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I. Fúnez-Núñez, C. García-Sancho, J.A. Cecilia, R. Moreno-Tost, L. Serrano-Cantador, P. Maireles-Torres. ***Recovery of pentoses-containing olive stones for their conversion into furfural in the presence of solid acid catalysts*****. Pages 1-13.**

Olive stones were employed as feedstock for furfural production in two stages: 1) autohydrolysis of hemicellulosic fraction to recover their pentoses, mainly xylose, and 2) subsequent dehydration of pentoses into furfural. Autohydrolysis step was optimized by using different experimental conditions (temperature: 160−200 °C and time: 30−75 min), giving rise to liquors with different xylose concentrations, since hydrolysis was incomplete in some cases. The combined use of a commercial γ-Al2O3 and CaCl2 led to total hydrolysis of non-hydrolyzed pentosans after autohydrolysis step, and the subsequent dehydration of pentoses into furfural. The maximum values of furfural yield and efficiency were 23 and 96 %, respectively, after only 60 min at 150 °C by using liquor obtained by autohydrolysis at 180 °C and 30 min (L5.1) as source of pentoses. This liquor, L5.1, provided better catalytic results than other liquors which had shown higher xylose concentration after autohydrolysis, probably due to these latter also exhibited a higher concentration of organic acids; thus, the presence of organic acids, such as acetic and lactic acids, could promote undesired reactions leading to lower furfural yields. Finally, γ-Al2O3 was more effective for furfural production under these experimental conditions than other solid acid catalysts, such as mesoporous Nb2O5, Nb-doped SBA-15 and Zr-doped HMS silicas, probably due to alumina has a higher density of acid sites.

- **Keywords:** Lignocellulosic biomass; Hemicellulosic liquors; Olive stones; Xylose dehydration; Furfural; Solid acid catalysts

Cong Ma, Huihui Yu, Yujie Gao, Wenjie Xu, Tiefu Xu, Liang Wang, Bin Zhao, Zhaohui Zhang, Jun Xu. ***Operation parameters optimization of a hybrid dead-end/cross-flow forward osmosis system for microalgae dewatering by response surface methodology*****. Pages 14-24.**

The high energy consumption of the microalgae dewatering process results in microalgae being less economically feasible as a new bioenergy material. As an energy-saving method, forward osmosis (FO) filtration can be applied in microalgae dewatering to reduce membrane fouling and energy consumption. In this study, a novel hybrid dead-end/cross-flow FO system was proposed to obtain highly efficient microalgae dewatering. The effects of agitation speed, draw solution concentration, and pH on microalgae and

membrane flux reduction volume concentration factors were investigated using Box-Behnken design (BBD) of response surface methodology (three factors and three levels). The results demonstrated that the higher the draw solution concentration and agitation speed, the higher the volume concentration factors. When the draw solution concentration and agitation speed reached their maximums (5M and 500r, respectively), the maximum volume concentration factor was obtained (3.73). pH exhibited the greatest influence on flux reduction. The flux reduction decreased more with an increase in pH (pH>7). When the pH was neutral or acidic, the influence of pH on flux was insignificant. This study provided a more efficient method for dewatering and reduced energy consumption by applying a BBD to optimize the operation parameters of a novel hybrid dead-end/cross-flow FO system for microalgae dewatering.

- **Keywords:** Forward osmosis; Microalgae dewatering; Box-Behnken design; Operation parameters

Sakineh Mohammadzadeh Yengejeh, Somaiyeh Allahyari, Nader Rahemi. *Efficient oxidative desulfurization of model fuel by visible-light-driven MoS2-CeO2/SiO2-Al2O3 nano photocatalyst coating*. Pages 25-35.

The MoS2-CeO2 nano photocatalyst on silica-alumina support was synthesized and dip-coated on glass plates with the aid of three polymeric surfactants, including polyvinylpyrrolidone (PVP), polyvinyl alcohol (PVA) and polyethylene glycol (PEG). The activity of resultant coatings was evaluated in photocatalytic oxidative desulfurization (ODS) of dibenzothiophene (DBT) and the results were compared with the activity of photocatalyst as powder. The MoS2-CeO2/SiO2-Al2O3 photocatalyst as powder degrades 96 % of DBT while immobilized photocatalyst coating (without surfactant) degraded 88 % of DBT. Using PVP, PVA, and PEG in MoS2-CeO2/SiO2-Al2O3 coating resulted in 86, 89, and 93 % of DBT conversion, respectively. Higher DBT removal by PEG containing coating compares to surfactant-free coating, was due to uniform morphology, more absorption of light, more shift of adsorption edge toward visible light, more surface OH groups, more porosity, more surface area, and bigger pore size, confirmed by FESEM, UV–vis DRS, BET-BJH, and FTIR. Beside PEG, silica sol was applied as a binder for MoS2-CeO2/SiO2-Al2O3 nano photocatalyst coating. The weight loss for this sample was insignificant after 30min of sonication, and none of the composing elements of coating was found in the fuel after five successive runs. With considering operating parameters like the number of photocatalyst coatings, the concentration of DBT, and pH, the DBT removal reached 98 %. Based on the obtained results, a mechanism was proposed for photocatalytic oxidative desulfurization of DBT using PEG containing MoS2-CeO2/SiO2-Al2O3 nano photocatalyst coating.

- **Keywords:** Oxidative desulfurization; Photocatalyst; Coating; MoS2-CeO2/SiO2-Al2O3; Surfactant

Alain R. Picos-Benítez, Blanca L. Martínez-Vargas, Sergio M. Duron-Torres, Enric Brillas, Juan M. Peralta-Hernández. *The use of artificial intelligence models in the prediction of optimum operational conditions for the treatment of dye wastewaters with similar structural characteristics*. Pages 36-44.

This work assesses the effectiveness of an artificial intelligence (AI) model based on an artificial neural networks (ANN) – genetic algorithm (GA) in the prediction of the behavior and optimization of the treatment of sulfate wastewaters with Bromophenol blue dye using an electro-oxidation (EO) process. Trials were made with a filter press-type reactor with a boron-doped diamond (BDD) anode. The ANN model was trained with 51 electrolytic experiments by using the electrolysis time, flow, current density, pH and dye concentration as input variables and the discoloration efficiency as the output one. The

performance of ANN was measured with RMSE and MAPE values of 10.73 % and 8.81 %, respectively, calculated from real and predicted values. Optimum conditions determined by GA were reached for the inputs of 10min, 11.9L min−1, 31.25mA cm−2, 2.8 and 41.25mgL−1, giving a discoloration efficiency of 88.8±0.3 %, close to 95.5 % predicted by the model. To validate the AI model, the same experimental conditions were applied to treat wastewaters with Bromothymol blue and Thymol blue, with analogous structures to Bromophenol blue, and a mixture of the three dyes by EO. In all cases, the loss of color decayed following a pseudo-first-order kinetics, with similar apparent rate constants. For the dye mixture, 69 % COD was reduced at 60min, with 13 % average current efficiency and 0.26kWh (g COD)-1 energy consumption. The AI model is a strong tool to design, control and operate the EO process with a BDD anode to treat wastewaters with similar dyes.

- **Keywords:** Artificial intelligence models; Electro-oxidation; Synthetic dye; Wastewater treatment

Roghayeh Ganji, Majid Peyravi, Soodabeh Khalili, Mohsen Jahanshahi. *Bilayer adsorptive ceramic membranes supported cage-like mesoporous silica for hexavalent chromium removal: Experimental and DFT studies*. Pages 45-54.

In this study, an adsorptive ceramic membrane coated by new layer of cage-like mesoporous silica SBA_16 which was modified with 3-aminopropyltriethoxysilane (APTES) was employed to remove (Cr (VI)) ions from aqueous solution. The morphologies and physiochemical properties of SBA_16 and modified SBA_16 (NH2-SBA_16) adsorbents as well as adsorptive membranes were characterized through thermal gravimetric analysis (TGA), Fourier transform infrared (FTIR), N2 adsorption-desorption isotherms, X-ray diffraction (XRD) and field emission scanning electron microscopy (FESEM). The adsorption isotherm data perfectly was fitted to Langmuir isotherm model and the adsorption capacity value of NH2-SBA_16 for Cr (VI) at pH of 2.5 was 61.9 mg/g. The experimental kinetic data agreed with pseudo-second-order model. The dynamic filtration test in dead-end system was utilized to evaluate the efficiency of ceramic membranes in hexavalent chromium removal. The modification of ceramic membrane (CM2) resulted in an excellent Cr (VI) removal (100 %) for permeate stream. Aminopropyl grafting on the ceramic membrane significantly enhanced the permeate flux from 56 L/m2h to 85.6 L/m2h. Density functional theory (DFT) calculations have been performed and the adsorption energy of Cr (VI) on NH2-SBA_16 was obtained 131.25 kJ/mol.

- **Keywords:** Cr (VI) removal; Ceramic membrane; Adsorptive membrane; Functionalized mesoporous SBA_16; DFT

Abdelhamid Bakka, Rachid Mamouni, Nabil Saffaj, Abdellatif Laknifli, Khalid Aziz, Aziza Roudani. *Removal of bifenthrin pesticide from aqueous solutions by treated patellidae shells using a new fixed bed column filtration technique*. Pages 55-65.

The Treated Patellidae Shells (TPS) packed in a fixed bed column for the removal of emerging contaminant such as bifenthrin provides novel insights into waste valorisation, application of environmentally harmless sorbents and removal of bifenthrin pesticide with extension possibilities for larger applications. The biosorbent was characterized by XRD, FTIR, SEM-EDS, TGA-DTA, pHPZC, and BET analysis. TPS biosorbent is composed of a single phase of calcium carbonate (CaCO3) having a high specific area of 158m2/g. The effects of important parameters such as flow rate, bed height, particles size and bifenthrin feed concentration were studied. The results show that the column efficiency is higher with higher flow rate, higher bed height, higher bifenthrin inlet concentration and

lower TPS particles size. The optimum adsorption capacity (40.53mg) is achieved using a flow rate of 8mL/min, a bed depth of 4cm (1.6g), in the TPS particles size range of 50–100µm and a bifenthrin feed concentration of 20mg/L. To model the experimental data, the Bohart-Adams (B-A), Thomas (T) and Yoon-Nelson (Y-N) models were used. The mathematical formulas of these three models are equivalent, that is why the Chu logistic model was developed to fit the experimental data with a single value of both adjusted correlation coefficient (Adj. R2) and chi-square (χ2), for each set. The non-linear form of Chu logistic model showed a good fit between predicted and observed values with higher Adj. R2 and smaller χ2 values. The Chu logistic model therefore made it possible to calculate the actual parameter values of B-A, T and Y-N models. The study of the adsorption isotherm allows to show that the Langmuir isotherm is suitable for describing experimental data. This adjustment of the Langmuir model with the observed data indicates the favorable adsorption and the higher bifenthrin adsorption capacity of TPS biosorbent. The TPS regenerative power study reveals that TPS has good regenerative capacity and can be recycled to remove pesticide molecules. The TPS biosorbent is effective in removing pesticides and can be considered as an alternative to the commercial adsorbent.

- **Keywords:** Patellidae shells; Adsorption; Fixed-bed column; Bifenthrin; Pesticide; Wastewater

F. Hampp, K.H.H. Goh, R.P. Lindstedt. *The reactivity of hydrogen enriched turbulent flames*. Pages 66-75.

The use of hydrogen enriched fuel blends, e.g. syngas, offers great potential in the decarbonisation of gas turbine technologies by substitution and expansion of the lean operating limit. Studies assessing explosion risks or laminar flame properties of such fuels are common. However, there is a lack of experimental data that quantifies the impact of hydrogen addition on turbulent flame parameters including burning velocities and scalar fluxes. Such properties are here determined for aerodynamically stabilised flames in a back-to-burnt opposed jet configuration featuring fractal grid generated multi-scale turbulence (Ret=314±19) using binary H2/CH4 and H2/CO fuel blends. The binary H2/CH4 fuel blend is varied from α=XH2/(XH2+XF)= 0.0, 0.2 and 0.4–1.0, in steps on 0.1, and the binary H2/CO fuel blend from α=0.3−1.0 also in steps of 0.1. The equivalence ratio is adjusted between the mixture specific lower limit of local flame extinction and the upper limit of flashback. The flames are characterised using PIV measurements combined with a flame front detection algorithm. The study quantifies the impact of hydrogen enrichment on (i) turbulent burning velocity (ST), (ii) turbulent transport and (iii) the rate of strain acting on flame fronts. Scaling relations (iv) that correlate ST with laminar flame properties are evaluated and (v) flow field data that permits validation of computational models is provided. It is shown that CH4 results in a stronger inhibiting effect on the reaction chemistry of H2 compared to CO, that turbulent transport and burning velocities are strongly correlated with the rate of compressive strain and that scaling relationships can provide reasonable agreement with experiments.

- **Keywords:** Hydrogen; Turbulent premixed combustion; Syngas; Turbulent burning velocity; Scalar transport; Rate of strain

Youzheng Chai, Pufeng Qin, Jiachao Zhang, Tianyou Li, Zhijian Dai, Zhibin Wu. *Simultaneous removal of Fe(II) and Mn(II) from acid mine wastewater by electro-Fenton proces*. Pages 76-90.

The treatment of acid mine wastewater containing Fe(II) and Mn(II) has been a hot topic in a long time. This paper studied the treatment of acid mine wastewater by the electro-Fenton process. First, the effect of key parameters including initial current intensity (50−300 mA), plate spacing (0.5–3.0 cm), and initial pH (3.0–5.0), aeration rate (0−200 mL/min) were studied. Based on these results, the performance of electro-Fenton

process in actual wastewater and the stability of electro-Fenton system were investigated. Then the removal mechanism and mutual promotion effect were analyzed. The removal efficiency of Fe(II) and Mn(II) in wastewater could reach 99.2 % and 90.5 %, respectively, under the optimal conditions (current intensity 200 mA, initial pH 4.0, plate spacing 1.5 cm, aeration rate 100 mL/min). Electro-Fenton process has an important effect in actual wastewater treatment (removal efficiency of Fe(II) and Mn(II) reached 96.5 %, and 87.5 %, respectively), while the stability of this process was good. The optimal conditions were optimized through Box-Behnken design and response surface method (RSM). Removal efficiency of Fe(II) and Mn(II) could reach 99.6 % and 92.9 %, respectively, under optimized conditions (current intensity 210 mA, plate spacing 1.6 cm, initial pH 4.0, aeration rate 110.4 mL/min). In addition, the economic advantage of electro-Fenton process in acid mine wastewater treatment were evaluated. The result indicated that the cost of electro-Fenton process was only 0.56 $/m3.

- **Keywords:** Acid mine wastewater; Electro-Fenton; Removal mechanism; Response surface method; Economic advantage

Shogo Kumagai, Asami Matsukami, Fumie Kabashima, Masafumi Sakurai, Michiko Kanai, Tomohito Kameda, Yuko Saito, Toshiaki Yoshioka. *Combining pyrolysis–two-dimensional gas chromatography–time-of-flight mass spectrometry with hierarchical cluster analysis for rapid identification of pyrolytic interactions: Case study of co-pyrolysis of PVC and biomass components*. Pages 91-100.

Co-pyrolysis of plastic/lignocellulosic biomass mixtures produces an extremely complex assortment of pyrolyzates. In the present work, co-pyrolysis of PVC with cellulose or xylan or milled wood lignin was conducted by employing pyrolysis–two-dimensional gas chromatography–time-of-flight mass spectrometry (Py-GC × GC-TOFMS) with the aim of achieving high throughput and comprehensive analysis of the complex pyrolyzates. Then, hierarchical cluster analysis (HCA), which is an algorithm that groups similar objects into groups called clusters, was applied to accomplish rapid screening for compounds influenced by pyrolytic interactions. This combined approach improved compound separation and identifiability and allowed the subsequent easy identification of new compounds and compounds increased or decreased by pyrolytic interactions during co-pyrolysis. The change in distribution during co-pyrolysis clearly suggests the occurrence of HCl-catalyzed dehydration of anhydrosugars and conversion of methoxyphenols into phenolic compounds. Thus, this study reveals the effectiveness of the approach combining Py-GC × GC-TOFMS with HCA, which promises to contribute to the acceleration of research on pyrolytic interactions. The understanding of pyrolytic interactions gained thereby will be crucial for maximizing the yield and quality of desired chemicals and fuels from plastic/lignocellulosic biomass.

- **Keywords:** Co-pyrolysis; Py-GC×GC-TOFMS; Biomass; PVC; Pyrolytic interaction; Hierarchical cluster analysis

Huitian Peng, Weimin Cheng, Yunxiang Guo, Changwei Xu, Cheng Guo, Qingxin Ma, Zhiqiang Liu, Shibo Yang. *Study on the spray field distribution of the roadway full-section water curtain device and its effect on the settlement of PM2.5*. Pages 101-113.

In order to effectively prevent the diffusion and pollution of highly concentrated PM2.5, the roadway full-section water curtain device has been developed in this paper. Based on our water spray experiments, a type II nozzle that was suitable for the water curtain device was selected. This roadway full-section water curtain device was optimized through a numerical simulation using Fluent software. The wind-droplet numerical simulation results showed that the water curtain device could achieve the optimal spray

parameters. When the water pressure Pw was 7 MPa and the nozzle was inclined to the upwind side at θ = 15°, a high-quality spray field with the concentration greater than 10 g m−3 covered 93.1 % of the cross-sectional area of the entire roadway. The settlement of harmful particulates of PM2.5 in the air-return pathway of the Bailu Coal Mine's 4307 coal mining face, using three roadway full-section water curtain devices, was then measured. The results showed that the ideal level of dust settlement can be achieved by consuming less water. It was also found that the settling rate of PM2.5 at the air-return pathway 200 m away from the coal mining face was as high as 95.7 %, indicating that the roadway full-section water curtain device had settled and controlled the PM2.5 in the roadway's airflow effectively.

- **Keywords:** PM2.5; Spray; Wind-droplet; Numerical simulation; Experimental analysis

Hiroki Gonome, Taichi Nagao, Yuto Takagi, Mizuho Ono, Takuma Kogawa, Shuichi Moriya, Junnosuke Okajima. *Protection from thermal radiation of hazardous fires: Optimizing microscale droplet size in mist barriers using radiative transfer analysis.* Pages 114-120.

The incidence of large-scale fires continues to rise, and the effects of radiation from these fires contributes to their continued spread. Water sprays have been widely used as an effective method to contain thermal radiation from fires. Results from previous studies on the sizes of water droplets in the spray barrier have limitations due to the significant computational time or complex analytical procedure involved. The aim of this study is to determine the optimal size of water droplets in the barrier mist using radiative transfer analysis for effective shielding of the radiation from the surroundings. The radiative properties of water droplets were analyzed using the Mie scattering theory and a radiative transfer analysis of the mist layer was performed. This demonstrated that the spectral reflectance of the mist layer can be controlled by the water droplet diameter. The effectiveness of optimizing the water droplet size in the mist layer to maximize protection from thermal radiation was also validated by experiments to evaluate the radiation shielding performance of the mist barrier.

- **Keywords:** Radiation attenuation; Mist barrier; Computational method; Microscale droplet; Radiation transfer equation

B.G. Reis, A.L. Silveira, Y.A.R. Lebron, V.R. Moreira, L.P.T. Teixeira, A.A. Okuma, M.C.S. Amaral, L.C. Lange. *Comprehensive investigation of landfill leachate treatment by integrated Fenton/microfiltration and aerobic membrane bioreactor with nanofiltration*. Pages 121-128.

Due to the presence of refractory organic pollutants and toxicity compounds, the choice of the best alternative for the landfill leachate treatment becomes a challenge. In this study the integration of aerobic membrane bioreactor with nanofiltration (MBR-NF) and hybrid Fenton-microfiltration process also with nanofiltration (FMF-NF) were compared for the treatment of landfill leachate. The roles of individual process on the organic and inorganic matter removal and toxicity reduction were discussed. By analyzing the residual compounds of each individual process, the mechanism of organic matter change during these processes was qualitatively investigated. The FMF process had the best percentage of color (47 %), COD (67 %), ammonia nitrogen (37 %) and toxicity (100 %) removal compared to MBR, which demonstrated removal of 31, 22, 27 and 44 % for the same parameters, respectively. NF plays a crucial role as a polishing stage, allowing for final removal rates >99.9 % and 95 % for color, 88 % and 95 % for COD and 92 % and 80 % for ammonia (MBR-NF and FMF-NF treatment routes, respectively), producing high quality and nontoxic permeates. Furthermore, the diversity of compounds identified with

different properties and toxicity patterns emphasizes the complexity of the relationships that occur in these aqueous matrices and the effects they cause.

- **Keywords:** Leachate; Toxicity; Organic compounds; GC–MS; Nanofiltration; MBR; AOP

Yun bei Li, Ting ting Liu, Jun li Song, Jing hua Lv, Ji shao Jiang. *Effects of chemical additives on emissions of ammonia and greenhouse gas during sewage sludge composting*. Pages 129-137.

Chemical additives of magnesium chloride (MaC) and ferrous sulfate (FS) were investigated in sewage sludge composting. A treatment without chemical additive was used as the control group (CK). The effects of MaC and FS on ammonia (NH3) and greenhouse gases (CO2, N2O and CH4) emissions were evaluated. The results showed that the addition of MaC and FS promoted the degradation of organic matter and increased the ammonium concentration of the compost product. The maximum pH values decreased from 8.98 (CK) to 8.49 and 8.0 in MaC and FS treatments, respectively. In addition, the NH3 emission for the MaC and FS treatments reduced by 58.3 % and 82.9 %, respectively, whereas the methane (CH4) emission decreased by 22.9 % and 24.9 %, respectively. However, in FS treatment, the carbon dioxide (CO2) and nitrous oxide (N2O) emissions were higher than those in CK. Furthermore, the FS treatment exhibited lower germination index values (71.4 %) and higher electrical conductivity (6.62 mS/cm). Therefore, MaC is suggested as an additive for reducing greenhouse gas emission and conserving nitrogen during sewage sludge composting.

- **Keywords:** Compost; Sewage sludge; Greenhouse gas; Ammonia emission; Chemical additives

Shakiba Samsami, Maryam Mohamadi, Mohammad-Hossein Sarrafzadeh, Eldon R. Rene, Meysam Firoozbahr. *Recent advances in the treatment of dye-containing wastewater from textile industries: Overview and perspectives*. Pages 138-163.

Dye-containing wastewater should be treated effectively using eco-friendly technologies in order to prevent the adverse impacts on the environment and natural water resources. This review summarizes the recent technologies used commonly for dye removal from wastewater, such as biological methods, advanced oxidation processes (AOP), electrocoagulation, adsorption, membrane technology, and photocatalytic reactors using novel nanomaterials. On the other hand, this review also addresses the performances, operating conditions, important process parameters, and the advantages and disadvantages of different treatment systems. Besides, in order to achieve efficient color removal, several previous studies have also focused on hybrid treatment technologies. Among the different hybrid treatments, the MBR (membrane bioreactor) and the PMR (photocatalytic membrane reactor) were reviewed in detail as they have shown to be practically promising for color removal from textile wastewater. Regarding the factors that influence the performance of PMR systems, the role of nanoparticles were discussed by considering their mechanisms of color removal.

- **Keywords:** Dye removal; Textile wastewater; Hybrid treatments; Membrane bioreactor; Photocatalytic membrane reactor

Olav Roald Hansen. *Hydrogen infrastructure—Efficient risk assessment and design optimization approach to ensure safe and practical solutions*. Pages 164-176.

With the ambition to cut emissions from transport hydrogen fuelled vehicles and marine vessels are now being introduced several places in the society. To support this development there is a need for infrastructure to produce and transport gaseous and liquid hydrogen. The properties and safety challenges related to the use of hydrogen are very different from those of conventional fuels, thus safe design may require unconventional solutions. Hydrogen has extreme properties in many ways. It is buoyant when in gas phase while a liquid hydrogen spray will develop a dense plume. The reactivity is higher, flammable range wider and the ignition energy lower than for conventional fuels. Flames may be invisible, and radiation is low. When performing risk assessments for land planning purposes, bunkering assessments or passenger and crew safety these aspects must be reflected. Properties like the positive buoyancy, strong dilution for sonic releases into air, and a low reactivity and energy content for concentrations below 10% must be exploited during design to ensure acceptable risk levels. In this article a two-level risk assessment and design optimization approach is presented in which risk screening with rapid consequence calculations and frequency assessments for release, dispersion, fire and explosion can be performed during concept selection phase with indicative hazard distances estimated. Possible risks of concern are in this way identified, and design can be adjusted, or mitigation measures introduced. For final design risk assessment CFD calculations can be performed for more precise consequence estimates. The risk assessment approach is described with illustrating examples. The focus is not only to ensure safety, but to do so in a cost-efficient and practical way.

- **Keywords:** Explosion; Hydrogen safety; Dispersion; CFD modelling

Qi Zhang, Liye Fu, Ziyuan Li, Tao Fan, Yunlong Ma, Peng Cai, Xinming Qian, Ruoheng Zhang, Yuying Chen. *Coupling mechanism of natural gas deflagration flame and continuous water in closed pipeline*. Pages 177-185.

In order to reveal the propagation characteristics and hazards of a gas explosion in urban drainage pipeline, the dynamic evolution of a methane deflagration in a closed water-containing pipeline was numerically simulated based on Computational Fluid Dynamics (CFD). The interaction mechanism between water oscillation and flame development during the methane deflagration was such revealed. The results show that the presence of water accelerates the flame propagation in the forward accelerating stage. However, the water generally played a significant role in inhibiting the flame propagation because of its cooling and blocking effects. And the flame acceleration may be enhanced with the water present if a longer tube is employed. The shear force generated by the compression wave acting on the stagnant water surface provides the most primitive power for the movement of water, which creates ripples in the calm water. The obstacles and the reciprocating motion of the compression wave make the water ripple and evolve into lifting thin water columns. The shearing effect of high-speed gas flow evolves the water columns into discrete water droplets. This evolution process of the water body increases the contact area between water and flame, thus blocking the transfer of heat and the expansion wave, inhibiting the self-sustained flame propagation, leading to its gradual extinction.

- **Keywords:** Gas deflagration; Drainage pipeline; Water oscillation; Urban lifeline; Flame extinction

Koichi Noda, Hidetoshi Kuramochi, Kazuko Yui, Kohei Ito, Naoko Yoshimoto, Yuichi Yoshimoto, Toshimi Nagata, Hitoshi Koshida, Hiroshi Suzuki, Masaki Takaoka, Masahiro Osako. *Behavior of radioactive cesium during direct melting treatment of decontamination waste with and without Cl-containing additives*. Pages 186-195.

We investigated the behavior of radioactive cesium (r-Cs) in a direct melting system (DMS), in which decontamination waste (DW) is thermally converted to slag and fly ash. Most of the r-Cs (98.4 %) in the DW was volatilized in the melting furnace and solidified in fly ash (FA), resulting in slag with low radioactivity. To produce even cleaner slag, we added two Cl-containing additives (CaCl2 and polyvinyl chloride) to promote r-Cs volatilization as r-CsCl gas. The former was more effective than the latter. This difference between different additives was investigated by thermal analysis. The partitioning behavior of other elements such as strontium (Sr) was also investigated. We measured the leachability of r-Cs, alkali metals, and Sr from the slag and FA to evaluate their safety. Our results showed that the slag can be used as a construction material. However, the r-Cs and Sr leachability from FA increased with increased presence of Cl in the feedstock. Finally, the effect of the two additives on the partitioning and leaching behaviors of r-Cs and Sr was investigated based on their chemical forms in the DMS as predicted by a thermodynamic equilibrium calculation.

- **Keywords:** Decontamination waste; Melting process; Radioactive cesium partitioning; Equilibrium calculation; Leachability; Radioactive cesium volatilization

Maria Cristina Collivignarelli, Carlo Collivignarelli, Marco Carnevale Miino, Alessandro Abbà, Roberta Pedrazzani, Giorgio Bertanza. *SARS-CoV-2 in sewer systems and connected facilities*. Pages 196-203.

As for the SARS coronavirus in the 2003 epidemic, the presence of SARS-CoV-2 has been demonstrated in faeces and, in some cases, urine of infected people, as well as in wastewater. This paper proposes a critical review of the state of the art regarding studies on the presence of SARS-CoV-2 in wastewater and sewage sludge, the factors affecting its inactivation and the main proposed treatments. In-vitro tests demonstrated low resistance of SARS-CoV-2 to high temperature, while even significant changes in pH would not seem to determine the disappearance of the virus. In real wastewater and in sewage sludge, to date studies on the influence of the different parameters on the inactivation of SARS-CoV-2 are not available. Therefore, studies involving other HCoVs such as SARS-CoV and HCoV-229E have been also considered, in order to formulate a hypothesis regarding its behaviour in sewage and throughout the steps of biological treatments in WWTPs. Finally, SARS-CoV-2 in wastewater might track the epidemic trends: although being extremely promising, an effective and wide application of this approach requires a deeper knowledge of the amounts of viruses excreted through the faeces and the actual detectability of viral RNA in sewage.

- **Keywords:** Coronavirus removal; CoViD; Human health; SARS; Sewage sludge; Wastewater

Abdalrahman Alsulaili, Meshari Al-Harbi, Khalad Elsayed. *The influence of household filter types on quality of drinking water*. Pages 204-211.

Point-of-use (POU) water filters nowadays are widely used worldwide to get highly purified potable water. In this study, people opinions about household water filters were obtained via well-constructed questionnaire distributed to 1200 participants in the state of Kuwait. Analyses revealed that respondents installed multiple household filtration systems due to the doubts that municipal water could include physical (40 %), chemical (36 %), and biological contaminants (31 %) that induces infectious and non-infectious diseases. Subsequently, total of 56 waters samples without and after using POU filters were collected from 28 homes in Kuwait distributed over all residential areas of Kuwait. The POU water filters were not found efficient to remove physical, chemical, and microbiological parameters and conversely water quality deteriorated in most houses after the POU filters. This is possibly due to lack of tanks and filter maintenance and therefore POU filters became reservoirs of various types of chemical, physical, and

microbial impurities. Based on results of questionnaires, published studies, and market study, a testing station was developed and eight different configurations of household water filters were investigated for 10 continues months. Results demonstrated that singular filters can efficiently remove water impurities if these household filters undergo to periodic cleaning activities. Removal efficiency of filters, with a proper regeneration, varied from 75 % (carbon wrapped filter) to 91 % (ceramic filter) for turbidity, from 58 % (polyspun filter) to 83 % (ceramic filter) for total coliforms, and 100 % for TSS with all filters over the tested period.

- **Keywords:** Drinking water quality; Point-of-use (POU) water filters; Physical and chemical properties; Microorganisms contamination

Umamaheswari J., Bharathkumar T., Shanthakumar S., Gothandam K.M. *A feasibility study on optimization of combined advanced oxidation processes for municipal solid waste leachate treatment*. Pages 212-221.

Municipal solid waste (MSW) leachate, mostly comprised of organic and inorganic substances originated from discarded organic matters, chemicals, and liquors at MSW dumpsite. Pollutant composition and toxic compounds of leachate necessitate the effective treatment before its disposal. In the current study, advanced oxidation processes; ozonation, peroxone process and photolytic ozonation were employed for the treatment of complex MSW leachate. Central Composite Design (CCD) of Response Surface Methodology (RSM) was applied to optimize the various operating parameters in the treatment system. The optimized condition of pH: 9.0; contact time: 60 min and Ozone dose: 5 g/h for a litre of leachate provided the maximum COD and NH3–N reduction of 72 % and 80 % respectively for photolytic ozonation (under 15 W–UVC; λ:254 nm) whereas under the same operating conditions, ozonation process provided 45 % of COD removal and 50 % of NH3-N removal. Peroxone process with H2O2 concentration of 800 mg/L, showed the maximum COD and NH3-N removal efficiencies of 61 % and 59.7 % respectively. The developed models have confirmed the interaction between the selected parameters; have good agreement with each other; have the best fit. The present approach provided the knowledge to adopt an efficient way of treatment to the complex MSW leachate to proceed further for pilot-scale treatment.

- **Keywords:** Advanced oxidation process; Ozonation; Peroxone process; Photolytic ozonation; Municipal solid waste leachate; Optimization

Pooja Thanekar, N.J. Lakshmi, Merul Shah, Parag R. Gogate, Z. Znak, Yu. Sukhatskiy, R. Mnykh. *Degradation of dimethoate using combined approaches based on hydrodynamic cavitation and advanced oxidation processes*. Pages 222-230.

Degradation of dimethoate (DM), an organophosphorus pesticide, present in aqueous solution considered as simulated wastewater was investigated using different approaches based on hydrodynamic cavitation. Initially, the effect of initial concentration of DM was investigated over the range of 20−75 ppm at a constant condition of 4 bar as inlet pressure. The maximum extent of degradation (25 %) was observed for 20 ppm solution using the approach of HC alone. The hybrid approaches of HC + UV, HC+H2O2, and HC + Fenton were subsequently investigated at inlet pressure of 4 bar and pH of 7 (natural pH of solution) using 20 ppm as the initial concentration. Significant increase in degradation for the combination operations such as HC + UV and HC+H2O2 with actual extent of degradation as 30.8 % and 72.5 % respectively was observed. Complete degradation of DM within only 40 min was established in the work using HC + Fenton combination at optimized Fe (II) and H2O2 loadings as 0.9 M and 0.18 M respectively. Also, COD reduction as high as 71.5 % was demonstrated using HC + Fenton combination at much lower Fe (II) and H2O2 loadings as 0.009 M and 0.045 M

respectively. The kinetic rate constants were obtained for all treatment approaches using the integral analysis. The toxicity analysis of DM, before and after treatment, was also performed using two bacterial strains as Bacillus subtilis and Pseudomonas aeruginosa. Based on the obtained values of cavitational yield and operational costs based on energy requirements, the different treatment approaches have also been compared. Overall, it was clearly demonstrated that HC + Fenton is an effective treatment approach for the complete remediation of DM and treated effluent also showed no toxicity to the bacteria.

- **Keywords:** Dimethoate; Hydrodynamic cavitation; Kinetic study; Toxicity; Fenton; Process intensification

Xiangmiao Tian, Zhiqiang Shen, Yuexi Zhou, Kaijun Wang. *Inhibition on biological acidification and microbial community by high-strength acetaldehyde*. Pages 231-238.

Research on the biological removal of high-strength acetaldehyde solution is severely lacking; consequently, this study comprehensively investigated the impact of acetaldehyde on biological acidification. Our results indicate that the yield of acid production significantly decreased with increasing acetaldehyde concentration; the yield declined 14.83%–71.12% under the selected initial acetaldehyde concentrations of 100 to 2000 mg/L. Moreover, the acid-producing inhibition rate (EC50) was 1,118.36 mg/L according to calculations and non-linear fitting. Furthermore, DNA content under 1000 mg/L at 96 h was 2.22 times higher than that without acetaldehyde, which indicated that the inhibition of biological acidification by acetaldehyde was caused by microbial consortium death. In particular, microbes secreted more extracellular polymeric substances to resist toxicity with 500 mg/L acetaldehyde, and protein-like substances in extracellular polymeric substances interacted with acetaldehyde. Finally, microbial consortiums were changed into a high-tolerance community of Chloroflexi, Actinobacteria, and Firmicutes at the phylum level after 96 h.

- **Keywords:** Acetaldehyde; Wastewater; Hydrolytic acidification; Biological inhibition; Extracellular polymeric substances; Microbial community

Cuiwei Liu, Yihan Liao, Zhaoxue Cui, Yuxing Li, Chenyang Weng. *Sound–turbulence interaction model for low mach number flows and its application in natural gas pipeline leak location*. Pages 239-247.

When leakage dynamic pressure waves (DPWs) propagate in low Mach number flows, the viscothermal effects are considered the main reason for sound attenuation. However, an experimental analysis conducted in this study shows that the non-equilibrium sound–turbulence interaction process is the main cause. The turbulence effects due to turbulent flows act on the DPWs, and the fluctuations due to the DPWs act on the turbulent flows. Both processes result in the turbulent absorption of the gas to the amplitude of the DPWs, leading to amplitude attenuation at sufficiently low frequencies. To predict the amplitude attenuation, a non-equilibrium sound–turbulence interaction model is established, solved, and verified using analytical and experimental results, which show that attenuation coefficients (ACs) obtained by considering the sound–turbulence interaction effects are 1.6–3.5 times larger than those obtained by only considering the viscothermal effects, even when the Mach number is between 0.0038 and 0.016. The established model can improve leak localization.

- **Keywords:** Natural gas pipelines; Dynamic pressure waves; Sound–turbulence interaction process; Amplitude attenuation; Leak localization

Giovanni Gadaleta, Sabino De Gisi, Silvio M.C. Binetti, Michele Notarnicola. *Outlining a comprehensive techno-economic approach to*

***evaluate the performance of an advanced sorting plant for plastic waste recovery*. Pages 248-261.**

Mixed plastics from municipal solid waste are usually recycled in suitable Material Recovery Facilities (MRFs) following separate collection. These plants allow the sorting of individual plastics with variable performance depending on the technologies adopted. The evaluation of the performance of MRFs is also conducted with different approaches, even in terms of timescales, making the results difficult to compare. In this context, this study presents a comprehensive techno-economic approach to evaluate the performance of a MRF for plastic waste recovery. As a support, the Molfetta MRF case study (Southern Italy) was considered with an inlet plastic amount of about 19,000 t/year. The methodological proposal was based on the analysis of the quantity and composition of the different incoming waste streams, calculation of the Purity Index (PI) and Recovery Index (RI), quantification of the mass balance as well as accurate economic assessment. PI and RI assess the technical performance of the facility. They achieved the highest values (>95 %) for manual and optical sorting indeed they reached good values (70–80 %) for dimensional one; the economic analysis showed a specific gain of 12.58 €/t of sorted waste. The comparison of the obtained results with those of a similar MRF in Northern Italy had corroborated the suitability of the proposed approach suggesting its application, although with the due exceptions referred to the economic part, to other world contexts.

- **Keywords:** Materials recovery facility; Municipal solid waste; Performance indicators; Plastic waste; Recycling; Sorting

Anshu Priya, Subrata Hait. *Biometallurgical recovery of metals from waste printed circuit boards using pure and mixed strains of Acidithiobacillus ferrooxidans and Acidiphilium acidophilum*. Pages 262-272.

Bioleaching ability of two acidophiles, viz. Acidithiobacillus ferrooxidans, a gammaproteobacteria, and Acidiphilium acidophilum, an alphaproteobacteria in pure and mixed strains was comparatively evaluated for the recovery of metals from waste printed circuit boards (WPCBs) of computer at pulp density in the range of 7.5−15 g/L. Results indicated a variation in metal leachability, showing improved bioleaching by the mixed strain. Mixed strain demonstrated the highest bioleaching of 96% Cu, 94.5% Zn, 75% Ni, and 74.5% Pb from the pulverized particles ranging from 0.075–1 mm size with a pulp density of 7.5 g/L at 18 days with asymptoticity from 12 days onward. Further, the corresponding maximum bioleaching efficiency by the mixed culture for precious and rare earth metals achieved was 46% Ag, 38% Au, and 31% Sc, 27% each of Ce and La, and 24% Nd. Improved bioleaching by the mixed culture may be due to the synergistic growth of the bacterial strains producing a collective effect leading to efficient metal solubilization. Higher production of exopolymeric substances (EPS) by the mixed culture demonstrated their remarkable role in metal bioleaching. A yield of greater than 99% of base metals by fractional chemical precipitation of bioleachate served as a concluding step in metal recovery.

- **Keywords:** Waste printed circuit board; Metal bioleaching; Alpha- and gammaproteobacteria; Pure and mixed cultures; Exopolymeric substances

Dilaeleyana Abu Bakar Sidik, Nur Hanis Hayati Hairom, Mohd Khairul Ahmad, Rais Hanizam Madon, Abdul Wahab Mohammad. *Performance of membrane photocatalytic reactor incorporated with ZnO-Cymbopogon citratus in treating palm oil mill secondary effluent*. Pages 273-284.

Green synthesis provides new avenues of nanoparticle synthesis using plants. In the present study, we attempted to synthesise ZnO nanoparticles via precipitation using different ratios of ZnO solution to leaf extract of Cymbopogon citratus (3:1, 5:1, and 9:1). The modified ZnO was characterised using Fourier transform infrared spectroscopy, transmission electron microscopy, and X-ray diffraction. The influences of the modified ZnO-C. citratus (ZnO-CC) nanoparticles on the removal of colour from and decline in the flux of palm oil mill secondary effluent (POMSE) in a membrane photocatalytic reactor (MPR) were studied. The performance of ZnO-CC 3:1 in terms of colour (99.84 %), COD (98.97 %), BOD (96.24 %) and turbidity removal (99.89 %) of the treated POMSE was significant. The improvement of the performance efficiency for POMSE treatment using MPR correlate with the reduction in the size of ZnO-CC 3:1 (6.6–42.9 nm) which promote higher degradation activity and minimize membrane flux decline during the process. Thus, it can be deduced that the coupled MPR system has significant potential for application in the palm oil mill effluent treatment industry as it mitigates membrane fouling and yields treated effluent of good quality.

- **Keywords:** Zinc oxide; Cymbopogon citratus; Precipitation; Palm oil mill secondary effluent; Membrane photocatalytic reactor

B. Neethu, G.D. Bhowmick, M.M. Ghangrekar. *Improving performance of microbial fuel cell by enhanced bacterial-anode interaction using sludge immobilized beads with activated carbon*. Pages 285-292.

Performance of a microbial fuel cell (MFC) is greatly influenced by capability of anode material in promoting attachment of electrogenic bacteria on its surface, which assists in higher electron transfer with minimal electrode resistance. In this investigation, feasibility of different anode materials made of stainless-steel (SS) mesh cage filled with sodium alginate beads matrix containing either bacterial inoculum (Ic) or activated carbon (AC) or combination of both (AC-Ic) was evaluated and performance was compared with MFCs operated with bare carbon felt and SS mesh as an anode material. Superior performance was exhibited by MFC having anode containing bead matrix with AC-Ic in SS mesh cage, which exhibited a maximum power density of 2.6 W/m3 and chemical oxygen demand (COD) removal efficiency of 91.6 ± 2.1 % due to enhanced bacterial-electrode interaction. Furthermore, the cost of bead-based electrodes was seventeen folds cheaper than carbon felt electrode, making it ideal for pilot-scale MFCs.

- **Keywords:** Activated carbon; Bacterial-anode interaction; Microbial fuel cells; Sodium alginate beads; Wastewater treatment

Horng-Jang Liaw, Chieh-An Yang. *Maximum flash point behavior of ternary mixtures with single and two maximum flash point binary constituents*. Pages 293-303.

Mixtures exhibiting maximum flash point behavior (MaxFPB) have the potential to reduce the fire and explosion hazard of liquids, such as waste solvent and liquid fuel. Commercial mixtures generally contain multiple components. However, existing research on MaxFPB is limited mainly to binary mixtures. Accordingly, the present study extends the literature by examining the MaxFPB of three ternary mixtures, namely phenol+cyclohexanol+cyclohexanone, phenol+cyclohexanol+benzyl alcohol, and phenol+acetophenone + 1-propanol. It is shown that two binary constituents of the former two mixtures exhibit MaxFPB, while a single binary constituent of the latter mixture has MaxFPB. For all three studied mixtures, the maximum flash point of the solution is located at their one of the binary constituents. In general, the results provide a useful source of reference for hazard reduction, process safety design, and fuel design.

- **Keywords:** Maximum flash point behavior (MaxFPB); Flash point; Fuel; Ternary mixture

Gehui Wang, Li Sang, Muhammad Tariq, Cong Lu, Wei Zhang, Kuangfei Lin, Botao Huang. *Systematic facile study of singleton e-waste recycling site to unveil the potential bio-indicator for atmospheric heavy metals by using tree leaves*. Pages 304-312.

Limited studies have been conducted with respect to atmospheric heavy metals pollution due to high cost of instruments and other associated challenges. In the present study, we have evaluated the possibility of using tree leaves as a bio-indicator of atmospheric pollution by analyzing the composition of 12 different heavy metals in leaves of six tree species and air, dust, or soil. We have chosen the four different regions of Zhejiang Province PR, China as a case study that can be employed anywhere worldwide. Among the four under consideration regions (Mukeng, Yanggongao, Wenqiaozhen, and Changyudongtian), air samples showed the highest values of total heavy metals (∑HM) 2234.28 mg/kg, while the lowest value were found in soil (17.51 mg/kg). Similar kind of heavy metal profiles were observed in the four matrices, especially for leaf and air. Cedrus deodara leaf was explored as an ideal passive sampler due to its high accumulation concentration (26.516 mg/kg) and high enrichment factor (0.93–4.02) for different heavy metals. In addition, the concentrations in Cedrus deodara leaves indicated a good value of the coefficients of correlations (r = 0.819-0.994) for Sn, Pb, Cu, Cd, As, Hg, Ni, and ∑HM in air. Furthermore, the leaf age and the lipid content could affect the accumulation of heavy metals. We strongly recommend that our current conducted research work will provide the facile, efficient along with cost-effective monitoring route for atmospheric pollution measurement with respect to heavy metals at anywhere of e-wastes recycling sites around the globe.

- **Keywords:** e-Waste recycling sites; Heavy metals; Air; Leaf; Biological indicator

Panagiotis Evangelopoulos, Henry Persson, Efthymios Kantarelis, Weihong Yang. *Performance analysis and fate of bromine in a single screw reactor for pyrolysis of waste electrical and electronic equipment (WEEE)*. Pages 313-321.

This study focuses on chemical recycling of plastics from waste electrical and electronic equipment (WEEE), which constitutes a problematic waste fraction due to the presence of brominated flame retardants. An auger reactor has been designed and used for this study. Real WEEE material provided by Stena Technoworld has been pyrolyzed under different temperature conditions. The performance of the reactor as well as other important parameters such as the fate of the bromine have been investigated and evaluated. The main outcome of this investigation is to simulate a continuous process, which can be useful for designing a full-scale industrial process. The mass balance results after performing thermal treatment at 400, 500, and 600 °C, showed a high gas yield (44 %wt) at the temperature of 600 °C, which energy content is enough to self-sustain the auger reactor. At the low temperature of 400 °C the oil production reaches its maximum yield as well as maximum concentration of bromine, corresponding to 0.5 wt% in the oil. Several valuable organic compounds have been detected in the oil composition, which can be used as precursors for feedstock recycling producing new plastics.

- **Keywords:** Pyrolysis; Screw reactor; Auger reactor; BRFs; WEEE; Feedstock recycling

Shengjian Li, Meng Liu, Chun Yin, Jing Chen, Xiangjun Yang, Shixiong Wang. *Tuning the structure flexibility of metal-organic frameworks via adjusting precursor anionic species for selective removal of phosphorus*. Pages 322-331.

This study proposes a new strategy for manufacturing metal-organic frameworks (MOFs) with respective topologies and properties by adjusting the anionic species in the precursor solution. Three MOFs (e.g. Fe/Al (Cl−), Fe/Al (NO3−) and Fe/Al (SO42−)) were successfully synthesized and used for removal of phosphate from water. Surprisingly, when chlorinated salt was used as the precursor, only Al was detected in the Fe/Al (Cl−). However, when nitrate and sulfate were used as the precursors, Fe and Al were simultaneously detected in the Fe/Al (NO3−) and Fe/Al (SO42−). These MOFs exhibit ultrafast adsorption kinetics and high uptake capacity for phosphate. The maximum phosphate uptake capacity (130 mg P/g) of Fe/Al (NO3−) is much higher than that of most phosphate removal materials reported in the literature. More importantly, Fe/Al (NO3−) can still effectively remove phosphate from water bodies after multiple cycles of adsorption/desorption. When there are a large number of common interfering ions (Ca2+, Mg2+, CO32-, HCO3−, Cl−, NO3− and SO42−) in the water, the prepared MOFs can still specifically remove phosphorus from water. In addition, the prepared MOFs can adapt to the removal of phosphorus in a wide pH water body. Furthermore, based on FTIR and XPS spectra, chemical adsorption and ligand exchange were identified as the main phosphorus removal mechanisms by Fe/Al (NO3−). These findings prefigure that MOFs synthesized by regulating the anionic species can efficiently and economically remove phosphate from water.

- **Keywords:** Metal-organic frameworks; Anionic; Morphology-tunable; Phosphate

Brian Gidudu, Evans M. Nkhalambayausi Chirwa. *Biosurfactants as demulsification enhancers in bio-electrokinetic remediation of petroleum contaminated soil*. Pages 332-339.

To remediate petroleum-contaminated soil, a DC powered electrokinetic reactor was used with amended biosurfactant concentrations of 28 g/L, 56 g/L, and 84 g/L to enhance the extraction of oil from the soil and aid in the biodegradation of the remaining oil by hydrocarbon-degrading microbes. The highest oil extraction of 83.15 ± 1.97 % was obtained with the biosurfactant concentration of 56 g/L while the highest degradation was observed when 84 g/L of biosurfactants were used. The bacteria survived the electro-halo-thermal environment and degraded the remaining hydrocarbons to as low as 0.0405 ± 0.057 mg of carbon/mg of soil when 84 g/L of biosurfactants were used. Microbial growth was however affected by the relentlessly changing pH in the reactor. The presence of biosurfactants significantly aided in oil recovery and biodegradation in the first 96 h of the experiments.

- **Keywords:** Soil; Electrophoresis; Electroosmosis; Bioavailability; Oil

Jie Li, Yi Li, Wenlong Zhang, Saraschandra Naraginti, A. Sivakumar, Chi Zhang. *Fabrication of novel tetrahedral Ag3PO4/g-C3N4/BiVO4 ternary composite for efficient detoxification of sulfamethoxazole*. Pages 340-347.

Wide spread of antibiotic resistant microorganisms and genes urge the evolution of effective methods to remove antibiotic pollution from the environment. Ag3PO4 is one of the best visible light photocatalyst but has drawbacks due to low stability. Combining Ag3PO4 with BiVO4 and g-C3N4 is expected to overcome these drawbacks and improve the efficiency. The present study deals with preparation of tetrahedral Ag3PO4/g-C3N4/BiVO4 ternary composite with superior photocatalytic activity and stability for efficient detoxification of sulfamethoxazole (SMX). Pure BiVO4 (51.3 %), g-C3N4 (40.2 %), Ag3PO4 (60.1 %) and other composites showed lower efficiency than Ag3PO4/g-C3N4/BiVO4 (93.6 %) in photodegradation of SMX (20 mg/L) after 60 min. Tetrahedral Ag3PO4 showed superior light adsorption capacity and photocatalytic activity when combined with g-C3N4/BiVO4 and also showed reduced charge recombination which were

supported by UV-DRS and PL analysis. The synergistic effects of both g-C3N4 and Ag3PO4/BiVO4 in the structure could facilitate the enhanced photostability and recyclability to Ag3PO4. Furthermore, the intermediate compounds generated during degradation of SMX were analyzed by LC-MS analysis and the plausible pathway was proposed. Moreover, the biotoxicity of the intermediate compounds was investigated by Escherichia coli (E. coli) colony forming unit assay and the results revealed that after 60 min a substantial decrease in biotoxicity was observed.

- **Keywords:** Tetrahedral Ag3PO4; BiVO4; Sulfamethoxazole; Detoxification; Biotoxicity

S. Zohra Halim, Mengxi Yu, Harold Escobar, Noor Quddus. *Towards a causal model from pipeline incident data analysis*. Pages 348-360.

Pipeline network facilitates transportation of hazardous materials over long distances and is considered a relatively safer mode of transportation. However, a significant number of incidents occurred over the last few years that has increased the need for development of an accurate predictive model for incidents. Pipeline incident databases have been collecting a wide range of data regarding the incidents including the background operating conditions, the causes contributed to the incident, and the severity of consequences. Most academic studies analyzing these databases have developed predictive failure models focusing only on a narrow range of factors that played a role behind certain categories of incidents. They fail to provide a holistic understanding of how interaction of multiple factors contributing to an incident or how their combined effect eventually leads to failure. The amount of data collected in the databases are however huge. For example, the current reporting format of Pipeline and Hazardous Materials Safety Administration (PHMSA) collects over six hundred datapoints from each incident. Given the large amount of information available and current technologies, it is now possible to look into ways to understand the holistic effect of all contributing factors. The current study looks into how the databases can be utilized to derive such a complete understanding. The study compares the databases of US PHMSA, Canada National Energy Board (NEB), and European Gas Pipeline Incident Data Group (EGIG) to examine the frameworks used to classify the causal factors of the incident data and shows that the background factors, underlying factors and the causal factors identified in the various databases are inter-related and show varying degrees of dependency. This curves the way forward to development of a causal model that will help identify the important factors that needs to be addressed and a prediction of future failure given existing conditions of a pipeline system.

- **Keywords:** Pipeline incident data; Causal factor; Background factors; Underlying cause

Guo Huimin, Cheng Lianhua, Li Shugang, Lin Haifei. *Regional risk assessment methods in relation to urban public safety*. Pages 361-366.

With the development of urbanization in China, the problem of urban public safety is becoming increasingly prominent. A scientific regional risk assessment of urban public safety can provide important support for risk warning and management systems. This study aims to introduce a comprehensive method to assess and manage regional risk factors of urban public safety. Taking regional risk assessment of urban public safety as the research object, and focusing on multiple sources of risk such as industry, infrastructure, traffic, and public places, this study provides a comprehensive and systematic classification of risks and identifies the characteristics of the various risk agents. The urban region is divided into three units: an industrial risk unit, an urban population-intensive unit, and an urban communal facilities unit. Then, a multi-agent index system for regional risk assessment in relation to urban public safety is established. Using the analytic hierarchy process, the entropy weight method, and

multiple connection numbers, both static and dynamic analyses of regional risks in relation to urban public safety are undertaken and the regional risks in relation to urban public safety are predicted.

- **Keywords:** Urban public safety; Regional risk; Multi-agent; Set pair analysis; Multiple connection number