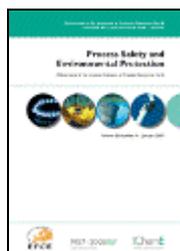


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T.A. Roberts, L.C. Shirvill, K. Waterton, I. Buckland. *Fire resistance of passive fire protection coatings after long-term weathering.* Pages 1-19.

Passive fire protection (PFP) systems are widely used by the oil, gas and chemical industries to protect offshore and onshore facilities against the effects of fire. However, there are concerns that the performance of PFP systems in a fire may have deteriorated because of weathering and/or that corrosion of the protected item may be taking place beneath the PFP systems. In May 1987, Shell UK began a long-term PFP weathering programme at a maritime test site using furnace tests to assess the fire performance of the materials. The programme was handed over to the Health and Safety Executive in October 1999 and was continued and extended to include the more severe jet fire testing of weathered specimens. This paper describes the effects of weathering on six epoxy intumescent PFP products and one cementitious PFP product in common use. The results are discussed in relation to alterations in physical form, corrosion of the substrate and changes in fire resistance.

- **Keywords:** Passive fire protection; PFP; Weathering; Corrosion; Fire resistance

Geraint O. Thomas, Gwyn L. Oakley. *An experimental investigation of the coupling between gaseous explosion pressures and a water volume in a closed vessel.* Pages 20-23.

An experimental test program has been undertaken on the pressure coupling between gaseous deflagration and detonations and an underlying volume of water. The two forms of gaseous explosions were initiated in an ullage space within of a closed cylindrical metal vessel. The vessel, placed in a vertical orientation, and was 2 m high and 0.247 m diameter. The depth of water used for the experiments was 1.44 m. For the combustion tests the maximum pressure recorded in the ullage was also developed in the water volume. For detonation tests however a distinct pressure wave developed in the water filled region, significantly modifying the time resolved pressure history at the vessel wall.

- **Author Keywords:** Constant volume combustion; Explosion; Pressure coupling; Water

Geraint O. Thomas, Gwyn L. Oakley. *Overpressure development during the combustion of a hydrogen–air mixture partial filling a confined space*. Pages 24-27.

The paper describes the results from experimental studies and theoretical predictions of the final overpressures developed on combustion of a partial volume inside a larger closed vessel. The partial volume is assumed flammable whilst the remainder of the volume is initially filled with air alone. Particular attention is given to partial volumes of hydrogen–air mixtures. The accuracy of two theoretical models for predicting the final equilibrium pressure throughout the entire closed volume are also assessed.

- **Keywords:** Hydrogen; Gas pockets; Constant volume combustion

X.U. Junming, Jiang Jianchun, Zuo Zhiyue, Li Jing. *Synthesis of tributyl citrate using acid ionic liquid as catalyst*. Pages 28-30.

Synthesis of tributyl citrate (TBC) has been studied by using acid functionalized ionic liquid as catalyst. The results indicated that acidic ionic liquids show good catalytic and reusable performance. Under the optimum conditions, using 1-methyl-3-(3-sulfopropyl)-imidazolium hydrogen sulfate as catalyst, the conversion of citric acid was 97%. After easily separated from the products the ionic liquid could be reused 13 times without any disposal, and the conversion of citric acid was not less than 93%. Therefore, an environmental friendly approach for the synthesis of tributyl citrate is provided.

- **Keywords:** Acid ionic liquid; Esterification; Catalyst; Tributyl citrate

Kathleen B. Aviso, Raymond R. Tan, Alvin B. Culaba, Jose B. Cruz Jr. *Bi-level fuzzy optimization approach for water exchange in eco-industrial parks*. Pages 31-40.

In order to minimize the consumption of resources and the generation of waste, eco-industrial parks (EIPs) have been designed to encourage the establishment of waste exchange networks between the plants contained within them. Considering that the participating plants have their individual fuzzy cost goals and that the park authority has the objective of minimizing total freshwater consumption in the EIP, this problem may be formulated as a bi-level optimization problem, with the park authority as the upper-level decision-maker. A bi-level fuzzy optimization model is developed to explore the effect of charging fees for the purchase of freshwater and the treatment of wastewater in optimizing the water exchange network of plants in an EIP. The effect of subsidizing exchange of streams between plants is also included in the model. Results show that it is not necessary to impose exorbitant fees, nor to completely subsidize costs associated with recycling, in order to induce significant reduction of the consumption of freshwater in the EIP.

- **Keywords:** Bi-level optimization; Eco-industrial parks; Industrial ecology; Game theory

Sheng Han, Peng Wang, Yuhong Wang, Yuping Song, Tianhui Ren. *Impact of alkyl methacrylate–maleic anhydride–alkyl methacrylate terpolymers as cold flow improver on crystallization behavior of diesel fuel*. Pages 41-46.

Alkyl methacrylate–maleic anhydride–alkyl methacrylate terpolymers (MR_1 –MA– MR_2) is one of the widely used cold flow improver. In order to develop more efficient MR_1 –MA– MR_2 , it is necessary to study the crystallization behavior of n-alkanes when adding MR_1 –MA– MR_2 into diesel fuel. In this paper, MR_1 –MA– MR_2 is prepared by the reaction of long-

chain alkyl methacrylate (MR₁), maleic anhydride (MA), and short alkyl methacrylate (MR₂). The diesel fuel before and after adding MR₁-MA-MR₂ is in situ filtrated at its cold filter plugging point (CFPP) in a manual CFPP apparatus. Extensive measurements of composition variation of n-alkanes are done by gas chromatograph and the results are compared. The experimental results show that after adding MR₁-MA-MR₂, the concentration distribution of n-alkanes in the filtrate is wide and arranges from 8 to 26, and mainly centralizes from 10 to 19. For the precipitate, the concentration distribution of n-alkanes gets richer in the lighter n-alkanes and poorer in the heavier n-alkanes. The concentration distribution of n-alkanes in the crystal solid shows a decreasing trend, especially with high carbon number n-alkanes (heavier than C₂₀). About 60–70% of the residual crystal solid is composed of non-paraffins such as isoparaffin, naphthene and other components. Crystallinities of n-alkanes show a slow decrease trend from C₈ to C₂₀. When the carbon number n-alkanes are heavier than C₂₀, the crystallinities of n-alkanes begin to sharply reduce with an increase of carbon number. The largest decline of crystallinity is C₂₆ n-alkane from 38.39% to 7.90%.

- **Keywords:** Alkyl methacrylate–maleic anhydride–alkyl methacrylate terpolymers; Cold flow improver; Crystallization; Diesel fuel

Gholamreza Moussavi, Frarough Kazembeigi, Mehdi Farzadkia. *Performance of a pilot scale up-flow septic tank for on-site decentralized treatment of residential wastewater. Pages 47-52.*

The aim of this research was to study the on-site anaerobic treatment of a medium-strength residential wastewater in a pilot-scale up-flow septic tank (UST). The effects of three different hydraulic retention times (HRTs) of 24, 12 and 6 h on the UST performance were investigated. The UST removed 85, 77, and 86% of biochemical oxygen demand (BOD₅), chemical oxygen demand (COD) and total suspended solids (TSS), respectively, at steady state operation and with a 24 h HRT. Decreasing the HRT to 12 and then 6 h resulted in deteriorated effluent quality and significantly reduced reactor performance. The sludge showed a high specific methanogenic activity (SMA) of 15.2 mL CH₄ g⁻¹ VSS d⁻¹ with raw wastewater substrate. The solids accumulated in the tank by the end of the experiment had a VSS/TSS of 0.57, demonstrating significant stabilization. Overall, the UST is concluded to be a technically and economically promising alternative to conventional septic tanks for the on-site decentralized treatment of residential wastewater, particularly in the rural communities of developing countries.

- **Keywords:** Anaerobic processes; Residential wastewater; On-site treatment; Septic tank

Denis Lima Guerra, Emiliano Mendonça Silva, Claudio Airoidi. *Application of modified attapulgites as adsorbents for uranyl uptake from aqueous solution : thermodynamic approach. Pages 53-61.*

An attapulgite (ATPG) clay sample has been chemically modified with silylating agents N-propyldiethylenetriethoxysilane and bis[3-(triethoxysilyl)propyl]tetrasulfide. The resulting matrices (ATPG_{3TPT} and ATPG_{NPTM}) have been characterized by elemental analysis, X-ray diffractometry, carbon nuclear magnetic resonance in the solid-state, and scanning electron microscopy. The natural and modified clay samples have been tested as potential adsorbents for the removal of uranyl(II) from aqueous solution at pH 2.0 and 298 ± 1 K. The maximum number of moles adsorbed was determined to be 5.55, 14.86, and 18.99 × 10⁻² mmol g⁻¹ for ATPG, ATPG_{3TPT}, and ATPG_{NPTM}, respectively. From calorimetric determinations the quantitative thermal effects for UO₂²⁺/center interactions gave exothermic enthalpy (–6.90 to –7.88 kJ mol⁻¹), negative Gibbs free energy (–22.34 to –24.56 kJ mol⁻¹), and positive entropy (51.80–56.00 J K⁻¹ mol⁻¹). These thermodynamic data confirmed the energetically favorable condition of such interaction at the solid/liquid for all systems.

- **Keywords:** Attapulgite; Surface properties; Adsorption; Calorimetry; Thermodynamic

Zhi-rong Liu, Shao-qi Zhou. *Adsorption of copper and nickel on Na-bentonite*. Pages 62-66.

The removal of copper and nickel from aqueous solution on the Na-bentonite has been studied under static conditions. Experiments were carried out as a function of solution pH, dosage of Na-bentonite, contact time and temperature. The adsorption equilibrium for nickel and copper onto Na-bentonite is reached in 200 min. The adsorption of copper and nickel is pH dependent in the pH range 2–9. The kinetic process of adsorption can be described by the pseudo-second-order kinetic equation excellently and the adsorption isotherm be fitted to the Langmuir model by means of regression analyses very well. The adsorption capacities follow the order of $\text{Cu}^{2+} > \text{Ni}^{2+}$ in single-component systems and competitive adsorption capacities in order decreasing is $\text{Cu}^{2+} > \text{Ni}^{2+}$ in binary-component systems.

- **Keywords:** Na-bentonite; Copper; Nickel; Adsorption; Isotherm; Kinetics

M.A.S.S. Ravagnani, M.H.M. Reis, R. Maciel Filho, M.R. Wolf-Maciel. *Anhydrous ethanol production by extractive distillation : a solvent case study*. Pages 67-73.

Production of anhydrous ethanol in large scale has been made by extractive distillation using conventional solvents like ethylene-glycol. In the present paper, extractive distillation process is studied to obtain pure ethanol using ethylene-glycol and tetraethylene-glycol as solvents. Residue curve maps are used to analyse the proposed distillation processes in interpreting mixture behaviours and feasibility of distillation columns. The industrial process is simulated at steady state from residue curve map analysis. Simulation results for the ethanol/water mixture using ethylene-glycol, the conventional solvent, and tetraethylene-glycol, an alternative solvent, are presented. These results showed that the process using tetraethylene-glycol is reliable, although it requires more energy than the process with ethylene-glycol. However, ethylene-glycol has a considerable toxicity level while tetraethylene-glycol is non-toxic.

- **Keywords:** Extractive distillation; Anhydrous ethanol; Tetraethylene-glycol; Residue curve maps; Clean technology; Process simulation