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ศูนย์ความเป็นเลิศด้านอนามัยสิ่งแวดล้อมและพิษวิทยา
Center of Excellence on Environmental Health and Toxicology

สำนักงานโครงการพัฒนาระดับบัณฑิตศึกษาและวิจัยด้านวิทยาศาสตร์และเทคโนโลยี
S&T Postgraduate Education and Research Development Office

การประชุมวิชาการประจำปี 2569

เรื่อง ประเด็นท้าทายใหม่ด้านอนามัยสิ่งแวดล้อม Emerging Issues in Environmental Health

Abstracts

August 15th, 2026

at the Convention Center, Chulabhorn Research Institute, Bangkok, Thailand



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Research Direction / Research Focus

Research Direction	Research Focus
1. Impact of the Environment on Human Health	1.1 Impacts of chemicals and climate change on human health and disease development and factors modulating such impacts
2. Development of Technology for Environmental and Health Research	2.1 Development of biologically active compounds for control, prevention and treatment of environmental health problems/diseases 2.2 Innovative technology for production, detection, treatment, detoxification, remediation, reduction, reuse and recycling of chemicals
3. Safety and Risk Assessment and Management of Chemicals and Environmental Management	3.1 Safety and toxicity of food, drugs and other chemicals including biofuels 3.2 Environment / health impact assessment and management

Abbreviations

CGI	=	Chulabhorn Graduate Institute
CRI	=	Chulabhorn Research Institute
PH	=	Faculty of Public Health, Mahidol University
SCBI	=	Environmental Biology / Biology, Faculty of Science, Mahidol University
EHT	=	Center of Excellence on Environmental Health and Toxicology
PERDO	=	S&T Postgraduate Education and Research Development Office

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**Impacts of chemicals and
climate change on human
health and disease
development and factors
modulating such impacts**

**APOPTOTIC EFFECTS OF TRICLOSAN EXPOSURE
IN FOLLICULAR THYROID CARCINOMA FTC-133 CELLS**

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Triclosan (TCS) is a widely used antimicrobial agent in personal care products that persists in the environment and raises concerns about potential effects on human health. This study aimed to investigate the apoptotic effects of TCS in FTC-133 cells. MTT cell viability assay was used to determine cytotoxicity, and apoptosis was evaluated using Annexin V-based analysis. Expression of apoptosis-associated proteins, including cleaved PARP, cleaved caspase-3, and DR5, was analyzed to elucidate the underlying mechanisms. In addition, Mitochondrial Outer Membrane Permeabilization (MOMP) was assessed by measuring mitochondrial membrane potential ($\Delta\Psi$) using the JC-1 assay to evaluate mitochondrial involvement. The results showed that TCS treatment significantly reduced cell viability and increased Annexin V-positive cells at 24 h. These results indicate that TCS can cause apoptosis in FTC-133 cells. Moreover, TCS induced caspase activation, as evidenced by increased cleaved caspase-3 and cleaved PARP at 3 and 24 h after TCS treatment, suggesting that caspase activation participates in TCS-induced apoptosis. Furthermore, $\Delta\Psi$ measurements revealed a significant reduction following TCS treatment at 1 and 3 h. Additionally, an increase in DR5 expression was observed at 24 h after TCS treatment, suggesting that TCS may also induce extrinsic apoptosis. Together, the findings of the present study suggest that TCS induces apoptosis in FTC-133 cells, associated with early mitochondrial dysfunction and DR5-related signaling.

Keywords: Triclosan, Apoptosis, DR5 signaling, Mitochondrial dysfunction, Thyroid, Thyrocytes

**ASSESSMENT OF GREENHOUSE GAS EMISSION REDUCTIONS FROM
BANGKOK METROPOLITAN ADMINISTRATION DISTRICT OFFICES:
A CASE STUDY OF SATHON DISTRICT OFFICE**

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Global warming and climate change have become critical global challenges driven primarily by greenhouse gas (GHG) emissions from human activities. Public sector organizations play an important role in reducing emissions through improved energy efficiency and effective carbon management strategies. This study aimed to assess the organizational carbon footprint (CFP) of the Sathorn District Office, Bangkok, Thailand, identify major sources of greenhouse gas emissions, and propose appropriate mitigation measures to support sustainable organizational management. Secondary data on greenhouse gas emissions generated from the operational activities of the Sathorn District Office were collected for the reporting period from October 2023 to September 2024. The organizational greenhouse gas inventory was developed by classifying emissions into Scope 1, Scope 2, and Scope 3 in accordance with the Carbon Footprint for Organization (CFO) Guidelines issued by the Thailand Greenhouse Gas Management Organization (TGO), consistent with ISO 14064-1:2018, the Greenhouse Gas Protocol, and ISO/TR 14069:2013. The results showed that the total organizational greenhouse gas emissions were 43,568.66 tCO_{2e}. Scope 3 emissions were the dominant contributor, accounting for the majority of total emissions (41,970.58 tCO_{2e}), followed by Scope 2 emissions (826.32 tCO_{2e}) and Scope 1 emissions (771.76 tCO_{2e}).

The findings indicate that greenhouse gas mitigation efforts should prioritize reducing Scope 3 emissions, particularly those associated with municipal waste management, while continuing to improve energy efficiency and fuel management in operational activities. This study provides baseline greenhouse gas emission data for the Sathorn District Office and offers practical guidance for local government organizations in developing carbon footprint inventories and implementing effective mitigation strategies in support of long-term carbon neutrality and national climate change goals.

Keywords: Organizational Carbon Footprint, Greenhouse Gas Inventory, Greenhouse Gas Emissions, Public Sector, Greenhouse Gas Mitigation

**CHARACTERIZATION OF A NOVEL MECHANISM ASSOCIATED
WITH REDUCED β -LACTAM ANTIBIOTICS SUSCEPTIBILITY
IN *Stenotrophomonas maltophilia***

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Stenotrophomonas maltophilia is an opportunistic multidrug-resistant pathogen that poses a significant therapeutic challenge because of its intrinsic resistance to multiple classes of antimicrobial agents. Although ceftazidime/avibactam (CZA) has demonstrated activity against multidrug-resistant Gram-negative bacteria, reduced susceptibility to this agent has increasingly been reported, and the underlying resistance mechanisms in *S. maltophilia* remain poorly understood. This study aimed to characterize the antimicrobial susceptibility profile of a CZA-resistant mutant and investigate the contribution of a TonB-dependent energy transduction (TBDET)-associated gene to the observed phenotype.

A spontaneous CZA-resistant mutant, designated KCA4, was generated from *S. maltophilia* K279a by serial exposure to increasing concentrations of CZA using the broth disk elution (BDE) method. Antibiotic susceptibility was evaluated by the Kirby-Bauer disk diffusion assay, genomic alterations were identified by whole-genome sequencing (WGS), and functional validation was performed through complementation with the TBDET-associated gene. Compared with the parental strain, KCA4 exhibited reduced susceptibility to CZA and altered susceptibility to multiple antibiotic classes, particularly β -lactam antibiotics. WGS identified a frameshift mutation in the TBDET-associated gene. Complementation with the TBDET-associated gene restored antibiotic susceptibility to a level comparable with that of the parental strain, demonstrating that disruption of this gene contributes to the reduced susceptibility observed in KCA4.

These findings demonstrate that loss of TBDET function contributes to reduced susceptibility to CZA and several additional antimicrobial agents in *S. maltophilia*. This study identifies the TonB-dependent transport system as a potential determinant of antimicrobial susceptibility and provides new insight into a non-classical mechanism of antimicrobial resistance in this clinically important pathogen.

Keywords: *Stenotrophomonas maltophilia*, Multidrug resistance (MDR), β -lactam resistance, Ceftazidime/avibactam (CZA), TonB-dependent energy transduction (TBDET)

EFFECTS OF DIISONONYL CYCLOHEXANE -1,2- DICARBOXYLATE (DINCH) ON HUMAN HEMATOPOIETIC DEVELOPMENT

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Among the various types of plasticizers available, phthalates have been the most extensively utilized. Dibutyl phthalate (DBP) and Di(2-ethylhexyl) phthalate (DEHP) are among the most well-recognized phthalates and have been identified in numerous studies as hazardous substances due to their endocrine-disrupting properties and associated risks to human health. In response to these concerns, there has been a shift toward using non-phthalate alternative plasticizers, such as Diisononyl cyclohexane-1,2-dicarboxylate (DINCH). Following its approval by the European Food Safety Authority in 2007, DINCH is increasingly used as a substitute for phthalates in several consumer products, medical devices, and personal care items, leading to widespread human exposure. The detection of metabolites of these plasticizers in maternal and cord blood confirms prenatal exposure during critical developmental windows. However, toxicity data of DINCH remain limited, particularly regarding its effects on stem cell biology and hematopoietic differentiation. This study aimed to investigate the effects of exposure to selected plasticizers on pluripotency maintenance and hematopoietic differentiation using an *in vitro* differentiation model. Human induced pluripotent stem cells (iPSCs) were exposed to DBP, DEHP, and DINCH (0.1-10 μ M) during pluripotency maintenance or exposed to DEHP and DINCH (0.01-10 μ M) during hematopoietic differentiation. The expression of pluripotency-associated genes was assessed on Day3 by quantitative real-time PCR, while development of hematopoietic stem and progenitors (HSPCs) was evaluated by flow cytometric analysis of CD34, CD43, and CD45 expression. Initial screening showed that DBP and DINCH did not significantly affect the expression of *NANOG*, *SOX2*, or *OCT3/4* transcripts. In contrast, treatment with 10 μ M DEHP significantly reduced *SOX2* expression. Therefore, DEHP and DINCH were selected for further investigation during hematopoietic differentiation. The results showed that both DINCH and DEHP significantly reduced the number of CD34⁺ cells. However, only DEHP significantly increased CD34⁺CD43⁺CD45⁻ cells while decreased CD34⁺CD43⁺CD45⁺ cells. Collectively, these findings demonstrate that DEHP exerts more pronounced effects than DINCH on hematopoietic progenitor development and maturation highlighting the utility of human iPSC-based models for evaluating the developmental toxicity of emerging plasticizers.

Keywords: Dibutyl phthalate, Di(2-ethylhexyl) phthalate, Diisononyl cyclohexane-1,2-dicarboxylate, Human inducible pluripotent stem cells, Hematopoietic differentiation.

EFFECTS OF *IN UTERO* EXPOSURE TO AIR POLLUTION ON MATERNAL AND NEONATAL METABOLOMIC PROFILES

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Exposure to traffic-related carcinogenic air pollutants during pregnancy is a significant public health concern due to their potential health risks to both mothers and their newborns. Metabolomics offers a powerful approach to characterize metabolic alterations associated with environmental exposures and to elucidate the biological pathways linking maternal exposure to fetal health. This study aimed to investigate impacts of traffic-related volatile organic compounds (VOCs) on urinary metabolomics profiles, oxidative DNA damage and metabolomics associated biological pathways in mothers and newborns.

A total of 79 mother-newborn pairs participated in the study, residing in high traffic-congested areas (47 pairs) and low traffic density (32 pairs). Urine samples were collected from pregnant subjects throughout the pregnancy period and from the newborns at birth. The levels of targeted urinary VOC metabolites, mandelic acid (MA), phenylglyoxylic acid (PGA), trans,trans-muconic acid (ttMA), and hippuric acid (HA), along with oxidative DNA damage, 8-hydroxydeoxyguanosine (8-OHdG), were measured by HPLC-MS/MS. When compared to low-traffic exposure group, high traffic-exposure mothers had significant higher urinary concentrations of MA at the 1st trimester (120.94 vs 110.90 mg/g creatinine, $p < 0.05$) and ttMA at 2nd trimester (24.74 vs 21.82 mg/g creatinine, $p < 0.05$). Maternal urinary concentrations of PGA and HA were slightly increased in high-exposure group across three trimesters of pregnancy. Maternal urinary 8-OHdG were 1.4-fold significantly higher in the high-exposure group at the 1st trimester ($p < 0.01$). In newborns, high-exposure group had significantly higher concentrations of urinary MA and HA ($p < 0.05$) by 2.26- and 2.03-fold, respectively. Urinary 8-OHdG concentrations were lower in high-exposure newborns.

An untargeted LC-MS/MS-based approach in urinary metabolomics, coupled with spectral library matching, identified a number of VOC-related metabolites with significant differences between exposure groups in both maternal and newborn urine. The metabolomic profiles between maternal and neonatal urine exhibited strong correlations for VOC-related metabolites. Pathway enrichment analysis highlighted considerable metabolic disruptions linked to airborne VOC exposure, mainly impacting amino acid biosynthesis and metabolism in both pregnant women and newborns.

In conclusion, these findings demonstrate that traffic-related VOCs exposure during pregnancy was associated with metabolic perturbations in both mothers and their newborns which may influence fetal metabolic programming. The altered metabolic pathways provide valuable insights for early risk assessment and the development of preventive strategies to improve maternal and newborn health outcomes.

Keywords: Volatile organic compounds, Traffic-related air pollution, oxidative DNA damage, Urinary VOC metabolites, Metabolic pathways

**FACTORS AFFECTING HYGIENE BEHAVIOR OF FOOD HANDLERS
IN PRIMARY SCHOOLS, MUEANG DISTRICT,
PHITSANULOK PROVINCE**

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This study was a cross-sectional design study. The objective was to study the factors affecting the hygiene behavior of food handlers in primary schools in Mueang District, Phitsanulok Province. The sample consisted of 90 food handlers in primary schools. The instruments used to collect data from the sample consisted of a questionnaire. The statistics used for data analysis were frequency, percentage, mean, standard deviation, and multiple regression analysis was used to analyze factors influencing food hygiene practices among food handlers. The results of the study revealed that the sample group were females (83.3%), aged 40 - 59 years (51.1%), with more than 10 years of work experience (43.3%), and 54.4% had previously received food hygiene training. The study found that food handlers had a high level of knowledge of food hygiene (93.3%, mean 17.4 ± 1.2), a high level of health beliefs (96.7%, mean 131.7 ± 10.6), and a high level of hygienic behavior (100.0%, mean 88.1 ± 5.7). Multiple regression analysis revealed that chronic diseases, monthly income, and knowledge level significantly predicted hygienic behavior ($R^2 = 0.265$, Adjusted $R^2 = 0.240$, $F = 10.356$, $p < 0.001$), explaining 26.5% of the variance. Health beliefs were not included in the predictive equation. The study highlights the need for continuous training and monitoring. In particular, washing raw materials and separating cutting boards for raw and cooked food are crucial in maintaining and improving hygienic practices and preventing foodborne and waterborne diseases.

Keyword: Food sanitation, Food handlers, Hygiene behavior, Primary schools

IN VITRO MODULATORY EFFECTS OF SODIUM ARSENITE ON CHOLANGIOCARCINOMA-FIBROBLAST INTERACTIONS

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Cholangiocarcinoma (CCA) is an aggressive cancer characterized by a desmoplastic tumor microenvironment (TME), where interactions between cancer cells and stromal cells contribute to cancer progression. Arsenic exposure has been associated with hepatobiliary malignancies, including CCA, but the mechanisms linking arsenic exposure to CCA progression remain poorly understood. This study investigated whether sodium arsenite exposure alters CCA-derived paracrine signaling and the molecular responses of fibroblasts. RNA sequencing was performed on LX-2 cells following direct sodium arsenite exposure or treatment with conditioned media (CM) collected from HuCCA-A4 cells cultured in the presence or absence of sodium arsenite. Our results demonstrated that direct arsenic exposure induced oxidative stress- and inflammation-related pathways in LX-2 cells, while CM from HuCCA-A4 cells promoted a robust inflammatory response in LX-2 cells, with NicheNet analysis prioritizing IL1B-IL1R1 as a potential ligand-receptor interaction. Although NicheNet analysis continue to prioritize IL1B-IL1R1 signaling in LX-2 cells treated with CM from sodium arsenite-exposed HuCCA-A4 cells, these cells exhibited a distinct transcriptional profile characterized by enrichment of protein synthesis, cellular stress adaptation, and proliferative signaling pathways, accompanied by reduced inflammatory signaling. These findings demonstrate that sodium arsenite exposure reshapes CCA-fibroblast communication by modifying cancer cell-derived paracrine signaling and altering fibroblast transcriptional responses. Such changes may contribute to remodeling of the tumor microenvironment and represent a potential mechanism linking environmental arsenic exposure to CCA progression.

Keywords: Cholangiocarcinoma, Arsenic, Sodium arsenite, Cancer-associated fibroblasts, Hepatic stellate cells, Conditioned medium, RNA-seq.

INTEGRATIVE STUDY OF GENETIC DAMAGE AND TRANSCRIPTOMIC ANALYSIS IN NEWBORNS PRENATALLY EXPOSED TO AIR POLLUTION

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Traffic-related air pollution particularly particulate pollution, fine and ultrafine particulate matters and PAHs, are increasingly recognized for their contribution to potential health risk. Growing evidence suggests that prenatal exposure to air pollution during pregnancy can adversely impact fetal development and increase the likelihood of childhood health problems. This study aimed to investigate genetic damage and transcriptomic alterations in the cord blood of newborns prenatally exposed to traffic-related air pollution. In addition, immunocytochemistry was performed to identify the DNA damage associated with prenatal exposure to air pollution in cord blood and, performed the transcriptomic analysis to identify gene expression alterations and identify molecular pathways potentially involved in DNA damage.

A total of 80 newborns' cord blood samples consisted of 45 high- and 35 low-traffic exposed newborns. Immunocytochemistry detection of DNA damage was performed in cord blood leukocytes to determine 8-hydroxy-2'-deoxyguanosine (8-OHdG), 8-nitroguanine (8-nitroG), and benzo[a]pyrene-DNA adduct (BPDE-DNA adduct). When compared to low-exposed group, the mean fluorescent intensity for all DNA damage biomarkers was significantly higher (Adjusted p-value < 0.0001) in the high-exposed group, showing 1.50-fold (88.00 vs 58.56), 1.42-fold (91.46 vs 64.51), and a 1.51-fold (105.92 vs 70.36) for 8-OHdG, 8-nitroG and BPDE-DNA adduct, respectively. RT-PCR analysis of transcription expression of DNA repair gene, *hOGG1*, was 1.62-fold significant reduction (4.07 ± 1.1 vs 6.54 ± 1.4 , $p < 0.0001$) in the high-exposure group. The association between 8-OHdG and *hOGG1* showed a significant negative correlation ($r = -0.3422$, $p < 0.05$). Under the transcriptomic analysis; gene set enrichment analysis (GSEA) revealed that differentially expressed genes were primarily associated with mitophagy, autophagy of mitochondria, myeloid leukocyte activation, leukocyte mediated cytotoxicity, regulation of innate immune response.

In conclusion, the study demonstrates prenatal exposure to traffic-related air pollution was associated with significantly increased DNA damage including 8-OHdG, 8-nitroguanine, and BPDE-DNA adducts, while reducing the *hOGG1* expression in cord blood. Additionally, the transcriptomic findings, together with the increased 8-OHdG levels, suggest that prenatal exposure to traffic-related air pollution induces oxidative DNA damage, and it may contribute to mitochondrial dysfunction, activation of inflammatory and innate immune response pathways. Overall, these findings will help to identify, and clarify mechanistic pathways of developmental toxicity in newborns.

Keywords: Traffic-related air pollution, Prenatal exposure, DNA damage, Gene expression, Transcriptomic

**MULTIDRUG RESISTANCE REGULATION BY TetR-type
REGULATOR AmcR IN *S. maltophilia***

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Antimicrobial resistance (AMR) represents a critical global threat and remains one of the major challenges in public health driven by the rising number of ineffective antimicrobial agents. This study focuses on *Stenotrophomonas maltophilia*, an opportunistic pathogen that can cause nosocomial infections. It is known as a multidrug-resistant bacterium due to its intrinsic resistance to multiple broad-spectrum antibiotics and its ability to acquire novel antibiotic resistance traits. The *amcR* has been identified in *S. maltophilia*, located upstream of *amcP1* gene, encoding a putative adaptor protein and *amcP2* encoding a putative multidrug efflux pump protein belonging to the resistance nodulation and cell division (RND) superfamily, suggesting an operonic structure. The *amcR* encodes a TetR-type transcriptional repressor, which is associated with the regulation of genes involved in bacterial antimicrobial resistance through one-component signal transduction system. A molecular docking study was performed with the most active compounds, including several antibiotics against *S. maltophilia* AmcR protein. The potential binding affinity of the ligands to the AmcR protein are ciprofloxacin, ceftazidime, amoxicillin and trimethoprim with CNN affinity score (pK) of 6.879, 7.532, 6.604 and 6.616, respectively. Deletion of *amcR* resulted in increased resistance of *S. maltophilia* to several antibiotics, such as, levofloxacin, ciprofloxacin, tetracycline, minocycline, ceftazidime and amoxicillin-clavulanic acid. These findings suggest that the absence of AmcR increased antibiotic resistance in *S. maltophilia*, which possibly due to upregulation of AmcP1-AmcP2 efflux pumps.

Keywords: *Stenotrophomonas maltophilia*, AmcR, Antimicrobial resistance (AMR), TetR-type regulator

**ORGANIZATION CARBON FOOTPRINT ASSESSMENT
OF PROMKIRI HOSPITAL, NAKHON SI THAMMARAT PROVINCE**

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This research aimed to assess the organizational carbon footprint of Promkiri Hospital, Nakhon Si Thammarat Province. Activity data related to greenhouse gas (GHG) emissions were collected to estimate carbon footprint for fiscal year 2025. GHG emission factors from the Thai Greenhousgas Organization (TGO) and relevant publications were applied. The emission sources were categorized into three scopes: direct GHG emissions (Scope 1), indirect GHG emissions from energy consumption (Scope 2), and other indirect GHG emissions (Scope 3). The results showed that the total carbon footprint amounted to 464 tCO₂eq. Among the three scopes, Scope 2 accounted for the largest share of emissions at 232 tCO₂eq, representing 50.22% of the total emissions and attributable mainly to the hospital's electricity consumption. This was followed by Scope 3, which generated 174 tCO₂eq, representing 37.66% of the total emissions and driven primarily by employee commuting. Scope 1 contributed 56 tCO₂eq, representing 12.12% of the total emissions and was mainly associated with fugitive emissions. The findings of this study will serve as a baseline for developing strategies to reduce GHG emissions from the hospital's operations and support the transition toward a low-carbon hospital.

Keywords: Climate change, Global warming, Hospital, Carbon footprint, GHG emissions

**REFINEMENT AND SENSITIVITY ASSESSMENT OF A LAMP ASSAY
FOR DETECTING wAlbB *WOLBACHIA* IN *Aedes aegypti***

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Mosquito-borne diseases transmitted by *Aedes aegypti*, including dengue, chikungunya, Zika, and yellow fever, remain major public health concerns. As rising global temperatures may expand mosquito vector ranges, effective vector control and monitoring strategies are increasingly important. This study developed and optimized a loop-mediated isothermal amplification (LAMP) assay for detecting the wAlbB *wsp* gene in wAlbB-transinfected Thai *Ae. aegypti*. The optimized assay used 66°C and a 30-min incubation time, detecting *wsp* standard DNA at 100 pg/μL. Matrix spike assays confirmed successful *wsp* detection in mosquito rearing water, larvae, and adult female extracts, with no amplification in non-spiked controls. The assay also detected wAlbB *wsp* directly from crude DNA extracted from a single transinfected mosquito within 20 min. These findings suggest that LAMP is a simple, rapid preliminary method for *Wolbachia* detection and could be further developed for field monitoring applications.

Keywords: *Aedes aegypti*; *Wolbachia*; wAlbB; Loop-mediated isothermal amplification

**Development of biologically
active compounds for control,
prevention and treatment of
environmental health problems
/diseases**

**ANDROGRAPHOLIDE INDUCES APOPTOSIS
IN PRIMARY EFFUSION LYMPHOMA (PEL) CELLS**

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Primary effusion lymphoma (PEL) is an aggressive large B-cell non-Hodgkin lymphoma (NHL) that is typically found in immunocompromised individuals and those chronically infected with Kaposi's sarcoma-associated herpes virus (KSHV), also known as human herpesvirus 8 (HHV-8). PEL patients have a poor prognosis, with a median survival time of approximately 5–9 months and often exhibit resistance to conventional chemotherapy. Andrographolide, a bioactive diterpenoid lactone isolated from *Andrographis paniculata*, has demonstrated anticancer activity against several types of cancer. Therefore, its potential therapeutic effects against PEL were investigated in this study. The cytotoxic and pro-apoptotic effects of andrographolide were evaluated in the PEL cell line (BCBL-1). Using the MTT assay, andrographolide exhibited concentration-dependent cytotoxicity against BCBL-1 cells, with IC₅₀ values of 87.96 μ M and 37.29 μ M after 24 and 48 h of treatment, respectively. To further investigate its pro-apoptotic activity, Western blot analysis of key proteins involved in the caspase signaling pathway was performed in BCBL-1 cells treated with 50 and 100 μ M of andrographolide. The results revealed markedly increased expression of cleaved caspase-9 and poly (ADP-ribose) polymerase (PARP) in andrographolide-treated cells, indicating activation of apoptotic pathways following treatment. These findings suggest that andrographolide exerts potent cytotoxic and apoptosis-inducing effects against PEL cells and provide a foundation for future *in vivo* studies evaluating andrographolide as a potential therapeutic agent for PEL.

Keywords: Primary effusion lymphoma (PEL), Andrographolide, Anticancer, Apoptosis

**ANDROGRAPHOLIDE INHIBITS CELL PROLIFERATION
BY MODULATING CELL-CYCLE REGULATORS
IN PRIMARY EFFUSION LYMPHOMA CELLS**

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Primary effusion lymphoma (PEL) is an aggressive, body cavity-based B-cell lymphoma with poor prognosis and limited therapeutic options, highlighting the need for novel targeted agents. Andrographolide, a diterpenoid compound from *Andrographis paniculata*, has shown promising anti-tumor activity, but its effects on PEL remain unclear. This study investigated the impact of andrographolide on GTO cell viability and cell-cycle regulation. Treatment with increasing concentrations of andrographolide (0–140 μ M) for 24h reduced GTO cell viability in a dose-dependent manner, with an IC_{50} of approximately 74.82 μ M. Moreover, andrographolide altered the expression of key regulators involved in G1 checkpoints. Specifically, it decreased expression of CDK4 and CDK6 while upregulating p53, p21 and p16, and increased the level of phosphorylated p38 MAPK, suggesting an activation of p38–p53–CDK inhibitor signaling axis leading to G1 cell-cycle arrest. These findings indicate that andrographolide suppresses GTO cell proliferation through the modulation of cell-cycle regulatory proteins, supporting its potential as a candidate therapeutic agent for primary effusion lymphoma.

Keywords: Primary Effusion Lymphoma (PEL), Andrographolide, Cell Cycle Arrest, G1 checkpoint

**CHARACTERIZATION OF BACTERIOPHAGE P1267
AGAINST MULTIDRUG-RESISTANT *Pseudomonas aeruginosa*
ISOLATED FROM TROPICAL WASTEWATER**

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Multidrug-resistant (MDR) *Pseudomonas aeruginosa* remains a major clinical challenge, particularly in settings where antibiotic options are increasingly limited. Here, we isolated bacteriophage P1267 from tropical wastewater and examined its activity against MDR *P. aeruginosa* clinical isolates. P1267 was recovered using spot and double-layer agar assays, purified by repeated single-plaque elution, and propagated to approximately 10⁹ PFU/mL. Its host range was tested against 76 MDR clinical isolates, and its biological properties were assessed by plaque morphology, one-step growth curve analysis, and thermal and pH stability assays. Virion morphology was examined by transmission electron microscopy (TEM). Among the phages tested, P1267 showed the broadest host range, lysing 48.7% (37/76) of MDR isolates. One-step growth curve analysis at an MOI of 0.01 showed a latent period of approximately 30 min and a burst size of approximately 2.5 × 10³ PFU per infected cell. The phage retained infectivity from 4 to 50 °C and remained stable across pH 4-11, suggesting good tolerance to environmental variation. TEM revealed an icosahedral head of approximately 55 nm in diameter and a long, flexible, non-contractile tail measuring approximately 100 nm in length and 13 nm in width, consistent with a siphovirus morphotype. These results identify P1267 as a stable, broad-host-range lytic phage and support its further evaluation as a component of phage cocktail development against MDR *P. aeruginosa* in clinical settings in tropical regions.

Keywords: Bacteriophage, Multidrug-resistant, *Pseudomonas aeruginosa*, Siphovirus

**Innovative technology
for production, detection,
treatment, detoxification,
remediation, reduction, reuse
and recycling of chemicals**

DEVELOPMENT OF DROPLET DIGITAL POLYMERASE CHAIN REACTION (ddPCR) FOR DETECTION OF *Legionella*

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Legionnaires' disease has emerged as a critical public health concern, with *Legionella pneumophila* recognized as the predominant cause of waterborne outbreaks worldwide. Conventional culture methods remain the standard for diagnosis, but they are time-consuming, requiring approximately two weeks of incubation, and may fail to detect bacteria present at low concentrations or in a viable but non-culturable state. To overcome these limitations, this study developed and optimized a droplet digital polymerase chain reaction (ddPCR) assay targeting the macrophage infectivity potentiator (*mip*) gene. The optimization assays identified 54 °C as the optimal annealing/extension temperature and 900/250 nM as the most effective primer/probe concentration, the assay demonstrated clear droplet separation and reproducibility. The limit of blank (LOB) was determined to be 0.13 copies/μL. Analytical sensitivity testing demonstrated reliable detection at 1 pg/μL, with copy numbers consistently above the LOB, and the limit of detection (LOD) was calculated as 0.348 copies/μL. Analytical specificity was confirmed by testing genomic DNA from fourteen waterborne bacterial species, where positive droplets were observed specifically in *L. pneumophila* DNA, with no cross-reactivity detected in non-target waterborne organisms. The ddPCR assay is well suited for applications in environmental monitoring and water safety surveillance, and it support quantitative microbial risk assessment by enabling accurate detection of low-level contamination.

Keywords: *Legionella pneumophila*, Legionnaires' disease, Droplet digital polymerase chain reaction, Macrophage infectivity potentiator (*mip*), Water safety monitoring

DIGITAL COLORIMETRIC ANALYSIS FOR EVALUATING CADMIUM UPTAKE IN RICE ROOT TISSUE

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Evaluating heavy metal accumulation in agronomic crops is essential for ensuring food safety. However, conventional analytical techniques are often time-consuming, labor-intensive, and costly, limiting their application in large-scale crop breeding programs that require rapid phenotypic screening. To address this challenge, this study evaluated a digital colorimetric method as a rapid, cost-effective alternative for assessing cadmium (Cd) accumulation in rice roots. Rice seedlings were grown hydroponically under Cd concentrations ranging from 0 to 20 mg L⁻¹ for 14 days. Three representative rice cultivars (IR64, PSL2, and KDML105) were initially used to validate the method, followed by an expanded evaluation of five major cultivars (PSL2, KDML105, Suphan1, RD31, and Chorati) for comprehensive phenotypic screening. Following harvest, root systems were subjected to histochemical staining, and the proportion of red-stained root area was quantified using digital image analysis. The colorimetric method successfully distinguished cultivars with high and low Cd accumulation. Method validation demonstrated a strong positive correlation between image-derived root traits and manually measured root biomass ($R^2 = 0.8659$). Furthermore, the percentage of red-stained root area showed a strong linear relationship with Cd concentrations in root tissues determined by flame atomic absorption spectrometry (FAAS) ($R^2 = 0.911$). These results demonstrate that digital colorimetric analysis provides a rapid, reliable, and low-cost approach for large-scale phenotypic screening of cadmium accumulation in rice roots, offering a practical tool for breeding programs aimed at developing rice cultivars with reduced heavy metal accumulation.

Keywords: Cadmium, Colorimetric analysis, Heavy metal, Rice, Stain

**Safety and toxicity of food,
drugs and other chemicals
including biofuels**

**MECHANISTIC INVESTIGATION
OF THE ANDROGENIC ENDOCRINE-DISRUPTING EFFECTS
OF EMERGING ENVIRONMENTAL CONTAMINANT
POLYHALOGENATED CARBAZOLES (PHCZs)**

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Polyhalogenated carbazole (PHCZs) are emerging contaminated chemicals, which have been detected in many organisms, soil, water and housedust. PHCZs can produce naturally and generated through anthropogenic activities such as production of indigo dye, photoelectric material intermediate, phosphorescent, and electroluminescent devices. Apart from environmental detections, humans may be exposed to PHCZs through multiple routes. The detection of PHCZs in human urine confirms that humans have been exposed to PHCZs. However, information regarding endocrine disrupting effect of PHCZs remains limited, especially its impact on androgen receptor (AR) activity. Therefore, six PHCZs were tested for their endocrine disrupting potential in vitro assay. AR luciferase reporter gene assay was used to evaluate agonist or antagonist activity in MDA-kb2 cell lines. Cells were treated under two conditions: in the presence of testosterone and in the absence of testosterone at different concentrations of PHCZs ranging from 0.01 μ M to 20 μ M. The result showed that five PHCZs significantly decreased luciferase activity, indicating that five PHCZs exhibited significant anti-androgenic activity on AR. We further evaluated mechanisms of AR inhibition by evaluating dose-response curve shifts and slope characteristics. The result demonstrated a rightward parallel shift in the dose response curves without significantly affecting the maximal response, highlighting that PHCZs act as competitive AR inhibitors targeting the ligand-binding domain. The effect of PHCZs on AR may lead to adverse effects on development and the reproductive system in humans and wildlife, resulting in negative impacts on ecosystem and human health.

Keywords: Polyhalogenated carbazole, Endocrine disrupting chemical, Androgen receptor, Anti-androgen, Competitive inhibitor

**MECHANISTIC INVESTIGATION
OF THE ANDROGENIC ENDOCRINE-DISRUPTING EFFECTS
OF EMERGING ORGANOPHOSPHATE FLAME-RETARDANTS**

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Organophosphate flame-retardants (OPFRs) have increasingly replaced legacy polybrominated diphenyl ethers (PBDEs) in consumer products; however, concerns regarding their endocrine-disrupting properties continue to emerge. While introduced as safer alternatives, these replacements often exhibit significant trophic magnification and ubiquitous environmental detection. However, mechanistic data describing how emerging OPFRs (BPP, DPP, TBP, TP, and 2DPP) interact with the androgen receptor (AR) remain scarce. This study provides novel insights into the endocrine-disrupting effects of emerging OPFRs by addressing the limited knowledge regarding their activity toward the AR. Among these compounds, 2DPP, a component associated with commercial flame-retardant formulations, has been detected in environmental matrices and may pose risks to hormone-regulated biological processes. Despite increasing environmental occurrence, its effects on AR signaling remain poorly understood. We utilized an *in vitro* framework cascading from metabolic viability in MDA-kb2 cell lines. Functional AR-mediated luciferase reporter gene assay was done to assess the androgenic and anti-androgenic activities followed by mode of AR inhibition by performing shift assay. This methodology facilitates the identification of specific binding mechanisms, distinguishing allosteric interactions. Results identified distinct mechanism among the OPFRs. TP exhibited competitive antagonism, characterized by a parallel rightward EC₅₀ shift. On the other hand, BPP, DPP, TBP, and 2DPP demonstrated antagonism via allosteric sites, suppressing maximal response regardless of ligand concentration. 2DPP was particularly potent, inducing a >50% reduction in maximal fold induction. This allosteric silencing suggests that increasing endogenous androgens cannot overcome the endocrine blockade, a complex pathway often overlooked by traditional safety tests that fail to account for non-monotonic dose-responses. These findings provide crucial evidence required to prevent regrettable substitutions and support robust regulatory oversight of emerging environmental contaminants.

Keywords: Organophosphate flame-retardants, Androgen receptor, Antagonism, Endocrine disruptor, Non-competitive binding

Environment / health impact assessment and management

**A FIELD SURVEY AND ASSESSMENT OF ILLUMINATION
AND LIGHT UNIFORMITY IN SUBDISTRICT HEALTH PROMOTING
HOSPITALS OF NONTABURI PROVINCE**

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Despite being a frontline component of Thailand's public health system, subdistrict health promoting hospitals remain understudied with respect to indoor lighting quality and its implications for occupational health. This cross-sectional study described healthcare personnel characteristics and assessed indoor lighting quality in 30 subdistrict health promoting hospitals in Nonthaburi province, Thailand. Illuminance and lighting uniformity were measured in seven functional room types: examination room, procedure room, dental room, Thai traditional medicine room, office, meeting room, and waiting area. Additionally, health effects were collected from 115 healthcare personnel using a structured questionnaire. The results revealed that most clinical rooms failed to meet national illuminance standards. This was particularly critical in the procedure rooms (96.7%) and examination rooms (83.3%), spaces requiring visual precision. In contrast, the Thai traditional medicine rooms showed the highest compliance (95.0%), followed by the waiting areas (73.3%). Regarding light uniformity, distribution was consistently uniform across the majority of space categories, with the exception of waiting areas, meeting rooms, and offices. Notably, more than one-third of personnel (37.4%) reported light-sensitive conditions, predominantly among those working in the procedure rooms, examination rooms, dental rooms and offices. These findings provide critical evidence for occupational health policies aimed at improving illuminance adequacy and lighting distribution in primary healthcare facilities.

Keywords: Lighting quality, Illuminance, Uniformity ratio, Health effect, Hospital

**FACTORS ASSOCIATED WITH INFECTIOUS WASTE
MANAGEMENT BEHAVIORS AMONG HOSPITAL PERSONNEL:
A CROSS-SECTIONAL STUDY USING THE PRECEDE–PROCEED MODEL**

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Infectious waste management is essential for preventing healthcare-associated infections, protecting healthcare personnel and patients, and minimizing environmental contamination. Despite established regulations and guidelines, personnel practices remain a key determinant of effective infectious waste management. This study investigated the status of infectious waste management, assessed factors associated with waste management behaviors, and examined the relationship between these factors and infectious waste management behaviors among personnel at Khok Samrong Hospital, Lopburi Province, Thailand, using the PRECEDE–PROCEED Model as the conceptual framework.

A cross-sectional study was conducted among 140 hospital personnel selected by simple random sampling and 19 cleaning staff recruited through purposive sampling. Data were collected using a structured questionnaire, an infectious waste management quality assessment form, a hospital infectious waste management survey form, and a daily contamination record form. Descriptive statistics, the Chi-square test, and Fisher's exact test were used for data analysis, with statistical significance set at $p < 0.05$.

The hospital's infectious waste management system complied with the Ministerial Regulation on the Disposal of Infectious Waste B.E. 2545 (2002). Good knowledge of infectious waste management was observed among 59.3% of hospital personnel, while 97.8% demonstrated positive attitudes. Good infectious waste segregation practices were reported by 83.6% of hospital personnel, and 84.2% of cleaning staff demonstrated good collection and transportation practices. Personal factors, knowledge, and attitudes were not significantly associated with waste management behaviors ($p > 0.05$). However, previous education or training was significantly associated with appropriate infectious waste segregation behavior ($p = 0.002$).

These findings suggest that continuous capacity building through regular training, together with organizational supervision, monitoring, and institutional support, can effectively promote appropriate infectious waste management behaviors among hospital personnel and sustainably improve the efficiency of hospital infectious waste management systems.

Keywords: Infectious waste management, Hospital personnel, PRECEDE–PROCEED Model

**FACTORS INFLUENCING HOUSEHOLD WASTE
SEPARATION BEHAVIORS
AMONG MAE SOT MUNICIPAL RESIDENTS
IN TAK PROVINCE, THAILAND**

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This study aimed to identify the factors influencing household waste separation behavior in Mae Sot Municipality, Tak Province, Thailand, by applying the Theory of Planned Behavior (TPB). A structured questionnaire was administered to a randomly selected sample of 350 households across three communities within the municipality. Data were analyzed using descriptive statistics (mean, standard deviation) and regression analysis. Results indicated that residents demonstrated highly positive attitudes (mean 3.80) and strong intentions (mean 3.65) toward waste separation; however, their actual separation practices were only at a moderate level (mean 3.19). Regression analysis revealed that information availability, positive attitudes, and economic incentives explained 57.8% of the variance in intention. Crucially, the study identified a significant "intention-behavior gap," where high intention did not directly translate into actual behavior. Instead, the primary drivers for actual practice were facilitating conditions (such as the presence of categorized bins) and information availability, accounting for 62.6% of behavioral variance. These findings suggest that waste separation in Mae Sot is "facility-driven" rather than "motivation-driven," highlighting the need for improved municipal infrastructure and the restoration of public trust in the waste collection system.

Keywords: Household waste separation, Theory of Planned Behavior (TPB), Eco-industrial town, Facilitating conditions, Thailand

**FOOD SANITATION KNOWLEDGE, ATTITUDES, AND PRACTICES
AMONG SCHOOL-VICINITY FOOD VENDORS:
A CASE STUDY IN MIN BURI DISTRICT, BANGKOK**

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Food sanitation among street food vendors surrounding schools is an important public health concern, particularly for school-aged children who are considered a vulnerable population. This cross-sectional study aimed to assess knowledge, attitudes, and practices (KAP) regarding food sanitation among food vendors and to examine the relationships among knowledge, attitudes, and practices regarding food sanitation.

A total of 63 food vendors operating around schools in Min Buri District, Bangkok, were selected using simple random sampling. Data were collected using a structured questionnaire, observational checklist. Descriptive statistics and Spearman's rank correlation coefficient were used for data analysis.

The results revealed that 60.32% of food vendors had a high level of knowledge, while 93.65% demonstrated positive attitudes toward food sanitation. However, 73.02% showed inadequate food sanitation practices. Knowledge was positively associated with attitudes ($r_s = 0.404$, $p = 0.001$). However, no significant association was observed between knowledge and practices ($r_s = 0.066$, $p = 0.607$), attitudes and practices ($r_s = -0.017$, $p = 0.893$).

The findings indicate that although food vendors possessed adequate knowledge and positive attitudes, these factors did not necessarily translate into appropriate food sanitation practices. Therefore, food safety interventions should focus not only on knowledge improvement but also on behavioral modification, practical training, and continuous monitoring programs.

Keywords: Knowledge Attitudes and Practices (KAP), Food Sanitation, Food Vendors, School-vicinity



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