Journal of Scientific & Industrial Research

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### S & T and Industrial Research

The rapid development of China's industry is characterized by high energy consumption and high pollutants emission, which has resulted in serious environmental problems. In this paper, Chinese provincial panel data are used to study the influence of the banking market structure on the industrial pollutants emission reduction. The results show that the concentration of the banking sector has a significantly positive effect on the industrial pollutants emission intensity. High concentration of the banking sector is not conducive to reducing pollutants emission intensity. Therefore, the banking market structure plays an important role in eliminating outdated production capacity and in the development of the energy-saving and low-polluted economy.

In the Cognitive Radio (CR) technology, fast and precise spectrum sensing is essential, so that the Secondary Users (SUs) can quickly adapt their parameters by dynamic monitoring of the spectrum, enabling them to utilize the available spectrum, and more importantly to prevent interference with Primary Users (PUs). To this effect the implementation of the classical spectrum sensing methods in a wideband scenario is a great challenge. This is because the classical methods need sampling rates greater than or equal to the Nyquist rate. Modern Compressive Sensing (CS) techniques exploit the sparseness of a typical wideband spectrum. In this paper a subNyquist sampling based sensing technique is studied. The correlation matrix of a limited number of samples containing noise is constructed and the Eigenvector (EV) estimator is used to discern the functional channels of the spectrum. The performance of this technique is assessed by calculating the probability of detection of the occupied signal as a function of the number of samples and the SNR parameters of random input. Simulation results show that a robust detection is possible, even with less number of samples and at low SNR.
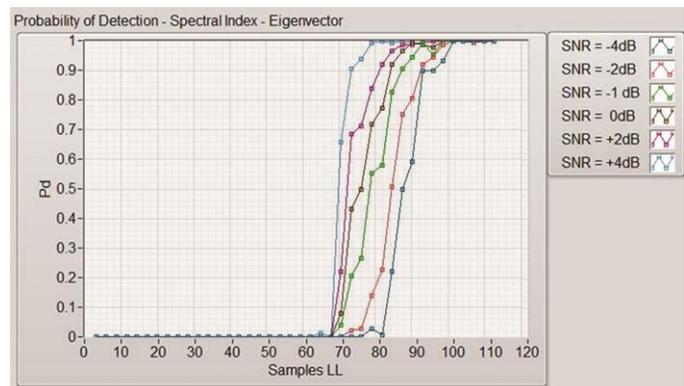
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Biomass processing in ionic liquids (ILs) is a promising technology but involves the simultaneous optimization of many variables in parallel. Here we investigated how dissolution of dissolving wood pulp in IL molecular co-solvents affects the structure of lignocellulosic materials. Mixtures of the IL 1-ethyl-3-methylimidazolium acetate ([C2mim][OAc]) and dimethylsulfoxide (DMSO) or dimethylformamide (DMF) were used to dissolve South African eucalyptus raw (un-bleached) and final (bleached) pulp and regenerated cellulose was obtained by addition of a 1:1 (v/v) water/acetone mixture. The regenerated cellulose materials were characterized by SEM, FTIR, TGA, and PXRD. The results showed that addition of co-solventsled to increased dissolution yields, presumably due to reduction of the IL viscosity facilitating faster dissolution of the wood materials. The selection of the co-solvent for the mixtures did not have a significant influence on the recovered materials, whose characteristics such as crystallinity and thermal stability depended only on the source material. Co-solvents did affect the purity of the recovered material, with DMF appearing to lead to greater contamination. Co-solvent addition is a viable approach for dissolution of dissolving wood pulp without affecting the quality of the recovered material providing removal and recovery of the spent solvents can be optimized.
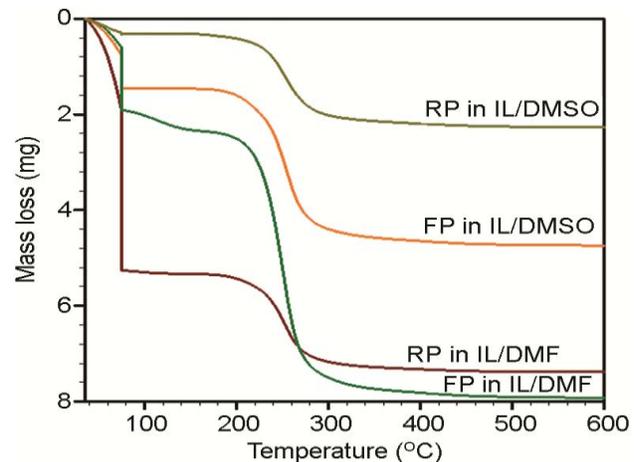
Z Tywabi, N Deenadayalu & B Sithole

Early detection of rotor faults can prevent the occurrence of catastrophic failures that could interrupt the manufacturing process in critical industries that use different types of inverters. This paper studies the inverter-fed case by analyzing the stator signal with a high-resolution subspace technique for spectral analysis known as multiple signal classification (MUSIC). The technique is compared to the standard fast Fourier transform, showing outstanding advantages to reduce the appearance of false positives. The results show the differences in the detection of faults when five inverters are used, considering also the line supply.

Industrial inverters

Altivar 66   PowerFlex 40   CFW-11
MicroMaster 420   ACS355

I Martin-Diaz, D Morinigo-Sotelo, O Duque-Perez, A Garcia-Perez, D Camarena-Martinez & R J Romero-Troncoso

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QSAR analysis of a series of previously synthesized *p*-substituted aromatic hydrazones tested for growth inhibitory activity against *Bacillus subtilis*, was performed using several physicochemical descriptors: Surface tension (ST), Molar Refraction (MR), Molar Volume (MV), Parachor (Pc), Index of Refractivity (η); Density (D) and Polarizability (α). Two-parameter models were obtained and validated by using several statistical parameters: R; R^2_{adj}; F-test; Sd; R_{ped}; PRESS/SSY; Q^2; S_{PRESS}; PSE and Q. Both the parameters (D and α) contributing to statistically best model (model 16) have positive input to the modeling of biological activity of selected hydrazones.
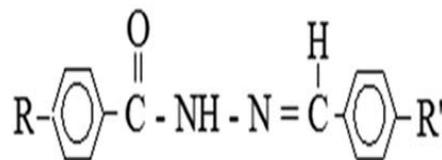
$$R-\langle\bigcirc\rangle-\overset{\overset{O}{\|}}{C}-NH-N=\overset{\overset{H}{|}}{C}-\langle\bigcirc\rangle-R'$$

V Dimova & M Jankulovska

Mannatide was a glycopeptide with a variety of bioactive compounds and isolated from fermentation broth of cultured *a-hemolytic streptococci* strain H1S-33. The influence of pH value on production of mannatide in batch fermentations was studied. The optimal values for biomass and mannatide production occurred at pH 7.5 and 7.0, reaching 17.91 g/L and 0.77 g/L, respectively, at constant pH in 5-L stirred fermenters. As a result, an effective pH-shift control strategy was established for the fermentation of mannatide in 5-L stirred fermenters. In this strategy, pH was controlled to 7.5 for the first 8 h of fermentation, and then subsequently shifted to 7.0 and maintained until the end of the process. The maximal mannatide production (0.98 g/L) was 27.6, 37.6 and 51.5% higher than that of the fermentation at constant pH 7.0 and 7.5 in 5-L stirred fermenters and initial pH 7.5 in shake flasks by taking the pH-shift control strategy. These findings suggested that pH-shift control in batch fermentations of α-hemolytic Streptococcus H1S-33 could enhance production of mannatide in 5-L stirred fermenters. This study would be helpful for the design of a highly efficient mannatide biosynthesis process.
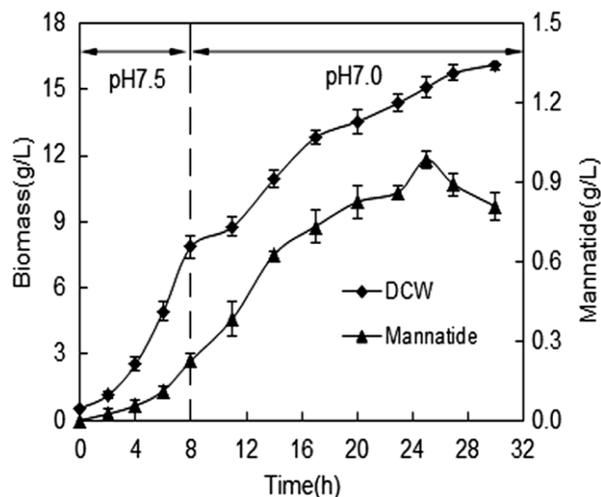
Jialan Zhang, Cui Xu, Yunlei Wan & Mengxiang Gao

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Energy and Environment

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The fracture behavior of single layer graphene sheet (SLGS) has been a subject of intensive research in recent years. Understanding the fracture mechanism of graphene under low temperature conditions is crucial for engineering applications of graphene. In this paper, a molecular dynamics (MD) simulation is employed to assess the effect of temperature on fracture properties of SLGS. The evolution of atomically cleaving of graphene is also discussed. A finite area of SLGS is subject to uniaxial tensile load in zigzag direction under various environmental temperatures between 1K and 77K. The effects of temperature on fracture properties as well as cracked morphology of SLGS are investigated. While our simulated results of fracture strength of SLGS agree with reported datum, simulated cracks are nucleated spontaneously instead of artificially inserted. The findings presented herein would help understand the morphology of a single layer pristine graphene sheet subjected to crack propagation at ultralow temperature.

Chieh Kung & Bin-Hao Chen

Waste Utilization

This research examines the impact of Organic Loading Rates (OLRs) on a Continuous Stirred Tank Reactor (CSTR) biogas system from the waste water of broilers' manure. The CSTR biogas system is comprised of a 12 m^3 raw material mixing tank, a solid/liquid separator, a liquid tank, a 60 m^3 reactor, a 10 m^3 sludge tank, a 15 m^3 biogas balloon, and a biogas flare system. The experiment was performed by examining the changes in the organic loading rates from 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, and 4.0 kg-COD/m^3-day. The following parameters of the waste water were measured in order to monitor and control the biogas system: 1) pH, 2) the temperature, 3) the alkalinity, 4) the Volatile Fatty Acids, 5) the Chemical Oxygen Demand (COD), 6) the Total Solids, 7) the Total Dissolved Solids, and 8) the Suspended Solid & Volatile Solid (VS). From the experiment, it was found that the average biogas production was 19.34 m^3/day and that the average biogas production rate was 0.30 m^3/kg-COD or 0.35 m^3/kg-VS. The composition of the biogas was methane (62.37%) and carbon dioxide (31.33%). In addition, the results showed that the production rate regarding the volume of biogas increased as the OLRs increased, then decreased after the Organic Loading Rates reached 3.0 kg-COD/m^3-day. The appropriate organic loading rate for operating the CSTR system was found to be 3.0 kg-COD/m^3-day, which yielded the maximum biogas production rate for the system.

(a)

A Srichat, R Suntivarakorn & K Kamwilaisak

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