Process Safety and Environmental Protection

rok 2015, ročník 93

Číslo 1 (January 2015)

Chai Siah Lee, John Robinson, Mei Fong Chong. *A review on application of flocculants in wastewater treatment*.

Flocculation is an essential phenomenon in industrial wastewater treatment. Inorganic coagulants (salts of multivalent metals) are being commonly used due to its low cost and ease of use. However, their application is constrained with low flocculating efficiency and the presence of residue metal concentration in the treated water. Organic polymeric flocculants are widely used nowadays due to its remarkable ability to flocculate efficiently with low dosage. However, its application is associated with lack of biodegradability and dispersion of monomers residue in water that may represent a health hazard. Therefore, biopolymers based flocculants have been attracting wide interest of researchers because they have the advantages of biodegradability and environmental friendly. But, natural flocculants are needed in large dosage due to its moderate flocculating efficiency and shorter shelf life. Thus, in order to combine the best properties of both, synthetic polymers are grafted onto the backbone of natural polymers to obtain tailor-made grafted flocculants. This paper gives an overview of the development of different types of flocculants that were being investigated for treatment of industrial wastewater. Furthermore, their flocculation performance will be reviewed and the flocculation mechanism will be discussed.

- **Keywords:** Coagulation–flocculation; Direct flocculation; Bio-flocculants; Grafted flocculants; Flocculation mechanism; Wastewater treatment

, Inside Front Cover, Process Safety and Environmental Protection, Volume 93, January 2015, Page IFC, ISSN 0957-5820, http://dx.doi.org/10.1016/S0957-5820(14)00195-5.

(http://www.sciencedirect.com/science/article/pii/S0957582014001955)

, Contents, Process Safety and Environmental Protection, Volume 93, January 2015, Pages i-ii, ISSN 0957-5820, http://dx.doi.org/10.1016/S0957-5820(14)00196-7.

(http://www.sciencedirect.com/science/article/pii/S0957582014001967)

Ali Fakhri, Investigation of mercury (II) adsorption from aqueous solution onto copper oxide nanoparticles: Optimization using response surface methodology, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 1-8, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.06.003.

(http://www.sciencedirect.com/science/article/pii/S0957582014000834)

Abstract: Abstract

Response surface methodology was practicable to optimize the mercury (II) removal using copper oxide nanoparticles in an aqueous matrice. The copper oxide nanoparticles structure was performed by TEM, SEM, XRD and BET. The experiment reactions were carried out based on a Box–Behnken design (BBD) and evaluated using RSM. Batch mode tests were conducted to prognosticate the adsorption equilibrium. The three parameters influence on the mercury removal was inquired by a response surface methodological approach. In study, influence of adsorbent dose, pH and temperature on the mercury removal unto copper oxide nanoparticles has been performed. The importance of the independent factors and their interactions were investigated by the ANOVA. The optimum pH, adsorbent dose and temperature were obtained to be 9.0, 0.05 g and 278 K, respectively.

Keywords: Mercury; CuO nanoparticles; Optimization; Box–Behnken design; Response surface methodology

E. Andrioli, L. Petry, M. Gutterres, Environmentally friendly hide unhairing: Enzymatic-oxidative unhairing as an alternative to use of lime and sodium sulfide, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 9-17, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.06.001.

(http://www.sciencedirect.com/science/article/pii/S0957582014000810)

Abstract: Abstract

Various studies have been conducted to develop technologies that minimize the environmental concerns associated with the leather industry. The use of enzymes and oxidizing products during the unhairing step reduces pollution by tanneries as well as process time. In this study, were used an enzymatic extract produced by a strain of Bacillus subtilis – BLBc 11 – and hydrogen peroxide to conduct enzymatic-oxidative unhairing as an alternative to the conventional process (lime and sodium sulfide). Tests for enzymatic-oxidative unhairing were performed by applying crude enzymatic extract at concentrations of 100 U g−1 and 300 U g−1 of hide and hydrogen peroxide at concentrations of 4% and 8%. Tests were conducted comparing the proposed unhairing method, the conventional unhairing and purely enzymatic unhairing, performed with crud enzymatic extract produced by strain BLBc 11. The results showed that the proposed enzymatic-oxidative unhairing method can be used as an alternative to lime and sodium sulfide.

Keywords: Unharing; Hair; Bacillus subtilis; Hydrogen peroxide; Enzymes; Hide

Siduo Zhang, Xiaotao Tony Bi, Roland Clift, Life cycle analysis of a biogas-centred integrated dairy farm-greenhouse system in British Columbia, Process Safety and

Environmental Protection, Volume 93, January 2015, Pages 18-30, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.02.017.

(http://www.sciencedirect.com/science/article/pii/S0957582014000366)

Abstract: Abstract

This study investigates the potential integration of a dairy farm and a greenhouse into an eco-industrial system to promote waste-to-energy and waste-to-material exchanges. Natural gas consumption is substituted by renewable biogas generated from anaerobic digestion (AD) of the dairy manure; CO2 for plant enrichment in greenhouses is supplied by biogas combustion and the digestate (digestion residue) from digesters is used as animal bedding, plant growing media and liquid fertilizers.

A life cycle analysis (LCA) was conducted to quantify the environmental impacts of the eco-industrial system in comparison to the conventional agriculture practices. The results show that the integrated system reduces non-renewable energy consumption, climate change impact, acidification, respiratory effects from organic emissions, and human toxicity by more than 40%. If the digestate surplus is treated as a waste, the integrated system shows an increase in eutrophication and respiratory effects from inorganic emissions while all the analyzed impacts are reduced if the digestate can be used for substituting chemical fertilizers.

Keywords: Industrial Ecology; Renewable energy; Energy integration; Climate change; Life cycle analysis; Environmental impact assessment

Sarah Bonvicini, Giacomo Antonioni, Pamela Morra, Valerio Cozzani, Quantitative assessment of environmental risk due to accidental spills from onshore pipelines, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 31-49, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.04.007.

(http://www.sciencedirect.com/science/article/pii/S0957582014000536)

Abstract: Abstract

The transport of hazardous materials by pipeline is widely used for the transfer of significant quantities of oil and chemicals. Due to the extremely low frequency of spills, pipelines are considered the safest mode for the land transportation of hazardous substances. Accident records, while confirming that Loss of Containment (LOC) events are rare, also point out the major-accident hazard of pipelines, due to the extremely severe potential consequences of spills. Quantitative Risk Analysis (QRA) techniques have been applied to pipelines since many years with the aim of evaluating risk for workers or exposed population. However, releases of liquids, as oil and oil products, also create an hazard to the environment, due to the potential of extensive soil and groundwater contamination. An integrated model was developed for the environmental Risk Analysis of spills from pipelines. Specific environmental risk indexes were defined, expressing the risk of soil and groundwater contamination, both in physical and economic terms. A case-study is presented and discussed to illustrate the features of the methodology. The results confirmed that the proposed model may be considered an important tool within a comprehensive approach to the management of risk related to onshore pipelines.

Keywords: Onshore pipelines; Major accident hazard; Quantitative risk analysis; Environmental risk; Soil contamination; Groundwater contamination

Richard H. Taylor, Lorenzo G.A. van Wijk, John H.M. May, Neil J. Carhart, A study of the precursors leading to 'organisational' accidents in complex industrial settings, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 50-67, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.06.010.

(http://www.sciencedirect.com/science/article/pii/S0957582014000901)

Abstract: Abstract

This study aggregates the narrative findings from the investigation of 12 accidents or 'near hits' across a wide range of industrial settings to build a catalogue of organisational and cultural precursors to accidents. It was found that many were important factors in multiple events. It is argued that by addressing these potential vulnerabilities using the findings and proposed tools based upon them, organisations undertaking safety related activities will not only develop greater awareness of these deeper-lying issues but should be able to better control the risks associated with them.

The precursors have been classified under eight headings and examples of key findings from three of these are presented. Statements providing potential defences against the identified vulnerabilities have been developed which should enable organisations to scrutinise the adequacy of existing expectations or requirements within their business. Probing questions have been developed based on the statements which should allow an assessment to be made as to whether these have been 'embedded' in the organisation.

It is argued that organisational vulnerability tools should be developed to enable a systematic approach to 'diagnosing' incubating precursors. It is also argued that there is the potential for further resilience to be achieved through the use of models of the complex dynamics of socio-technical processes within organisations.

Keywords: Organisational vulnerabilities; Organisational resilience; Accident precursors; Systems thinking; Hierarchical process modelling; Socio-technical dynamics models

Man-Hong Huang, Wei Zhang, Chong Liu, Hong-Ying Hu, Fate of trace tetracycline with resistant bacteria and resistance genes in an improved AAO wastewater treatment plant, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 68-74, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.04.004.

(http://www.sciencedirect.com/science/article/pii/S0957582014000500)

Abstract: Abstract

The fate of trace tetracycline, tetracycline resistant bacteria (TRB) and tetracycline resistant genes (TRGs) in an improved anaerobic-anoxic-oxic (AAO) wastewater treatment plant (WWTP) was investigated in this study. Quantitative real-time polymerase chain reaction (qPCR) and conventional heterotrophic plate count method were used to measure eight tet genes (tetA, tetB, tetC, tetE, tetM, tetO, tetS and tetX) and TRB, respectively. The TRB percent of total heterotrophic bacteria (THB) is about 1.31–24.1% in WWTP influent. Tet gene abundance in the WWTP varied greatly among the gene types. The concentrations of TRGs in effluent samples ranged from

7.11 × 10−9 to 1.53 × 10−4 copies/copy 16S rRNA gene. TRB and THB, tetM and tetO, tetE and tetX, but not the others, showed a significant correlation with each other (p < 0.01). The relationships between ribosomal protection protein genes, enzymatic modification gene and corresponding concentrations of antibiotics were found to be considerably significant (R2 = 0.898, p < 0.01 for ribosomal protection protein genes and R2 = 0.872, p < 0.05 for enzymatic modification gene).

Keywords: Fate; Tetracyclines; Tetracycline resistant bacteria (TRB); Tetracycline resistant genes (TRGs); Modified anaerobic-anoxic-oxic (AAO) process; Wastewater treatment

Seyed Miri Lavasani, Anousheh Zendegani, Metin Celik, An extension to Fuzzy Fault Tree Analysis (FFTA) application in petrochemical process industry, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 75-88, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.05.001.

(http://www.sciencedirect.com/science/article/pii/S0957582014000706)

Abstract: Abstract

Fault Tree Analysis (FTA) is an established technique in risk management associated with identified hazards specific to focused fields. It is a comprehensive, structured and logical analysis method aimed at identifying and assessing hazards of complex systems. To conduct a quantitative FTA, it is essential to have sufficient data. By considering the fact that sufficient data is not always available, the FTA method can be adopted into the problems under fuzzy environment, so called as Fuzzy Fault Tree Analysis (FFTA). This research extends FFTA methodology to petrochemical process industry in which fire, explosion and toxic gas releases are recognized as potential hazards. Specifically, the case study focuses on Deethanizer failure in petrochemical plant operations to demonstrate the proposed methodology. Consequently, the study has provided theoretical and practical values to challenge with operational data shortage in risk assessment.

Keywords: Risk assessment; Fault tree analysis; Fuzzy sets; Petrochemical industry; Safety management; Operations modelling

Saeed Eini, Bahman Abdolhamidzadeh, Genserik Reniers, Davood Rashtchian, Optimization procedure to select an inherently safer design scheme, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 89-98, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.05.002.

(http://www.sciencedirect.com/science/article/pii/S095758201400072X)

Abstract: Abstract

There are different well-established strategies for making a process plant inherently safer. The benefits of applying these strategies on reducing the overall risk inside a plant are obvious. However, some of these changes are rejected many times because they appear to be too costly. But if the effects of applying inherently safer design strategies are investigated not only on the processing costs of a plant but also on the potential accident costs, the decision would in fact be different. In this paper an optimization

procedure is proposed which integrates both processing and accident costs for different design schemes. In this procedure, some of the design variables are chosen with regard to inherently safer design strategies. The objective function is the sum of accident costs and plant lifecycle processing costs. For assessing accident costs, consequence modeling techniques and probit functions are applied. Consequence modeling formulas and an objective function are codified in an optimizer package (MATLAB) and to accomplish the optimization process a process simulator (called HYSYS) is coupled with this package. The application of the proposed procedure is demonstrated by selecting an optimum process scheme for a Refrigeration plant as a case study.

Keywords: Process safety; Optimization; Inherently safer optimum design; Consequence modeling; Safety economics; Inherent safety

Roberto Lisi, Giancarlo Consolo, Giuseppe Maschio, Maria Francesca Milazzo, Estimation of the impact probability in domino effects due to the projection of fragments, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 99-110, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.05.003.

(http://www.sciencedirect.com/science/article/pii/S0957582014000731)

Abstract: Abstract

Despite the remarkable severity of domino effects in activities at major hazard, a complete methodology analysing such events has not been developed and integrated within Quantitative Risk Analysis (QRA). Such a deficiency appears to be particularly remarkable for domino effects triggered by the projection of fragments. The aim of the present work is therefore to propose a systematic procedure for the quantification of domino effects due to fragments projection within QRA. To achieve this objective, the deterministic approach for the estimation of the realistic trajectory of fragments is entirely reviewed. In order to incorporate such a reviewed approach within the standard QRA, a probabilistic model for the impact probability of the fragments is developed by applying a Monte-Carlo method to the trajectory equations. The validation of the proposed framework is carried out by using the data related to an accident occurred in 1993 in the oil refinery of Milazzo (Italy).

Keywords: Domino effect; Probabilistic analysis; Fragments projection; Tank explosion; Monte Carlo simulation; Quantitative Risk Analysis

Majid Bagheri, S.A. Mirbagheri, Majid Ehteshami, Zahra Bagheri, Modeling of a sequencing batch reactor treating municipal wastewater using multi-layer perceptron and radial basis function artificial neural networks, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 111-123, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.04.006.

(http://www.sciencedirect.com/science/article/pii/S0957582014000524)

Abstract: Abstract

A sequencing batch reactor was modeled using multi-layer perceptron and radial basis function artificial neural networks (MLPANN and RBFANN). Then, the effects of influent concentration (IC), filling time (FT), reaction time (RT), aeration intensity (AI), SRT and MLVSS concentration were examined on the effluent concentrations of TSS, TP, COD and NH4+-N. The results showed that the optimal removal efficiencies would be obtained at

FT of 1 h, RT of 6 h, aeration intensity of 0.88 m3/min and SRT of 30 days. In addition, COD and TSS removal efficiencies decreased and TP and NH4+-N removal efficiencies did not change significantly with increases of influent concentration. The TSS, TP, COD and NH4+-N removal efficiencies were 86%, 79%, 94% and 93%, respectively. The training procedures of all contaminants were highly collaborated for both RBFANN and MLPANN models. The results of training and testing data sets showed an almost perfect match between the experimental and the simulated effluent of TSS, TP, COD and NH4+-N. The results indicated that with low experimental values of input data to train ANNs the MLPANN models compared to RBFANN models are more precise due to their higher coefficient of determination (R2) and lower root mean squared errors (RMSE) values.

Keywords: Sequencing batch reactor; Neural network modeling; Multi-layer perceptron; Radial basis function; Municipal wastewater

Viacheslav Liato, Steve Labrie, Marzouk Benali, Mohammed Aïder, Ion exchange membrane-assisted electro-activation of aqueous solutions: Effect of the operating parameters on solutions properties and system electric resistance, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 124-138, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.04.005.

(http://www.sciencedirect.com/science/article/pii/S0957582014000512)

Abstract: Abstract

The properties of electro-activated (EA) aqueous solutions as well as the dynamics of their changes were considered in the current study using aqueous solutions of NaCl and NaHCO3. The concentrations of the salt solutions were 0.5, 0.25, 0.125 and 0.05 M. The tests were performed at the DC current densities of 25, 37.5, and 50 Å/m2. The electro-activation reactor consisted of three individual cells assembled together and separated by anion-exchange (AEM) and cation-exchange (CEM) membranes. During the experiments, four configurations of the membrane placements and solutions concentrations were studied. The obtained results showed the dynamics of the electro-activation process that allows obtaining electro-activated solutions with targeted properties such as pH and oxydo-reduction potential (ORP). It was possible to obtain electro-activated solutions at the anodic side (acid anolyte) with pH of 3.0, 3.5, and 4.0 and ORP of +1100 ± 15 mV when NaCl solution was used as electrolyte. Furthermore, several types of electro-activated solutions with high redox potential (ORP = +921 ± 12 mV) and neutral pH (6.48 ± 0.05) were obtained on the anode side when sodium carbonate was used. At the same time, two types of solutions, one with acid pH (2.14 ± 0.14) and the other one with alkaline pH (10.46 ± 0.03) with ORP = +689 ± 10 and 110 ± 21 mV, respectively, were obtained in the central compartment which considered as electro-activated solutions obtained by means of noncontact electro-activation.

Keywords: Electro-activation; Aqueous solutions; Ion exchange membranes; Reactor; Electrolysis

Jan M. Skowroński, Tomasz Rozmanowski, Małgorzata Osińska, Reuse of nickel recovered from spent Ni–Cd batteries for the preparation of C/Ni and C/Ni/Pd layered electrodes for

energy sources, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 139-146, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.02.007.

(http://www.sciencedirect.com/science/article/pii/S0957582014000147)

Abstract: Abstract

Nickel recovered in the recycling process of Ni–Cd batteries was used as a main component of bath for electrodeposition of nickel onto carbon fabric in order to obtain C/Ni composite. A part of the obtained composite was additionally coated with a thin layer of palladium (C/Ni/Pd composite). All the materials were investigated to assess the possibility of their use in the processes of electrochemical storage (sorption/desorption) of hydrogen and electrochemical oxidation of methanol. The obtained results showed the composites to be active electrode materials in these processes. The electrodes exhibited high activity and cyclability, especially in the process of methanol oxidation due to electrocatalytic activity of both nickel deposited onto carbon fabric and the outer layer of porous palladium coating nickel substrate.

Keywords: Nickel–cadmium battery recycling; Carbon fabric; C/Ni electrode; C/Ni/Pd electrode; Hydrogen storage; Methanol oxidation

R.B. Soares, F.L.P. Pessoa, M.F. Mendes, Dehydration of ethanol with different salts in a packed distillation column, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 147-153, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.02.012.

(http://www.sciencedirect.com/science/article/pii/S0957582014000317)

Abstract: Abstract

This work aimed the evaluation of a saline extractive distillation for the ethanol production. A thermodynamic model was used to predict the influence of the salts in the liquid–vapor equilibrium of the system water–ethanol and inside the packed column. The experiments were done in a distillation unit, with an internal diameter of 5.9 cm and a packing section with 37 cm of height, packed with raschig rings with 0.73 cm of characteristic inner made of glass. All the bottom and top samples were analyzed by refractive index. Two synthetic charges with the same composition of ethanol that are produced in the refinery (0.02 and 0.25 mol.L-1) were distilled under atmospheric pressure. Sodium chloride, calcium chloride, potassium acetate, calcium nitrate and a mixture of sodium and potassium acetates were added to the synthetic charges and the results were compared to the experiments already done without the presence of the salts, revealing the ethanol enrichment in the top product of the distillation unit, for all the systems analyzed. Another charge from the refinery, known as load of wine without yeast, was evaluated and the results indicated the same behavior, enriching the ethanol with the application of the saline extractive distillation.

Keywords: Raschig rings; Extractive distillation; Mass transfer

Rawel Singh, Thallada Bhaskar, Bhavya Balagurumurthy, Effect of solvent on the hydrothermal liquefaction of macro algae Ulva fasciata, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 154-160, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.03.002.

(http://www.sciencedirect.com/science/article/pii/S095758201400038X)

Abstract: Abstract

Hydrothermal liquefaction is an attractive approach for the conversion of aquatic biomass like algae as it does not require the energy intensive drying steps. The objective of the study is to understand the effect of various solvents (H2O, CH3OH and C2H5OH) on product distribution and nature of products of hydrothermal liquefaction of macro algae Ulva fasciata (MAUF). Hydrothermal liquefaction of MAUF was performed using subcritical H2O (300 °C) as well as supercritical organic solvents CH3OH and C2H5OH (300 °C). The use of alcoholic solvents significantly increased the bio-oil yield. The bio-oil yield was 44% and 40% in case of liquefaction with CH3OH and C2H5OH respectively whereas the bio-oil yield was 11% with H2O. Use of alcoholic solvents converted the acids obtained in bio-oil to the corresponding methyl and ethyl esters. 1H NMR data showed that use of alcoholic solvents (C2H5OH and CH3OH) increased aliphatic content of bio-oil1 (ether/methanol/ethanol fraction). FTIR and SEM results showed the difference in the bio residue obtained using alcoholic solvents and H2O. The results showed that liquefaction with supercritical alcohols is an effective way to produce functional hydrocarbons for chemical feedstock.

Keywords: Algae; Hydrothermal; Liquefaction; Solvent; Bio-oil; Bio fuels

S. Evangelisti, P. Lettieri, R. Clift, D. Borello, Distributed generation by energy from waste technology: A life cycle perspective, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 161-172, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.03.008.

(http://www.sciencedirect.com/science/article/pii/S0957582014000445)

Abstract: Abstract

Municipal Solid Waste in general and its organic fraction in particular is a potential renewable and non-seasonal resource. In this work, a life cycle assessment has been performed to evaluate the environmental impacts of two future scenarios using biogas produced from the organic fraction of municipal solid waste (OFMSW) to supply energy to a group of dwellings, respectively comprising distributed generation using solid oxide fuel cell (SOFC) micro-CHP systems and condensing boilers. The London Borough of Greenwich is taken as the reference case study. The system is designed to assess how much energy demand can be met and what is the best way to use the digestible waste for distributed energy purposes.

The system is compared with two alternative scenarios fuelled by natural gas: a reference scenario, where the electricity is supplied by the grid and the heat is supplied from condensing boilers, and a fuel cell micro-CHP system. The results show that, although OFMSW alone can only supply between 1% and 4% of the total energy demand of the Borough, a saving of ~130 tonnes of CO2 eq per year per dwelling equipped with micro-CHP is still achievable compared with the reference scenario. This is primarily due to the surplus electricity produced by the fuel cell when the micro-CHP unit is operated to meet the heat demand. Use of biogas to produce heat only is therefore a less desirable option compared with combined heat and power production. Further investigation is required to identify locally available feedstock other than OFMSW in order to increase the proportion of energy demand that can be met in this way.

Keywords: Biogas; Distributed generation; SOFC; LCA; OFMSW; Micro-CHP

Arif Widiatmojo, Kyuro Sasaki, Yuichi Sugai, Yoshiaki Suzuki, Hiroyuki Tanaka, Kagemi Uchida, Hiroyuki Matsumoto, Assessment of air dispersion characteristic in underground mine ventilation: Field measurement and numerical evaluation, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 173-181, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.04.001.

(http://www.sciencedirect.com/science/article/pii/S0957582014000470)

Abstract: Abstract

The environmental safety of an underground mine depends strongly on its ventilation system. An efficient ventilation system provides fresh air, removes hazardous gases and dust, and maintains the temperature and humidity at appropriate levels. One of the most important factors in removing hazardous gases and dust is the dispersion behaviour in the mine network. This factor determines the longitudinal spreading and the average air residence time of gases or particulate matter throughout the mine. This paper describes tracer gas measurement in an underground mine and the utilisation and analysis of the dispersion characteristics using numerical simulations. The concentration–time curve obtained from the measurement is simulated to evaluate the effective diffusion coefficient that reflects the general dispersion characteristic of an entire mine. The evaluated values of effective diffusion coefficient are then compared to other data from several studies. The diffusivities obtained in this study were higher than other analytical and empirical results. More research is still required to identify the main factors causing such higher diffusivities. However, the results from the present work can be an important standpoint for future work. Numerical simulation conducted in this research was confirmed to be effective in detecting several leakage paths occurring in the mine ventilation network.

Keywords: Tracer gas; Underground mine ventilation; Dispersion; Numerical simulation

Tareq A. Albahri, MNLR and ANN structural group contribution methods for predicting the flash point temperature of pure compounds in the transportation fuels range, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 182-191, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.03.005.

(http://www.sciencedirect.com/science/article/pii/S095758201400041X)

Abstract: Abstract

A QSPR method is presented for predicting the flash point temperature (FPT) of pure compounds in the transportation fuels range. A structural group contribution method is used to determine the flash point temperature using two techniques: multivariable nonlinear regression and artificial neural networks. The method was used to probe the structural groups that have significant contribution to the overall FPT of pure compounds and arrive at the set of 37 atom-type structural groups that can best represent the flash point for about 375 substances. The input parameters to the model are the number of occurrence of each of the 37 structural groups in each molecule. The neural network method was the better of the two techniques and can predict the flash point of pure compounds merely from the knowledge of the molecular structure with an overall correlation coefficient of 0.996 and overall average and maximum errors of 1.12% and

6.62%, respectively. The results are compared to the more traditional approach of the SGC method along with other methods in the literature.

Keywords: Flash point; Group contribution; Molecular modeling; Neural networks; Quantitative structure property relation; QSPR

Upenyu Guyo, Joylene Mhonyera, Mambo Moyo, Pb(II) adsorption from aqueous solutions by raw and treated biomass of maize stover – A comparative study, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 192-200, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.06.009.

(http://www.sciencedirect.com/science/article/pii/S0957582014000895)

Abstract: Abstract

The potential to remove Pb(II) ion from wastewater treatment systems using raw and treated maize stover through adsorption was investigated in batch experiments. To achieve this, batch mode experiments were conducted choosing specific parameters such as pH (2–8), dosage concentration (2–30 g L−1), contact time (5–180 min), temperature (20–45 °C) and metal ion concentrations (10–50 mg L−1). Adsorption was pH-dependent showing a maximum at pH value 5. The equilibrium sorption capacities of raw and treated maize stover were 19.65 and 27.10 mg g−1, respectively. The adsorption data fitted well to the Langmuir isotherm model. Kinetic studies revealed that the adsorption process followed pseudo-second-order model. The calculated thermodynamic parameters showed that the adsorption of Pb(II) was spontaneous and exothermic in nature. Consequently, this study demonstrated that both raw and treated maize stover could be used as adsorbents for the treatment of Pb(II) from industrial wastewaters.

Keywords: Adsorption; Pb(II); Kinetics; Adsorption isotherms; Raw maize stover; Treated maize stover

Serkan Sahinkaya, Disintegration of municipal waste activated sludge by simultaneous combination of acid and ultrasonic pretreatment, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 201-205, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.04.002.

(http://www.sciencedirect.com/science/article/pii/S0957582014000482)

Abstract: Abstract

The individual and simultaneous effects of acid and ultrasonic pretreatment on the disintegration of municipal waste activated sludge (WAS) were investigated based on chemical properties of WAS. In the combination of acid and ultrasonic pretreatment methods (ultrasonic-acid pretreatment), lowering pH accelerated and enhanced the disintegration of waste biological sludge. Therefore, the same disintegration efficiency (obtained by ultrasonic pretreatment alone) was achieved by the combined pretreatment in shorter sonication times. Optimum pretreatment conditions were ultrasonic power density of 1.0 W/mL and pretreatment time of 10 min for ultrasonic pretreatment alone, and ultrasonic power density of 1.0 W/mL, pretreatment time of 10 min and initial sludge pH of 2.0 for the combined pretreatment. Sludge disintegration degrees were about 30% and 40% under these optimized conditions, respectively. Optimum sludge concentration was found to be 1.0% total solid (TS)

content for the combined pretreatment. As a result, ultrasonic-acid pretreatment has been determined as a new and effective combined sludge pretreatment method to improve the sludge disintegration.

Keywords: Acid pretreatment; Disintegration; Pretreatment; Ultrasonic pretreatment; Waste activated sludge

Ming Yang, Faisal Khan, Vikram Garaniya, Shuhong Chai, Multimedia fate modeling of oil spills in ice-infested waters: An exploration of the feasibility of fugacity-based approach, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 206-217, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.04.009.

(http://www.sciencedirect.com/science/article/pii/S095758201400055X)

Abstract: Abstract

The increasing demand for energy and the high probability of finding vast reserves have shifted offshore exploration and production activity into colder and harsher environments. Offshore activity increases risk of oil spills in these colder and harsher marine environments. The development of a spill contingency plan requires the prediction of fate and transport of oil. Oil spill trajectory and fate modeling in cold marine environments is an exceedingly complex problem, in which variability of physical environment and oil-ice interactions must be addressed. This paper explores the usefulness of the fugacity approach for spill fate and transport modeling in ice-infested waters through a simulation model that combines surface oil weathering algorithms with Level IV fugacity models. Four bulk compartments are used for modeling: air, ice cover, water and sediment. Weathering of surface oil on and under the ice cover is represented by a system of differential equations. Unsteady state mass balance equations are also developed for each of the four bulk phases. The outputs of the multimedia fate model are time-dependent profiles of oil slick area, fraction evaporated, water content in oil, viscosity, and concentration of oil in air, ice cover, water, and sediment. The application of the proposed model is illustrated through the simulation of a hypothetical oil spill in the Labrador Sea. The proposed model is simple but has the promise that it can be further developed to become directly useful to the simulation of spill behavior in ice-infested waters.

Keywords: Ice-infested waters; Harsh environment; Marine oil spills; Arctic; Fugacity; Fate modeling

Shenteng Chang, Chungsying Lu, Hsiaoyun Huang, Shihchieh Hsu, Removal of VOCs emitted from p-xylene liquid storage tanks by a full-scale compost biofilter, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 218-226, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.06.004.

(http://www.sciencedirect.com/science/article/pii/S0957582014000846)

Abstract: Abstract

A full-scale compost biofilter system (CBS) was built to treat vapor losses emitted from three analogous vertical fixed roof p-xylene (p-X) liquid storage tanks of 7500 m3 total working volume. The CBS showed a stable and efficient treatment of standing loss (LS) and working loss (LW) with an average removal efficiency of 95.4% through 18-month standing storage and filling operation of the tanks. The weight of activated carbon

employed in the concentration buffer influences the CBS performance for LW treatment under high organic loads. The daily average pressure drops across biofilter bed displayed very low with a maximum of 7.6 mm-H2O. This reflects that the CBS can be operated without stress and compression of biofilter bed and thus reduce maintenance frequency. No additional inputs of chemicals and fuels along with low electricity and water usage helped in its prolonged operation and increased its cost effectiveness. These advantages make the CSB become a promising control technology of vapor losses emitted from fixed roof organic liquid storage tanks.

Keywords: Fixed roof storage tank; p-Xylene; Standing loss; Trickle-bed air biofilter; Working loss; Activated carbon

Muthuraman Govindan, Il-Shik Moon, Uncovering results in electro-scrubbing process toward green methodology during environmental air pollutants removal, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 227-232, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.06.008.

(http://www.sciencedirect.com/science/article/pii/S0957582014000883)

Abstract: Abstract

Present findings uncovered the electro-scrubbing process as a green methodology. This green methodology was assessed by an analysis of electrode dissolution into an electrolyte and acid fumes emission to the atmosphere. As an initial experiment oxidation effect of Co(II) by PbO2 electrode revealed an enhanced oxidation efficiency of ~20% compared to a Pt-coated Ti electrode. The mist concentration from the first scrubber test was approximately 30 times lower than that of the indoor air particles. In addition, molar mass of Co(II) and SEM analyses revealed no Co(II) or PbO2 from the first scrubber. An analysis of the second scrubber showed no Co(II), PbO2 or pH changes during a 24 h study confirming that no sulphuric acid escaped from the first scrubber or mediator containing electrolyte solution. This electro-scrubbing process was applied to the air pollutants removal process, in which a definite ratio between Co(III) and odor gases at given concentrations were identified. These results show that this electro-scrubber can maintain its initial concentration of Co(II) and H2SO4 by just adding water, and is become a highly sustainable and green methodology system without a loss of H2SO4 and Co catalysts to the environment.

Keywords: Sustainability; Green methodology; Mist particles; Mediated electrochemical oxidation; Electro-scrubbing; Air-Pollutants

Q. Zhang, Q.J. Ma, Dynamic pressure induced by a methane–air explosion in a coal mine, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 233-239, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.05.005.

(http://www.sciencedirect.com/science/article/pii/S0957582014000755)

Abstract: Abstract

The hazardous effect of dynamic pressure and strong gas flows induced by a methane–air mixture explosion in underground coal mines is studied. The dynamic pressure effect of a methane–air explosion was analyzed by numerical simulation, in a duct and tunnel. Compared to the overpressure generated by an explosion that can act on a body, the dynamic pressure caused by the high-speed flow of the gaseous combustion products can

cause serious damage as well. At the structural opening of a coal mine, the destruction caused by the dynamic pressure induced by a methane–air explosion is more serious than the overpressure. For a tube or tunnel partially filled by a methane–air mixture, the dynamic pressure is lower than the overpressure in the region occupied by the flammable mixture. Beyond the premixed region, the dynamic pressure is of the same order of magnitude as the overpressure.

Keywords: Dynamic pressure; Explosion; Methane–air mixture; Hazardous effect; High speed flow; Numerical simulation

Tianshui Liang, Mengjie Liu, Zhonglin Liu, Wei Zhong, Xiukun Xiao, Siuming Lo, A study of the probability distribution of pool fire extinguishing times using water mist, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 240-248, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.05.009.

(http://www.sciencedirect.com/science/article/pii/S0957582014000792)

Abstract: Abstract

Water mist, a replacement for Halon gaseous agents in fire fighting, has been studied for decades. However, the fire-extinguishing reliability of water mist is debated. For example, there are significant differences in extinguishing times between tests conducted under the same conditions, and water mists have difficulty extinguishing small fires. To date, no study of the probability distribution of extinguishing times has been reported. In this study a statistical analysis of the extinguishing time distribution of pool fires extinguished using water mist is presented. The fire sources were circular/square stainless steel pans with gasoline, diesel, ethanol or daqing RP-3 as fuel. Two types of extinguishing scenarios were observed. In one situation, the fire was extinguished via a blow off process, when the flames had not yet been suppressed. Flame cooling is the primary fire extinguishing mechanism; the mass loss rate and combustion heat of the fuel are two key factors. In the other situation, the fire was initially suppressed and subsequently extinguished after a long suppression stage. Surface cooling is the primary fire extinguishing mechanism; the flash point of the fuel is the key factor.

Keywords: Pool fires; Water mist; Fire extinguishment; Flame cooling; Surface cooling; Variance analysis

S. Mandal, S.S. Mahapatra, M.K. Sahu, R.K. Patel, Artificial neural network modelling of As(III) removal from water by novel hybrid material, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 249-264, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.02.016.

(http://www.sciencedirect.com/science/article/pii/S0957582014000354)

Abstract: Abstract

The present study reported a method for removal of As(III) from water solution by a novel hybrid material (Ce-HAHCl). The hybrid material was synthesized by sol–gel method and was characterized by XRD, FTIR, SEM–EDS and TGA–DTA. Batch adsorption experiments were conducted as a function of different variables like adsorbent dose, pH, contact time, agitation speed, initial concentration and temperature. The experimental studies revealed that maximum removal percentage is 98.85 at optimum condition: pH = 5.0, agitation speed = 180 rpm,

temperature = 60 °C and contact time = 80 min using 9 g L−1 of adsorbent dose for initial As(III) concentration of 10 mg L−1. Using adsorbent dose of 10 g L−1, the maximum removal percentage remains same with initial As(III) concentration of 25 mg L−1 (or 50 mg L−1). The maximum adsorption capacity of the material is found to be 182.6 mg g−1. Subsequently, the experimental results are used for developing a valid model based on back propagation (BP) learning algorithm with artificial neural networking (BP-ANN) for prediction of removal efficiency. The adequacy of the model (BP-ANN) is checked by value of the absolute relative percentage error (0.293) and correlation coefficient (R2 = 0.975). Comparison of experimental and predictive model results show that the model can predict the adsorption efficiency with acceptable accuracy.

Keywords: Adsorption; Arsenic; ANN; Hybrid materials

Caixia Wang, Hui Wang, Meng Lin, Xiaoke Hu, ZnO nanoparticles induced cytotoxicity on human pulmonary adenocarcinoma cell line LTEP-a-2, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 265-273, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.05.007.

(http://www.sciencedirect.com/science/article/pii/S0957582014000779)

Abstract: Abstract

Novel nanoparticles (NPs) such as zinc oxide (ZnO) NPs are widely produced and applied in our daily lives at a rapid pace. Thus, the toxicity of ZnO NPs should be monitored as an important standard for environmental risk assessment. Here we assessed the in vitro cytotoxicity of ZnO NPs on human pulmonary adenocarcinoma cells LTEP-a-2 by tetrazolium salt colorimetric assay of cell proliferation in the presence or absence of ZnO NPs. ZnO NPs-induced morphological changes in LTEP-a-2 cells were examined by light and scanning electron microscopy. The mechanism by which ZnO NPs impose the cytotoxic effect was investigated by a combination of active oxygen test, lactose dehydrogenase-release assay, and apoptosis detection. Results showed that ZnO NPs significantly inhibited the proliferation and induced evident morphological changes (cell shrinkage and chromosome condensation) in LTEP-a-2 cells. Additionally, ZnO NPs increased the level of intracellular reactive oxygen species and induced the formation of apoptotic vesicles as well as the lysis of cell nuclei. Zn2+ ions released from ZnO NPs into aqueous solution are important components that exert cytotoxic effects on LTEP-a-2 cells. This study provides new insights to the cytotoxicity of ZnO NPs against human health.

Keywords: Human pulmonary adenocarcinoma cells; ZnO nanoparticles; Cytotoxicity; Reactive oxygen species; Apoptosis

Serkan Şahinkaya, Erkan Kalıpcı, Seval Aras, Disintegration of waste activated sludge by different applications of Fenton process, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 274-281, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.05.010.

(http://www.sciencedirect.com/science/article/pii/S0957582014000809)

Abstract: Abstract

Oxidative disintegration of municipal waste activated sludge (WAS) using conventional Fenton (Fe2+ + H2O2, CFP) and Fenton type (Fe0 + H2O2, FTP) processes was investigated and compared in terms of the efficiency of sludge disintegration and enhancement of anaerobic biodegradability. The influences of different operational variables namely sludge pH, initial concentration of Fe2+ or Fe0, and H2O2 were studied in detail. The optimum conditions have been found as catalyst iron dosage = 4 g/kg TS, H2O2 dosage = 40 g/kg TS and pH = 3 within 1 h oxidation period for both CFP and FTP. Kinetics studies were performed under optimal conditions. It was determined that the sludge disintegration was happened in two stages by both processes: rapid and subsequent slow disintegration stages and rapid sludge disintegration stage can be described by a zero-order kinetic model. The effects of oxidative sludge disintegration under the optimum conditions on anaerobic digestion were experienced with biochemical methane potential (BMP) assay in batch anaerobic reactors. Total methane production in the CFP and FTP pre-treated reactors increased by 26.9% and 38.0%, relative to the untreated reactor (digested the raw WAS). Furthermore, the total chemical oxygen demand reductions in the pre-treated reactors were improved as well.

Keywords: Activated sludge; COD; EPS; Fenton process; Sludge disintegration; Zero valent iron

Fereshteh Motahari, Mohammad Reza Mozdianfard, Masoud Salavati-Niasari, Synthesis and adsorption studies of NiO nanoparticles in the presence of H2acacen ligand, for removing Rhodamine B in wastewater treatment, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 282-292, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.06.006.

(http://www.sciencedirect.com/science/article/pii/S095758201400086X)

Abstract: Abstract

Cost efficient NiO nanoparticles were synthesized by hydrothermal production of nano-scale Ni(OH)2, using Ni(NO3)2·6H2O and NaOH as precursors, in the presence of H2acacen ligand, followed by calcinations of the produced Ni(OH)2. Prepared samples were then characterized using X-ray powder diffraction (XRD), field-emission scanning electron microscopy (FESEM), Fourier transform infrared (FT-IR) spectra, Brunauer–Emmet–Teller (BET) and transmission electron microscopy (TEM). BET analysis revealed high surface area for pure nano sized NiO, averaging 176.56 m2/g and confirming its application as an efficient adsorbent. Experimental studies for Rhodamine B (RB) removal from aqueous solutions in batch systems revealed that the adsorption equilibrium was best represented by Langmuir isotherm, with the maximum monolayer capacity of 111 mg/g for RB. The kinetic data was well described by a pseudo-second-order kinetic model, having intraparticle diffusion model as a rate limiting step.

Keywords: NiO nanoparticles; Rhodamine B; Adsorption isotherms; Kinetics

S. Chilton, J. Covey, M. Jones-Lee, G. Loomes, N. Pidgeon, A. Spencer, Response to 'Testing the validity of the "value of a prevented fatality" (VPF) used to assess UK safety measures', Process Safety and Environmental Protection, Volume 93, January 2015, Pages 293-298, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.11.002.

(http://www.sciencedirect.com/science/article/pii/S0957582014001785)

P.J. Thomas, G.J. Vaughan, 'Testing the validity of the "value of a prevented fatality" (VPF) used to assess UK safety measures': Reply to the comments of Chilton, Covey, Jones-Lee, Loomes, Pidgeon and Spencer, Process Safety and Environmental Protection, Volume 93, January 2015, Pages 299-306, ISSN 0957-5820, http://dx.doi.org/10.1016/j.psep.2014.11.003.

(http://www.sciencedirect.com/science/article/pii/S0957582014001797)

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(http://www.sciencedirect.com/science/article/pii/S095758201400202X)