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Table of Contents

ICESI_0031	4
Milk Clotting Activity of Protease Extracted from <i>Yatsin Biri</i> Ginger Cultivar of Northwestern Nigeria	4
ICESI_0033	5
Extraction of titanium dioxide from ilmenite waste via caustic decomposition process.....	5
ICESI_0034	6
Isolation and Characterization of a Novel Angiotensin-Converting Enzyme Inhibitory Peptide from <i>Cassia Occidentalis</i>	6
ICESI_0043	9
Determination of Capability Indices of Chemical Oxygen Demand Using SBR for Water Treatment	9
ICESI_0044	10
An Experimental Investigation of Bias Acoustic Liner on nacelle lip-skin ..	10
ICESI_0048	11
Digital Dentistry - Digital restoration of dental implant prosthesis.....	11
ICESI_0053	12
Chemical Fingerprinting and Bioactivity of Essential Oils from Ecuadorian's Amazon: <i>Chenopodium ambrosioides</i> (Amaranthaceae), <i>Schinus molle</i> (Anacardiaceae) and <i>Dacryodes peruviana</i> (Burseraceae) ...	12
ICESI_0056	13
Utilization of supermarket wastes for methane production.....	13
ICESI_0057	14
Enhancement of Optoelectronic Properties of Germanium Metal-Semiconductor-Metal Photodetectors through a SiO₂ Anti-Reflection Layer	14
ICESI_0059	15
Semi-analytical Method and Asymptotic Analysis Method Applied Mathematical-biology Models.....	15
ICESI_0066	16
Experimental Investigation of Flow Under a train	16
ICESI_0068	18
Building a Long-Term Care Information System Based on the Whole Person Concept through Service-Oriented Architecture.....	18
ICESI_0069	19
Analytic Expression for Most Penetrating Particle Size for Fibrous Collectors considering Cunningham Slip Correction Factor	19
ICESI_0070	20
Electrical and morphology properties of Novel additive for Highly conductive PEDOT: PSS films	20
ICESI_0074	21
Test Driven Development Architecture for Unit Testing of Object Oriented Software.....	21
ICESI_0075	22
"Determination of the Emissions of Suspended Particles (PM₁₀ AND PM_{2.5})	22

	by Wind Motion Through Mathematical Simulation in the Province of Chimborazo of the Year 2015"	22
ICESI_0076	.....	23
	Study and analysis of NO₂ emissions generated by motor vehicles in the "Terminal terrestre" area of Riobamba city, Ecuador	23
ICESI_0079	.....	24
	Uncertainty factor analysis by repeated measurement of Ion Chromatography System	24
ICESI_0081	.....	26
	Biogenic Emissions of Non Methanogenic Volatile Organic Compounds in Ecuador	26
ICESI_0082	.....	27
	Investigating dissolved air flotation (DAF) performance for drinking water treatment plant	27
ICESI_0085	.....	28
	Local fault identification using Microtremor Analysis (case study: local fault in Surabaya river)	28
ICESI_0087	.....	29
	Mobile Devices Application of the Levels of Ultraviolet Radiation Measurement and his Validation in Chulucanas District on Piura Región's of Perú	29
ICESI_0089	.....	30
	Moxibustion reduces stress-related alterations in liver in a restraint-stress model	30
ICESI_0090	.....	31
	Synergistic effects of Rhei Radix et Rhizoma and Corydalis Tuber on high-fat diet-induced metabolic abnormalities in a mouse model	31
ICESI_0092	.....	32
	OFDMA in LTE Mobile Communications	32
ICESI_0093	.....	33
	Experimental Investigations of a Parabolic Trough Collector	33
ICESI_0097	.....	34
	The effects of hydraulic retention time (HRT) on chromium (VI) reduction using autotrophic cultivation of Chlorella vulgaris	34
ICESI_0104	.....	35
	Modeling, Analysis and Design of Mechanical and Structural Systems Involving Uncertainties	35
ICESI_0153	.....	36
	Rational Design of Surface Wettability toward Clean Water Production	36
ICESI_0155	.....	38
	Fabrication and Properties of Epoxidized Natural Rubber Filled Guar Gum Thin Film	38
ICESI_0157	.....	39
	Moving Beyond Corporate Acceleration Programs: the Need for Community Entrepreneurial Acceleration Programs	39
ICESI_0159	.....	40

Effect of Metakoaline and Superplasticiser on the Fresh Properties of Self Compacting-Concrete.	40
ICESI_0163	41
Evaluating Triaxial Accelerometers and Force Sensitive Resistors in Building Interactive Freestanding Bags	41
ICESI_0165	42
The Feasibility of Deploying Robotic Waiters in the Service Industry	42
ICESI_0166	43
Study of the effect of nozzle body and needle seat dimension on injection quantity.....	43
ICESI_0173	44
Optimization of Spray Drying Conditions for Momordica Charantia Rich Charantin Extract Powder	44

Milk Clotting Activity of Protease Extracted from *Yatsin Biri* Ginger Cultivar of Northwestern Nigeria

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Abstract

The recurrent increase in prices of calf rennet and ethical considerations linked to the production of such enzymes for cheese making and related processes have ignited a flame of scientific enquiries on the possibility and suitability of their substitution by other enzymes of plant sources. In this research, partial characterization and milk clotting activity (MCA) of $(\text{NH}_4)_2\text{SO}_4$ fraction of protease extracted from *Yatsin Biri* ginger rhizome cultivar of the family Zingiberaceae from northwestern Nigeria were analyzed. The protease extracted showed optimum activity at temperature near 50 °C and pH value of 5.5. Relative activity of the enzyme was also observed within a broad pH range of 4.5 to 7.0 accordingly. The enzyme was completely denatured at higher temperature of 100 °C and a pH range of 11.5. The milk clotting property of the protease indicated 2.83 and 1.81 folds of MCA and milk clotting specific activity (MCSA) respectively in relation to commercial calf rennet with MCA/PA ratio of 2.18. These properties of *Yatsin Biri* ginger protease, especially its milk clotting activity, make it a suitable candidate for substituting calf rennet application in the food industries, particularly in dairy and cheese making processes.

Keywords: Ginger protease, Milk clotting activity, Calf rennet, Characterization, Extraction.

Extraction of titanium dioxide from ilmenite waste via caustic decomposition process

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Abstract

Titanium dioxide (TiO_2) has been successfully synthesized from ilmenite waste (98% purity) as raw material by caustic decomposition method using NaOH pellets and followed by sulphate process. The end product was then characterized by using Energy Dispersive X-ray (EDX) to identify its chemical composition, Field Emission Scanning Electron Microscope (FESEM) to investigate the particle morphology and size while X-Ray Diffraction (XRD) to analyse the crystallinity of the extracted titanium. It was found that the TiO_2 percentage significantly increased with higher reaction temperature and reached its maximum value of 98.59% yield at 90°C . On the other hand, the acid concentrations (1M, 2M and 3M) also affect the product crystallinity and can be seen from the XRD results analysis

Keywords: Synthetic rutile, Titanium dioxide, Caustic hydrothermal, Sodium titanate.

Isolation and Characterization of a Novel Angiotensin-Converting Enzyme Inhibitory Peptide from *Cassia Occidentalis*

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Abstract

1. Background

Hypertension is a common cardiovascular disorder, which increases the risk of coronary thrombosis, stroke and renal failure (Mittal and Singh, 2010). Angiotensin converting enzyme (ACE) is a key component in the Renin Angiotensin Aldosterone System (RAAS), that increases blood pressure by constricting blood vessels due to the conversion of angiotensin I to angiotensin II, hence, the use of ACE inhibitors such as captopril, enalapril etc in the treatment of hypertension. These inhibitors are known to have side effects, such as cough, skin rashes and angioderma (Persson *et.al.*, 2009), thus, interest in finding natural, non-toxic, safer, economical and effective ones for the control and treatment of high blood pressure. Several ACE inhibitory peptides from a wide variety of plants have been recently isolated, but very little has been reported on bioactive peptides derived from *C. occidentalis*. *C. occidentalis* Linn is a weed reported to possess anti-inflammatory, antihepatotoxic, antibacterial (Samy and Ignacimuthu 2000) properties. In Northern Nigeria, it is used in the treatment of hypertension and other cardiovascular diseases, but there is a paucity of information on its antihypertensive constituents. This study describes the isolation, purification, characterization; amino acid composition and inhibition pattern of an angiotensin converting enzyme (ACE) inhibitory peptide from the leaves of *C. occidentalis*.

2. Method

Crude proteins were extracted from the leaves using a protein extraction kit (MinuteTM Total Protein Extraction Kit for Plant Tissues) and purified by a three-step method as described by Abdulazeez *et al.* (2015) with some modifications: cold acetone precipitation, Gel filtration and ion exchange chromatography. ACE inhibitory activity was determined using spectrophotometric rate method as described by Cushman and Cheung (1971) and the inhibition pattern investigated from the Lineweaver-Burks' plot. The Amino Acid profile was determined using Technicon sequential Multi-Sample Amino Acid Analyzer (TSM).

3. Results

From the results, the ACE inhibitory activity of the peptide increased from 0.1573 to 0.0197 U, while specific inhibitory activity increased from 0.0046 to 0.097 Umg⁻¹ at a purification fold of 21.09 and yield of 13% (Table 1). The optimum pH and temperature of the peptide were 8.0 and 40°C, respectively. The digestive enzymes, pepsin and trypsin significantly ($P<0.05$) decreased the activity of the peptide compared to the standard ACE inhibitor, enalapril. The peptide was found to be an oligopeptide with thirteen amino acids: Lys, Arg, Asp, Thr, Ser, Glu, Pro, Gly, Ala, Val, Ile, Leu, and Phe, and exhibited a competitive pattern of inhibition.

Table 1: Purification Profile of ACE Inhibitory Peptides from *Cassia occidentalis* leaves

Purification Steps	Protein content (mg/ml)	Total protein (mg)	Inhibitory activity (U)	Specific inhibitory activity (U/mg)	Purification fold	Yield (%)
Crude	1.72	34.36	0.1573	0.0046	1	100
Acetone precipitation	1.55	7.76	0.0705	0.0095	1.98	45
Gel filtration	1.42	4.26	0.0440	0.0103	2.25	28
Ion exchange	0.10	0.20	0.0197	0.097	21.09	13

1 U of inhibitory activity was defined as the amount of the inhibitor that decreased ACE activity by 50%

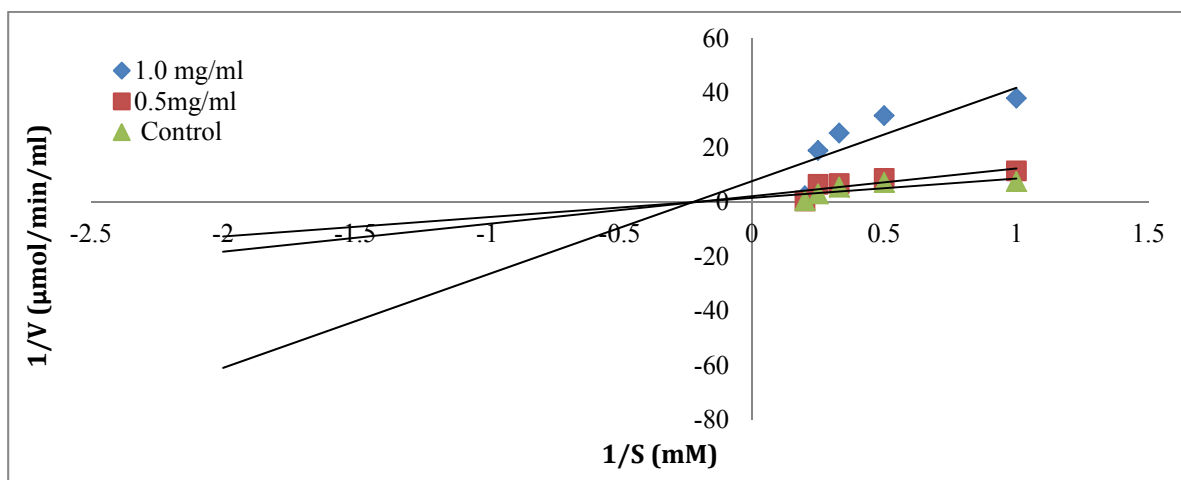


Figure 1: Lineweaver-Burk's plot of the purified ACE inhibitory peptide from *C. occidentalis*

4. Conclusion

This study has shown that *C. occidentalis* contains ACE inhibitory peptides that may be beneficial as nutraceutical or pharmacological drug for the treatment of hypertension.

Keywords: Angiotensin converting enzyme, *Cassia occidentalis*, Hypertension, Peptide.

Determination of Capability Indices of Chemical Oxygen Demand Using SBR for Water Treatment

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Abstract

To ensure the quality criteria of reuse waste water, proper monitoring of process parameters is to be taken care. For waste water treatment method, the Sequential batch reactor (SBR) is a promising technology which is being used worldwide. Waste water is categorized according to BOD, COD, TSS and bacterial presence. This paper deals with the determination of Chemical Oxygen Demand (COD) is one of the important parameters in the waste water that needs analysis in the water treatment. This paper deals with the determination of process capability, process capability ratio and process capability index of COD; using control charts and run rules. The revised process capabilities of COD have been calculated by eliminating the out of control data points. The results show that the process capability of stabilized process is 2.08. The computed lower process capability and the upper process capability are 1.79 and 2.37 respectively.

Keywords: Chemical oxygen demand, Sequential batch reactor, X-bar and MR charts Process capability index, Run rules.

An Experimental Investigation of Bias Acoustic Liner on nacelle lip-skin

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Abstract

The paper demonstrates the effect of Bias Acoustic Liner for nacelle lip-skin for civil aircrafts. The effect of drag on nacelle profile along with the compatibility with anti-icing system. Additionally, the absorption of noise that reduced by using of Bias acoustic liner has been discussed. An acoustically absorbent material is employed with honeycomb liner for the required acoustic attenuation features for the aircrafts engines. The BAL system behaves differently at different positions, around the rotor fan to absorb the fan noise; however, at the nacelle position along with anti-icing system, it shows dual nature i.e., noise reduction as well as drag reduction without using of bias flow or micro blowing. The experiment run between 0^0 - 5^0 (degree) angle of attack and Reynolds no. 2.2×10^5 to 5.8×10^5 to achieve drag reduction by 22%, at 2^0 angle of attack found the effective inclination for drag reduction, using large area over where acoustic reducing material is used from the close source. In this paper we will also discuss briefly about Bias Acoustic Liner applications in aircraft engines.

Keywords: Drag, Nacelle lip-skin, Reynolds no., Anti-icing, Acoustic liner.

Digital Dentistry - Digital restoration of dental implant prosthesis

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Abstract

Digital workflow was introduced almost 30 years ago. Nowadays, fixed dental prostheses such as inlay, onlay, crown, and bridge fabricated by CAD/CAM procedures combined with digital impression systems in dental clinic are getting popular for development of scanner and milling machine. Besides, these systems are more comfort, cost effective and time saving for patients and dentists. However, in implant prosthesis, digital restorations have not been familiar for the impression procedures and fabrication of implant supra-structures. I would explain below procedures with case report.

Digital dentistry workflow

- A. CBCT & 3D image evaluation of patient and planning
- B. Prosthetic driven implant placement with surgical stent or prefabricated temporary prosthesis
- C. Digital impression used by Intra-oral scanning system
- D. CAD/CAM customized abutments & supra-structures made by CAD/CAM milling machine.
- E. Prosthesis delivery

Digital restoration of dental implant in partial edentulous patient can be simplifying procedures, saving treatment time, laboratory time & money, preventing cross-infection, decreasing laboratory errors and making patient & dentist comfortable. Besides, procedure with developments of 3D printing systems becomes easier, simpler, and more economic. All procedure can be processed in dental clinic.

Keywords: Digital dentistry, Intraoral scanner, Digital impression.

Chemical Fingerprinting and Bioactivity of Essential Oils from Ecuadorian's Amazon: *Chenopodium ambrosiodes* (Amaranthaceae), *Schinus molle* (Anacardiaceae) and *Dacryodes peruviana* (Burseraceae)

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Abstract

Three Amazonian essential oils (EOs) obtained through steam distillation of fresh leaves of *Chenopodium ambrosiodes* (Amaranthaceae), *Schinus molle* (Anacardiaceae) and *Dacryodes peruviana* (Burseraceae), named CA, SM, and DP, were chemically characterized by GC-MS (1). Their chemical compositions were mainly characterized by the following compounds: CA, limonene 41.48%; SM α -phellandrene 13.62%; DP, β -3-carene. All the essential oils were then checked for their antioxidant activity: These oils evidenced interesting results with both DPPH and ABTS assays, showing respectively DPPH-IC₅₀ = 0.5 mg/ml and ABTS-IC₅₀ = 0.15 mg/ml. Antibacterial properties of all EOs, verified through Broth dilution method (2), evidenced interesting bioactivity especially of SM against *Klebsiella oxytoca* (MIC=500 μ g/mL), *Pseudomonas aeruginosa* (MIC=250 μ g/mL), *Proteus vulgaris* (MIC=500 μ g/mL), *Enterococcus faecalis* (MIC=500 μ g/mL), *Micrococcus luteus* (MIC=250 μ g/mL) and *Staphylococcus aureus* (MIC=500 μ g/mL). Studies of synergistic effects are currently in progress. Valuable results against *Candida albicans* have been shown by DP with MIC=1250 μ g/mL. The research has been extended to dermatophytes and phytopathogens fungi through Agar vapour method (2). CA showed 100% growth inhibition against the dermatophyte *Nannizzia gypsea*. This project give an essential contribution to the valorization of biodiversity of Ecuadorian Amazonia and to the definition of possible industrial applications.

Keywords: *Chenopodium ambrosiodes*, *Schinus molle*, *Dacryodes peruviana*, Bioactivity, Synergy.

Utilization of supermarket wastes for methane production

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Abstract

In this experimental work, the utilization of mixed supermarket wastes was investigated in order to produce biogas (methane) as a source of renewable energy. The recent development of retail sector has led to operation of numerous supermarkets in Turkey and it is predicted that a huge amount of waste is generated from this sector. Within the scope of this work, meat wastes (MW), dairy products wastes (DPW), fruit –vegetable-flower wastes (FVFW), and sugar containing waste (SW) products, whose expiry dates were due, were obtained from a supermarket chain and mesophilic batch anaerobic digestion tests were performed in order to determine the potential of methane (CH₄) recovery from these materials. Batch mesophilic anaerobic reactors were run at total solids (TS) ratios of 5, 8 and 10 %, respectively. The highest methane yield of 0.44 L CH₄/g VS_{added} was obtained from anaerobic digestion of wastes (FVFW+DPW+MW+SW) at 10 % TS, with 66 % of methane (CH₄) composition in the biogas produced. Anaerobic digestion of mixed wastes at 5 % TS and 8 % TS provided slightly lower methane yields of 0.41 and 0.40 L CH₄/g VS_{added}, respectively. When the wastes were digested alone, without any co-substrate addition, the highest methane yield of 0.40 L CH₄/g VS_{added} was obtained from FVFW at 5 % TS. Based on the experimental results obtained, it could be stated that a suitable carbon/nitrogen (C/N) ratio, proper adjustment of the buffering capacity (alkalinity) and the addition of essential trace metals (such as Ni, Co, Mo) could significantly improve volatile solids (VS) conversion, biogas and methane production yields. In summary, it can be concluded that the anaerobic digestion of super market wastes can actually reduce the amount of waste to be disposed of in sanitary landfills and provide methane as a source of renewable energy in developing countries, where such wastes contribute to emissions and landfill leachate generation.

Keywords: Supermarket waste, Methane, Renewable energy.

Enhancement of Optoelectronic Properties of Germanium Metal-Semiconductor-Metal Photodetectors through a SiO₂ Anti-Reflection Layer

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Abstract

The interdigitated germanium (Ge) metal-semiconductor-metal (MSM) photodetectors (PDs) with and without an SiO₂ anti-reflection (AR) layer was fabricated, and the effect of SiO₂ AR layer on their optoelectronic response properties were investigated in detail. The lowest reflectance of 15.6 % at the wavelength of 1550 nm was obtained with a SiO₂ AR layer with a thickness of 260 nm, which was in a good agreement with theoretically calculated film thickness for minimizing the reflection of Ge surface. The Ge MSM PD with 260 nm-thick SiO₂ AR layer exhibited enhanced device performance with the maximum values of responsivity of 0.65 A/W, the quantum efficiency of 52.2%, and the detectivity of 2.49×10^9 cm Hz^{0.5}W⁻¹ under the light illumination with a wavelength of 1550 nm. Moreover, time-dependent switching analysis of Ge MSM PD with 260 nm-thick SiO₂ AR layer showed highest on/off ratio with excellent stability and reproducibility. All this investigation implies that 260 nm-thick SiO₂ AR layer, which is effective in the reduction in the reflection of Ge surface, has a great potential for Ge based optoelectronic devices.

Keywords: Ge, SiO₂ anti-reflection layer, Metal-semiconductor-metal, Photodetector, Responsivity.

Semi-analytical Method and Asymptotic Analysis Method Applied Mathematical-biology Models

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Abstract

In our research we applied the well known the Homotopy Analysis Methods (HAM), which is semi-analytical method, perturbation method, to study a reaction-diffusion-advection model for the dynamics of populations under biological control. According to the predator-prey model, the advection expression represent the predator density movement in which the acceleration is proportional to the prey density gradient. The prey population reproduces logistically, and the interactions between the prey populations obeys to the Holling's prey-dependent Type II functional response. The predation process splits into the following subdivided processes: random movement which represented by diffusion, direct movement which described by prey taxis, local prey interactions, and consumptions which represented by the trophic function. In order to ensure a successful biological control, one should cause the predator-pest population to stabilize at a very low level of pest density. One reason for this effect is the intermediate taxis activity. However, when the system go out from stability, for example very intensive prey taxis destroy the stability, leads to chaotic dynamics with pronounced outbreaks of pest density.

Keywords: Predator-prey model, Mathematical - biological model, Homotopy analysis method, Method of integral invariant manifold, Reaction-diffusion-advection model.

Experimental Investigation of Flow Under a train

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Abstract

Flow induced vibrations of high-speed trains in tunnels has become a subject of discussion in view of ride comfort in Japan. Several studies have been conducted extensively and the following mechanism of the phenomenon was suggested [Suzuki et al., 2008; Nakade and Ido, 2014]. The velocity distribution under the train is different from that in its outer side. Then the flow under the train becomes unsteady by Kelvin-Helmholtz instability. Then, the flow becomes meandering in the horizontal plane under the body. When the train runs in the tunnel, the meandering flow impinges the tunnel wall and moves upwards in the space between the train side and the tunnel wall. This flow makes a pressure fluctuation on the train side and causes the vibration of the train. However, this mechanism was not fully confirmed yet. Therefore, we have investigated the flow under the train experimentally. We focus on the meandering flow in the horizontal plane in this study.

A 1/50 scaled model of train with the ground floor is set in a wind tunnel (fig.1). The length of the train is 1,560 mm, which is corresponding to 3 cars of a train set. Shapes of front and rear nose of the train are streamlined. There are no gaps between the cars. To investigate the effect of bogies parts, three types of the underbody shapes are prepared: 1) cavities with bogies, 2) cavities without bogies and 3) flat floor (no cavities and bogies). To investigate the effect of the train width, a train with the normal size and one with a wider size are prepared. Flow speed is 5 m/s. Reynolds number based on the train height is 2.5×10^4 . PIV measurement is conducted in the horizontal plane under the last car.

The measurement shows as follows. 1) The flow meanders with a wave length of 4 times of train width. 2) Although the underbody shapes do not affect the wavelength, the bogie inside the cavities enhances the meandering flow.

Keywords: High-speed train, flow-induced vibration, flow instability, PIV measurement.

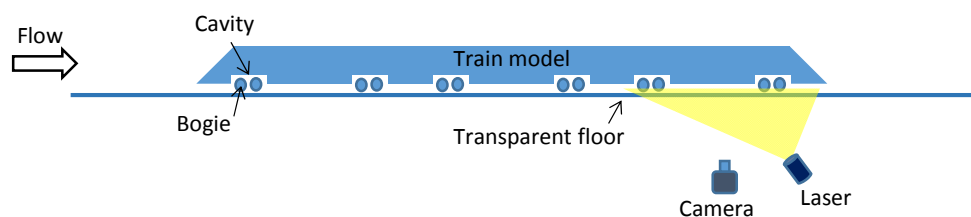


Figure 1: Sketch of the experimental setup.

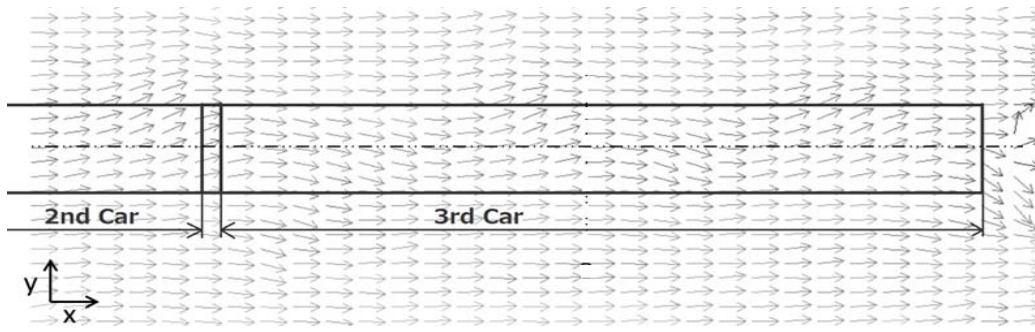


Figure 2: An instantaneous flow pattern

Building a Long-Term Care Information System Based on the Whole Person Concept through Service-Oriented Architecture

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Abstract

Although there are long-term care institutions that increase service efficiency and quality through the establishment of long-term care systems, the caring approach for long-term care emphasizes comprehensive health care, including the physical, mental, and spiritual state of older persons. Such care systems based on the whole person concept require constant cross-referencing and an emphasis on reminders for anomalous incidents. If the system establishment lacks integrated concepts, the system will then be unsuitable. This study aims to apply the concept of service-oriented architecture to integrate the previously dispersed and different operations of the long-term care system. This involves substituting the function module of the original system architecture with a service-based approach to provide a service interface. In addition, there must be a connection between the well-defined interface for the services and the formation of comprehensively integrated system architecture. Finally, the study assesses the system to support the actual improvement on the operational performance of personnel.

Keywords: Long-term care institutions, Service oriented architecture, Long-term care information management system.

Analytic Expression for Most Penetrating Particle Size for Fibrous Collectors considering Cunningham Slip Correction Factor

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Abstract

The collection efficiency of aerosol particle by fibrous collectors has been an important subject of numerous theoretical, numerical and experimental studies. The important filtration mechanisms of fibrous collectors are Brownian diffusion, interception, inertial impaction and gravitational settling.

It is well known that the Diffusion and interception dominate the particles motion at opposite size regimes. An increase in the particle size increases the collection efficiency due to interception and inertial impaction (Lee and Liu, 1982). On the while, decrease in the particle size causes an increase in the collection efficiency because of Brownian diffusion. Between the regions where two or more mechanisms operate simultaneously, but no one mechanism predominates, there exists a size regime which aerosol particles in spherical or fibrous collectors penetrate most effectively, and the corresponding minimum collection efficiency (Jung and Lee, 2007). Especially, in diffusion mechanism dominant regime, the aerosol slip effects cannot be negligible for small particle size, which should be corrected by Cunningham correction factor.

In this study, the analytic expression for most penetrating particle size was analytically driven. The Cunningham slip correction factor was simplified and modified in order to accommodate the entire particle size ranges. The newly driven expression concerns the slip correction implicitly contained in the diffusion coefficient for aerosol particles in low Knudsen number region. The obtained analytic expression for most penetrating particle size is compared with exact solution and showed the good agreement.

Keywords: Aerosol collection efficiency, Minimum collection efficiency, Most penetrating particle size, Cunningham slip correction factor, Fibrous collector.

Electrical and morphology properties of Novel additive for Highly conductive PEDOT: PSS films

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Abstract

With increasing the application field of the transparent electrode and the associated market scale expansion, next generation flexible electrodes that can replace conventional indium tin oxide (ITO) for transparent electrodes have been of great interest. Various materials, Such as conducting polymer (CP), carbon nanotube (CNT), Graphene, metal nanowires, have been investigated. Among the many ITO-alternatives, Poly (3, 4-ethylendioxythiophene) (PEDOT), a conducting polymer (CP) has attracted considerable interest due to its excellent electrical and optical properties. The PEDOT: PSS composite is one of the most promising organic-based electrode materials owing to its inherent advantages over other conducting polymers such as high transparency in the visible range, long term stability, and water-solution processability. Nevertheless, PEDOT: PSS does suffer from the major drawback of low electrical conductivity. The conductivity of pristine PEDOT: PSS from aqueous solution is below 1 S Cm^{-1} . Inherent properties are limited to commercial application. Recently, there are many of research efforts on improving its electrical conductivity through chemical processing.

In this study, we have tried to improve low conductivity PEDOT: PSS by using the organic acid such as sulfosuccinic and p-Toluenesulfonic. By adding to organic acid, PEDOT: PSS electrical properties is dramatically increased. Also, PEDOT: PSS films with a tiny quantity fluoropolymer showed superior conductivity than organic acid method. The conductivity enhancement of PEDOT: PSS through chemical processing is attributed to the change of PEDOT: PSS shape. This results indicated that the possibility as a new transparent electrode material in the flexible display field.

Keywords: PEDOT: PSS, Conducting polymer, Transparent electrode, Organic acid.

Test Driven Development Architecture for Unit Testing of Object Oriented Software

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Abstract

This paper focuses on addressing the problems and challenges involved in testing and improving the quality of object-oriented test case design. The aim of the study is to provide the software tester/developer with quantitative reliability measures of the automate test case design for unit testing of object-oriented system. The paper introduces automated test case design architecture for unit testing of OOS and describes the problems and challenges involved in unit testing of object-oriented system.

Keywords: OOS, TDD, XP, Black-box testing, BP, UI, Test case.

"Determination of the Emissions of Suspended Particles (PM₁₀ AND PM_{2.5}) by Wind Motion Through Mathematical Simulation in the Province of Chimborazo of the Year 2015"

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Abstract

The particulate matter analysis (PM₁₀ and PM_{2.5}) product of the wind power was carried out in 2015 at the Chimborazo province, using mathematical modeling established by the WRAP report, including mathematical formulae and their numerical conditions, in addition the use of wind speed meteorological data taken during the 2015 year in a sequence of 3 times a day. Using the ArcGis software, the emission mesh was obtained with an extension of 1 km² for each cell and by the Spline tool that allows interpolating and linking wind speed data, the cover vegetation and land use map of 2014 year. Also values of the friction surface were determined for different soil types, obtaining the PM₁₀ values and determining 15% as result for PM_{2.5}. The type of soil with longer length was grassland producing higher re-suspension of PM with a total of 17450, 164 g/m² a month. The result of total PM₁₀ emissions in re-suspension for 2015 year was 29236,245 g/m² a month, of which 59,76% were issued in august caused by the strong winds that start at early hours of the day, the low cloudiness and for being the dries season in Ecuador. Consequently, Alausí and Guamate were the most affected with 94,299 g/m² a month; in august and the least affected canton was Guano that in most of months except June did not get PM emissions. It is concluded, that this research method gives us a focus on improving the quantity of breathing air, due to the serious effects on human health and the environment that the particulate matter causes, needing strategies for pollution and providing power for atmospheric compounds being able to infer transport and chemical transformation.

Keywords: Natural Sciences, Mathematical, Simulation, Particulate matter (PM), Air pollution, Wind resuspension, Atmospheric emissions, Chimborazo (province), ArcGIS (software).

Study and analysis of NO₂ emissions generated by motor vehicles in the “Terminal terrestre” area of Riobamba city, Ecuador

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Abstract

Riobamba is the capital of the province of Chimborazo. It is located in the center of the country, in the “Cordillera de los Andes”, at 2,750 meters above sea level; radiation in this city is higher compared to the rest of the cities of the country due to its height. The population of the city is 458,581 inhabitants with an approximate of 47,064 motor vehicles; in fact, the bigger number of motor vehicles at Chimborazo province is located in this city. In spite of that, there are no studies of air quality in areas with the greatest influx of vehicles that will help us to quantify the degree of pollution in this city, monitoring has been the only study carried out to determine the behavior of certain pollutants in the atmosphere.

The object of this study is to measure the concentration of NO₂, as this is the main precursor in the generation of tropospheric ozone, therefore through this research we will attempt to locate the vulnerable zones in the area that was selected to conduct the above-mentioned study.

The area of study is the “Terminal Terrestre” of Riobamba and its surroundings areas, due to its location as a central point were the majority of motor vehicles are located. Passive samplers were used for the monitoring of the contaminant concentration; the samplers were located in various points selected by applying the simple random sampling technique. Subsequently, the traffic flow in this area was analyzed using vehicular simulation software: VISSIM. In addition, a map was generated using the ArcGis software with the previously obtained data, in which, areas with the greatest concentration of NO₂ can be identified and therefore the vulnerable zones can be displayed.

Keywords: Mathematical modeling, VISSIM, VERSIT, Air quality, NO₂ emissions, Environmental engineering.

Uncertainty factor analysis by repeated measurement of Ion Chromatography System

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Abstract

The measurement uncertainty is a parameter that shows the dispersion characteristics of reasonably estimated measured values associated with test result and can be regarded as an essential element for assuring mutual recognition and reliability. Since the cause of uncertainty can vary widely including detection limit and sampling, it is not realistic to analyze and evaluate all factors. Therefore, the uncertainty estimation is the procedure of determining the uncertainty elements and model by reflecting all factors that can occur during a measurement and calculating the standard uncertainty of each. The standard uncertainty element can be calculated in terms of type A standard uncertainty and type B standard uncertainty. The type A standard uncertainty is estimated with a function based on the frequency distribution of repeated measured values while the type B standard uncertainty is estimated by assuming a probability density function that can have the measured value through existing information or data. This study estimated the measurement uncertainty of ion chromatography (IC) system to maintain the traceability of certified reference material (CRM) and device and secure the reliability of analysis result in ion analysis.

The IC system analysis conforms to Standard Methods 22nd; 2012(4110 B.), and the uncertainty is calculated with the measurement model in the form of $y=ax+b$. Here, a represents the slope calibration curve, b represents the intercept of calibration curve, and x represents the unknown sample concentration. The uncertainty factors of IC analysis using the measurement model include the calibration curve, repeated

measurement of device, and standard solution preparation. The uncertainty of standard solution preparation are further segmented into standard solution, standard volume, flask, and pipet to measure the standard uncertainty.

The reliability of IC system is calculated with three types of standard uncertainties. The relative standard uncertainties is calculated to be 0.226 9 while the degree of freedom is calculated to be 14. The expanded uncertainty calculated by multiplying the t-distribution table by k coefficient of 1.96 with 95% confidence is 0.153 9 mg/L. Finally, the test result including the measurement uncertainty is $U = 0.153\ 9$ mg/L (95% confidence, $k=1.96$). and Considering the fact that the reliability is generally accepted when the measurement uncertainty is 10~20% or less of measured value, the IC system used in this study is judged to be reliable.

Keywords: Uncertainty factor, Ion Chromatography system, Statistical analysis.

Biogenic Emissions of Non Methanogenic Volatile Organic Compounds in Ecuador

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Abstract

Ecuador is one of the countries with a greater biodiversity in America; however, biogenic emissions has been never studied. Emissions of biogenic volatile organic compounds are important because of their potential influence on the formation of tropospheric ozone. Emissions of volatile organic compounds were estimated for the vegetation of Ecuador, for 2010, categorized in three groups in function of their reactivity: isoprene lifetime of 1 to 2 hours; monoterpenes, lifetime of 0.5 to 3 hours; and other volatile organic compounds, generally with a lifetime of 1 day. The basic model of Guenther was used, that considers the temperature and the photosynthetically active radiation as physical parameters with high influence. It was determinate hourly emissions, daily representative for each month, monthly and annual. Results were represented in georeferenced maps.

Total emissions arise to 1855.6 kt a^{-1} , of which 1278.6 kt a^{-1} belongs to isoprene, 427.6 kt a^{-1} to monoterpenes and 149.3 kt a^{-1} to other volatile organic compounds. Highest emissions are located in zones with oil palm crops, in Santo Domingo and Esmeraldas provinces. Results provides valuable information to inventories of national emissions of air pollutants, and may be used to simulation studies of tropospheric ozone

Keywords: Biogenic emissions, Isoprene, Monoterpenes, Other volatile organic compounds, Model of Guenther.

Investigating dissolved air flotation (DAF) performance for drinking water treatment plant

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Abstract

In recent years there have been large increases in the hydraulic loading rates used to design dissolved air flotation (DAF) facilities for drinking water applications. High rate DAF processes are now available at loading rates of 20 to 40 m³/m²·h. This research evaluated dissolved air flotation (DAF) as a separation method for algae and organic compounds from water treatment plants. DAF uses the super saturation of air to raise suspended algae and other particles to the surface, where they can be easily removed. DAF, in conjunction with chemical coagulants and flocculants, can approach more than 90% algae and 50% of organic compounds removal. During the service period of 2016.05 to 2016.06, DAF pilot plants (500 ton/day) process has shown a constantly sound performance for the treatment of raw water, yielding a significantly low level of turbidity (DAF treated water, 0.21~1.56 NTU). A case study was carried out to evaluate the dissolved air flotation (DAF) pilot plants (500 ton/day) process installed in the Youngchon drinking water treatment plant (YCWTP). A pilot DAF unit was used to determine the optimum alum dose for algae and 2-MIB, geosmin removal. In addition, a bench-scale jar test unit was used to study the effects of various alum and polymer doses on removal efficiencies at different times of the day. An optimal alum dose was found to be approximately 30 mg/L based on results from both the pilot and lab scale experiments. This study evaluated several integration of a DAF combining with granular activated carbon (GAC). In order to optimize the best position of the GAC process, pilot plants experiments were performed using several water samples, such as raw water, coagulated water and DAF treated water collected from YCWTP.

Keywords: Algae, Dissolved air flotation, Integration, Organic compounds, High rate.

Local fault identification using Microtremor Analysis (case study: local fault in Surabaya river)

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Abstract

Region in this study is the capital city of Surabaya, East Java Province. This research will be focused on local fault that crosses the river city of Surabaya, because the river crossed by a bridge Surabaya in Dinoyo, Jagir, Wonokromo overpass bridge and dam Gunung Sari. Based on the geological conditions of the city of Surabaya in the form of alluvial basins and sandstone with clay and limestone sedimentary rocks, and crossed by fault Kendeng moving 5 millimeters per year. With the composition of sediment deposition in Surabaya, the region that has the geological conditions in the form of alluvial, tuff, sandstone and would have a great potential danger terhadap intensity ground shaking due to amplification and the intensity of the earthquake. So the purpose of this study is to describe the local faults that exist around Surabaya river, which periodically if hit by an earthquake can move and cause damage to the existing infrastructure. The method used in this study using analysis of Horizontal to Vertical Spectral Ratio (HVSr) to determine the natural frequency response in the area and will be integrated with the data Vs30 to obtain the thickness of layers of sediment and in this research used inversion HVSr to imaging suburface condition of local fault Surabaya river, so as to determine the danger zones around the fault of the Surabaya local river.

Keywords: Local fault, Mikrotremor, Horizontal to vertical spectral, Vs30, Sediment thickness, Inversion HVSr.

Mobile Devices Application of the Levels of Ultraviolet Radiation Measurement and his Validation in Chulucanas District on Piura Región's of Perú

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Abstract

App is a software application mobile that is installed on mobile devices in order to facilitate the achievement of tasks, operations or management of day to day user. This research develops an analysis of the efficiency of mobile applications in the measurement of levels of ultraviolet radiation in Chulucanas district, in order to verify the reliability of the data obtained and foster a culture of prevention to Sun overexposure in the chulucanense population to prevent UV radiation-related illnesses. The methodology employed considers the information coming of three applications mobile previously selected, World UV, Uv-indeks and NoTeQuemes for free downloaded. It takes of data is made in 3 points georeferenced of the District of Chulucanas that are, city of "Chulucanas", "Chapica Campanas" and "Papelillo" town. The measurement is carried out 5 times to the day every two hours, starting is to them 8:00 a.m. and culminating to them 4:00 p.m., by a period of a month. The results obtained indicate the hourly and daily influence on the development of the level of ultraviolet radiation. In the observed sectors it is determined that the hour of greatest impact occurs at noon solar day, as regards the most suitable type of mobile application UV Indeks is considered to be the one with the best response according to the results obtained in the consulted bibliography.

Keywords: Ultraviolet radiation, Monitoring, Mobile application, Prevention.

Moxibustion reduces stress-related alterations in liver in a restraint-stress model

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Abstract

Moxibustion is one of the oldest therapies in traditional oriental medicine (TOM); in addition, it has been used to treat many chronic modalities. Baihui (GV20), which is located on the dorsal midline of the skull, is a common moxibustion point to treat especially stress-related diseases. In this study, we evaluated the anti-stress effect of direct moxibustion on GV20 in a mouse model. Sprague-Dawley rats were divided into four groups; naïve group, control group, M1 group, M2 group. Three groups (except for the naïve group) were subjected to restraint stress for 4 hours, 5 days/week for 2 weeks. We treated moxibustion during restraint stress on M1 group, and right after restraint stress on M2 group. Moxibustion significantly reduced elevation of serum AST and ALT levels compared with control group. Moxibustion also significantly ameliorated stress-induced alterations in oxidative stress (ROS, MDA, NO) and antioxidant capacity (TAC, GSH, SOD) as well as changes in inflammatory cytokines in liver. These results support the clinical relevance of moxibustion on chronic stress and its possible mechanism might be modulating oxidative and inflammatory reactions in liver.

Keywords: Moxibustion, Stress, Liver, GV20.

Synergistic effects of *Rhei Radix et Rhizoma* and *Corydalis Tuber* on high-fat diet-induced metabolic abnormalities in a mouse model

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Abstract

The herbal plants *Rhei Radix et Rhizoma* and *Corydalis Tuber* have been both used to treat ‘*blood stasis*’ (瘀血) in traditional Oriental medicine. *Blood stasis* indicates a wide range of metabolic abnormalities. Furthermore, two or more herbal plants are typically used in combination to improve therapeutic efficacy. In this study we evaluated the effect of the 30% ethanol extracts of *Rhei Radix et Rhizoma* (Rhei) and *Corydalis Tuber* (Corydalis), and the mixture of Rhei and Corydalis (RheiCo), using a high-fat diet-induced metabolic syndrome model. Six groups of C57BL/6 male mice (except for the naïve group) were fed a high-fat diet for 12 weeks. Among these six groups, five groups (except for the control group) were given a high-fat diet with Rhei (100 mg/kg), Corydalis (100 mg/kg), RheiCo (50 or 100 mg/kg). Hepatic steatosis, serum lipid profiles, insulin-related markers, obesity-related markers, hepatic gene expression, and oxidative stress markers were analyzed. Rhei, Corydalis, and RheiCo significantly improved on hepatic lipid accumulation, serum lipid profiles, body, liver and peritoneal adipose tissue weights, and oxidative stress biomarkers. RheiCo at 100 mg/kg exerted significantly greater effects on hepatic TC and triglyceride, adipose tissue weight, and oxidative stress biomarkers, compared with single herb. In addition RheiCo exerted significantly greater effects on lipid synthesis-associated gene expression (peroxisome proliferator-activated receptor gamma, fatty acid synthase, sterol regulatory element-binding transcription factor-1c, and peroxisome proliferator-activated receptor alpha). RheiCo significantly improved metabolic abnormalities compared with Rhei or Corydalis alone in high-fat diet model, and its underlying mechanism is partially associated with lipid synthesis-associated hepatic gene expression.

Keywords: Rhei radix et rhizoma, Corydalis tuber, Metabolic syndrome, Synergistic effect.

OFDMA in LTE Mobile Communications

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Abstract

This paper aims to investigate, design, simulate, analyze and suggest possible improvements related to Orthogonal Frequency Division Multiple Access (OFDMA) in Long Term Evolution (LTE) mobile communications. Analysis and design are based on “ETSI TS 136 211 V10.0.0” technical specification, defined by the Third Generation Partnership Project (3GPP). The first section, “Introduction” contains a review of concepts defined by the 3GPP for LTE. Section two “Design and Simulation Settings”, contains block diagrams and parameters for the design. Different number of users and the introduction of fading are contemplated to create multiple scenarios. Moreover, OFDMA symbol design and Matlab Simulink diagrams are presented. The third section “Results and Analysis”, studies the results obtained in Matlab Simulink. The transmitted and received integer data are shown; as well as the error rate calculation. Also, modulated transmitted and received data are compared, and Bit Error Rate (BER) curves are analyzed. The last section, “Conclusions” contains the investigation conclusions and topics of interest for future study.

Keywords: Mobile communications, LTE, Downlink, OFDMA.

Experimental Investigations of a Parabolic Trough Collector

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Abstract

It is being widely realized that for sustainable development, presently used energy mediums such as fossil fuels and nuclear power have to be quickly replaced by renewable energy sources. This paper deals with investigating the performance of solar parabolic trough collector (PTC) and the heat storage unit (HSU); which stores the heat in Phase change material (PCM) in the form of latent heat of fusion from the parabolic trough collector through Heat transfer fluid (HTF). The mean solar irradiation falling over the PTC and the heat gain in HTF was determined to calculate the efficiency of PTC. After that heat gain in PCM in the Heat storage unit (HSU) and its effectiveness is determined. The experiments were done with four combinations of different HTFs and PCMs using three different flow rates of 50, 100 and 150 LPH with 12 experiments in total. It is concluded that flow rate has significant effect over the performance of both PTC and HSU. It is seen that flow rate of 100 LPH is found most suitable for Phase change material as above and below of this flow, the effectiveness of the HSU decreases. It is also found that Paraffin wax is more suited as PCM than water, as it stores more heat. Similarly; ethylene glycol solution is more efficient HTF; as it gives better efficiency of PTC than water as HTF.

Keywords: Parabolic trough collector, Heat storage unit, Heat transfer fluid, Flow rate, Phase change material, Solar energy storage.

The effects of hydraulic retention time (HRT) on chromium (VI) reduction using autotrophic cultivation of *Chlorella vulgaris*

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Abstract

Chromium is an acutely toxic heavy metal that is known to be a carcinogen. Of the two predominant forms of chromium, Cr(III) and Cr(VI), Cr(III) has only about one thousandth the toxicity of Cr(VI). Using microalgal biomass is one way to remove Cr(VI) from the environment. Four days of hydraulic retention time (HRT) was required to completely reduce 10 mg/L of Cr(VI) in the influent. Microalgal biomass is conventionally regarded as an adsorbent in most Cr(VI) reduction studies. However, this study found *C. vulgaris* had the potential to convert Cr(VI) to Cr(III) through the enzymatic route of chromium reductase, although the measured chromium reductase activity of *C. vulgaris* was less than that reported values obtained in bacteria. X-ray absorption near-edge spectroscopy (XANES) analysis further showed the absorption edge of Cr(III) in Cr(VI)-treated *C. vulgaris*, supporting the assumption of Cr(VI) potentially being converted to less-toxic Cr(III).

Keywords: Bioremediation, Adsorption, Chromium reductase, Microalgae.

Modeling, Analysis and Design of Mechanical and Structural Systems Involving Uncertainties

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Abstract

Many practical engineering systems are too complex to be described by precise models and in exact terms, because real-life phenomena have to be simulated by mathematical approximations. Due to the impreciseness of many parameters involved in the system, it is impossible to perform the analysis and design computations using only crisp values. When the imprecise parameters are expressed as interval numbers, the response equations can be converted to the form of interval expressions. The required computations can then be carried using the rules of interval arithmetic. Compared to the analysis, design and optimization with crisp and precise variables, the computations with imprecise variables makes more sense in several situations. For example, the fiber content of a fiber-reinforced composite structure is a very important factor in predicting the strength of the structure. Due to the limitations of the manufacturing process used, its precise value may not be known. In such a case, interval analysis based computations can treat the fiber content as an interval number. This paper presents the application of interval analysis in the design and optimization of structural and mechanical systems.

Keyword: Uncertain systems, Interval analysis, Optimization, One-way clutch, Planar truss.

Rational Design of Surface Wettability toward Clean Water Production

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Abstract

The talk is composed of three parts:

(1) Surface with switchable oil attraction and repulsion for selective oil/water separation. Advanced materials with surfaces that have controllable oil wettability when submerged in aqueous media have great potential for various water-related applications. Smart surfaces can be made on commonly used materials, including non-woven textiles and polyurethane sponges, which are able to switch between superoleophilicity and superoleophobicity in aqueous media. The smart surfaces were obtained by grafting a block copolymer, comprising blocks of pH-responsive poly(2-vinylpyridine) and oleophilic/hydrophobic polydimethylsiloxane (i.e., P2VP-b-PDMS) on these materials.

(2) A bio-inspired method for direct preparation of stable superhydrophilic micropatterns onto superhydrophobic surface for efficient fog collection. By directly inkjet printing a bio-inspired ink of dopamine solution with delicately optimized solution composition, stable Wenzel's microdroplets of dopamine solution with well-defined micropatterns were obtained onto the superhydrophobic surfaces, and after the formation of polydopamine via the in-situ polymerization of dopamine, superhydrophilic micropatterns can be readily achieved.

(3) A photothermal, self-floating and self-healing membrane for enhanced solar-driven water desalination. The membrane was prepared by deposition of light-to-heat conversion materials onto porous stainless steel mesh, followed by a hydrophobic modification. The results confirm that with the membrane floating on water surface, a sharp local temperature gradient was generated on the water surface, leading to significantly increasing water evaporation rate. The membrane recovered its hydrophobicity once lost autonomously. A brief introduction to King Abdullah University of Science and Technology (KAUST) and student recruitment information will also be presented in the seminar.

Bio of the speaker:

Prof. Peng Wang joined KAUST in September 2009 as a founding faculty member and he is currently an associate professor and program chair in Environmental Science and Engineering program at KAUST. He received his M.S. and Ph.D. degree from the University of California, Santa Barbara (UCSB), both in Environmental Science and Management. His research focuses on rational design, synthesis, and application of nanomaterials for clean water and clean energy production. His research constantly produces top journal publications and has garnered attentions from international media.

Many of his publications are on the ESI highly cited paper list. More information regarding Professor Wang's group and his research can be found at <https://enl.kaust.edu.sa>.

Keywords: Wettability, Block copolymer, Oil water separation, Fog collection.

Fabrication and Properties of Epoxidized Natural Rubber Filled Guar Gum Thin Film

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Abstract

The aim of this work is preparation of epoxidized natural rubber/guar gum (ENR-GG) blends for polymer electrolyte membrane fuel cells (PEMFC) applications. ENR-GG blends were successfully prepared by solution casting technique from solution mixture of ENR and GG. ENR-GG solutions were directly mixed with crosslinking agents to prepared membrane. In this study, the ratio of ENR-GG (100/0, 90/10, 80/20, 70/30 and 60/40) were prepared for mechanical testing such as tensile properties, scanning electron microscopy (SEM) and dielectric constant, respectively. It was found that the tensile properties of membrane decreases as the amount of GG increased. SEM showed a smooth and fracture surfaces of ENR-GG membranes. The results from the dielectric constant increases with increases the amount of GG.

Keywords: ENR, Guar gum, Mechanical properties, Solution casting.

Moving Beyond Corporate Acceleration Programs: the Need for Community Entrepreneurial Acceleration Programs

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Abstract

There is significant evidence of correlation between collaboration, innovation and growth of start-ups and large companies. Although there are different types of collaboration arrangements between corporates and startups it is a challenge select what type of collaboration shall be more adequate. This paper proposes a collaboration framework between corporates and startups according to the objectives, investment needed and working engagement between parties. The paper also discusses about the despite corporate accelerators programs have become a major trend in the form of Open Innovation for large and medium size companies there is also a clear challenge related with the efficiency of these programs. Based on 6 cases studies, we argue about the need to design more purposeful, more formal, more structured and more deliberate knowledge leaks that we designate as 'Knowledge Effusion'. We also stress the need for fostering more effective open innovation within sectorial communities of innovation through deliberate 'Knowledge Effusion' on acceleration programs through the creation of what we designate as 'Community Entrepreneurial Acceleration Programs'. The concept of communities is related with 'cluster' or 'ecosystem' i.e. it includes an extended domain of action from multiple stakeholders within an economic activity.

Keywords: Acceleration, Startups, Open innovation, Knowledge effusion.

Effect of Metakoaline and Superplasticiser on the Fresh Properties of Self Compacting-Concrete.

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Abstract

Self-compacting concrete (SCC) refers to high strength concrete which will compact under its own weight and does not require external vibration. The self-compacting concrete is a relatively innovative type of concrete that differs from the conventional vibrated concrete SCC composition consists of maximum volume of fine aggregate and powder content, whereas coarse aggregate occupies lesser quantity. The concrete prepared for SCC was highly fluid and it was achieved by Super plasticizers and Stabilizers of optimum dosages. This research presents the result of an experimental programme that has been carried out, aimed at investigating of FRESH properties of SCC contain metakoaline and superplasticiser. The fresh state properties of the concrete were evaluated. Finally, some hardened state properties of the concrete were assessed. Portland cement was partially replaced with 30%, 50% 70% and metakoaline the water cement ratio was maintained 0.5 for all the mixes .Properties included workability, compressive strength, total water absorption and all were evaluated. The result indicated that the medium volume contain of metakoaline can be used in SCC to produce good strength concrete with this type of superplasticiser that originated from waste material .Replacing 50% of Portland cement with fly ash resulted in a strength of more than 38mpa at 28days .High absorption values are obtained with increasing amount of metakoaline however almost all the specimen exhibits absorption of less than 5%. The concrete mixes contained 3 different dosage of a novel super plasticiser based on the carboxylic with and without metakoaline .the percentage of dosage of superplasticiser is 0.25%, 1%, and 2% respectively. The increase in superplasticiser dosage from 0.25% to 2% the workability increase so the required slump flow meet the criteria of EFNARC also the result of mechanical properties compressive strength for 0.25% ,1% and 2% have shown significant performance compare with the control mixes.

Keywords: Hassan laminu, Maidriss aloomo polytechnic geidam, Self-compacting, Concrete, Superplasticiser, Fresh properties and compressive strength,metakoaline, Nigeria, Maidriss aloomo polytehcic geidam.

Evaluating Triaxial Accelerometers and Force Sensitive Resistors in Building Interactive Freestanding Bags

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Abstract

In martial arts, punching bags are important equipment used for training purposes. Widespread availability of small cheap micro-controllers and various types of sensors makes it possible to build an economical interactive punching bag. In this work, we evaluate the feasibility and the effectiveness of using commonly available COTS triaxial accelerometers and force sensitive resistors in building a cost-effective interactive punching bag. We present a mechanism to transform real time sensor data into a calibration model that can be used to optimize the level of correlation between the accelerometer and the force sensitive resistors. The results show that the accelerometers can detect the impact of punches as well as the force sensitive resistors do while offering the ground for building a model for categorizing different types of punches using the sensor outputs of the three axes. Therefore, a single triaxial accelerometer sensor module has the potential to reduce the necessity for multiple impact based sensors when building an interactive punching bag leading to simplification in the physical design and reduction in the materials cost. We also show that there are opportunities for improving the accuracy in detecting the levels of impacts and types of punches by means of a calibrated model of filtering noisy sensor data.

Keywords: Microcontroller, Triaxial accelerometer, Force sensitive resistance, Sensors.

The Feasibility of Deploying Robotic Waiters in the Service Industry

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Abstract

In paper, we present the design of a waiter robotic system for the service industry – the food outlets or restaurants. For such applications, we have considered and proposed a suitable mechanical and system design commensurate with the users' requirements of cost and functionality. The engineering involved the robot design and eco-system. The tray conveying omni-directional robot is adjustable for different table heights and has a 3-tiered dumb-waiter for 3 trays. It is autonomous and it navigates using a map of the outlet. It is able to reach to within a 1 m of the target table and avoiding both mapped and unmapped obstacles. To supporting eco-system, we have worked on a docking system to ensure that diners get their food and return the trays easily and have designed a central computer system that will have the capability to interface with business system.

Positioning the robot to with 1 m accuracy requires a docking system to navigate the robot closer to various types of tables or furniture used in any outlet. This part requires fine tuning. Robustness is important and challenging to achieve. The interface with the owner's business computer is business sensitive but is useful especially with the advent of NFC RFID and various type mobile apps. The growth opportunity for waiter robotic system is in this area as well.

Keywords: Design and applications, Autonomous omni-directional robot, Waiter robotic eco-system.

Study of the effect of nozzle body and needle seat dimension on injection quantity.

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Abstract

The diesel-powered vehicles are used widely and longer in the transportation, especially the common rail injection system. Its technology can improve the weakness of the old diesel injection system in case of emission, fuel economy and engine noise. Thus, precise fuel injection is important that manufacturers need to consider, because inaccurate production might directly affects on the fuel injection quantity in combustion process. In the design of nozzle injector, cone angle and roughness surface of nozzle body and needle on seat areas are the key that will affect to the amount of fuel in functional test bench. The seat dimensions of the nozzle piezoelectric injector are studied with reference to cone angle difference and roughness surface both of the nozzle body and needle seat areas under the four injection pressure test points; 1600, 1500, 900 and 400 bar for understanding about the effect on fuel injection quantity based on current production by using statistic tools.

Keywords: Diesel injector, Injection quantity, Seat dimension.

Optimization of Spray Drying Conditions for *Momordica Charantia* Rich Charantin Extract Powder

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Abstract

The main purpose of rich charantin extract powder production from *Momordica Charantia* are to identify the most influencing independent variables, their interactions and optimum value of variables. The independent variables were inlet temperature (160-200)°C, feed flow rate (2-4)mL/min, and nozzle size (0.5-1.5)mm. On the other hand, the responses were encapsulation efficiency and powder moisture content. *Momordica Charantia* have a lot of benefits on health such as antitumor, antimicrobial, antiviral, immunotoxic, antifertility and antimutagenic and have potential on controlling glucose levels in hyperglycemic states in Asian countries. The charantin powder was performed by co-current spray dryer, while response surface methodology will concluded the experimental result analysis. The optimum variables are inlet temperature 160°C, feed flow rate 2.00mL/min, and nozzle size 1.17mm will produce powder with 99.27% encapsulation efficiency and powder moisture content with 1.784%.

Keywords: *Momordica charantia*, Charantin, spray drying, Response surface methodology.



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