicosis Risk Factors-Field Survey

2025-06

Background: Silicosis remains a critical occupational health challenge, particularly among artisanal and small-scale gold miners (ASGM). This study investigates the prevalence of silicosis and its associated risk factors, while assessing the levels of respirable dust and crystalline silica exposure in Mongolian artisanal miners.

Methods: A cross-sectional survey was conducted with 124 employees of the Tsagaan Tsakhir artisanal gold miners in Bayankhongor Province, Mongolia. Participants completed questionnaires and underwent medical exams, including spirometry and X-rays. Dust samples (n = 10) were collected during a working day, and the workplace was divided into underground exploration and outdoor grinding areas. Multivariate analysis evaluated risk factors for silicosis.

Results: Underground quarrying (dry) showed the highest exposures (dust geometric mean (GM): 8.107 mg/m3; silica GM: 2.156 mg/m3), followed by grinding (dust GM: 1.374 mg/m3; silica GM: 0.555 mg/m3). Wet quarrying and packaging tasks had significantly lower levels. A total of 124 male participants (mean age 35.9, mean work years 5.7) were included. Twenty four participants (19.4%) had silicosis, with 58% having profusion 2 or higher. Multivariate analysis showed increased odds of silicosis with longer work years (OR = 2.6) and specific work positions (e.g., underground drilling: OR = 6.23).

Conclusion: Artisanal gold miners in Mongolia face significant health risks due to high silica exposure and inadequate protective measures. Urgent interventions, including improved dust control and routine medical

surveillance, are needed to mitigate silicosis risks in this vulnerable population.
Authors: Densenbal Dansran, Ichinnorov Dashtseren, Garamjav Khishigdavaa, Solongo Bandi, Byambadolgor Dagviikhorol, Naransukh Damiran, Bayanmunkh Tseden, Bat-Erdene Moyor, Jun-Pyo Myong
Full Source: Safety and health at work 2025 Jun;16(2):187-192. doi: 10.1016/j.shaw.2025.04.005.

Modeling the impact of health care worker masking to reduce nosocomial SARS-CoV-2 transmission under varying adherence, prevalence, and transmission settings

2025-06-27
Objectives: To understand the scenarios where health care worker (HCW) masking is most impactful for preventing nosocomial transmission.
Methods: A mathematical agent-based model of nosocomial spread with masking interventions. Masking adherence, community prevalence, disease transmissibility, masking effectiveness, and proportion of breakroom (unmasked) interactions were varied. The main outcome measure is the total number of nosocomial infections in patients and HCW populations over a simulated three-month period.
Results: HCW masking around patients and universal HCW masking reduces median patient nosocomial infections by 15% and 18%, respectively. HCW-HCW interactions are the dominant source of HCW infections and universal HCW masking reduces HCW nosocomial infections by 55%. Increasing adherence shows a roughly linear reduction in infections. Even in scenarios where a high proportion of interactions are unmasked "breakroom" interactions, masking is still an effective tool assuming adherence is high outside of these areas. The optimal scenarios where masking is most impactful are those where community prevalence is at a medium level (around 2%) and transmissibility is high.
Conclusions: Masking by HCWs is an effective way to reduce nosocomial transmission at all levels of mask effectiveness and adherence. Increases in adherence to a masking policy can provide a small but important impact. Universal HCW masking policies are most impactful should policymakers wish to target HCW infections. The more transmissible a variant in circulation is, the more impactful HCW masking is for reducing infections.

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Policymakers should consider implementing masking at the point when community prevalence is optimum for maximum impact.
Authors: Timothy D Whiteley, James Stimson, Colin S Brown, Julie V Robotham, Stephanie Evans
Full Source: Infection control and hospital epidemiology 2025 Jun 27:1-7. doi: 10.1017/ice.2025.78.