

# COLLEGE OF ENGINEERING RESEARCH DAY

Abstracts for papers presented in the 11th Annual Research Day  
held on 1/1/1437 at King Khalid University, organized by the  
College of Engineering Research Center

*Proceedings*

## Preface,

*College of Engineering at King Khalid University offers different facilities to motivate scientific research. Since after establishment in the academic year 1434, the Research Center, College of Engineering is engaged in encouraging the scientific activities of the College faculty members by providing technical and administrative support.*

*Number of researches were conducted covering different aspects in both theoretical as well as applied level. The College faculty members published the results of their research in scientific journals and conferences recognized worldwide.*

*Other activities including organizing seminars and research days; where faculty members and professionals come together to get acquainted with the latest research activities taking place within the College.*

*This report presents the abstracts for the papers presented in the annual research day held on 14<sup>th</sup> of October 2015. The Day's research theme was Environmental and renewable energy. Topics covered in this day reflects the research conducted within the College various Departments and showed great diversity and strong potentials for this arena that can be applied within the Kingdom.*

*I would like to thank the Deanship of Scientific Research and the College of Engineering for their ongoing support to the Center.*

*I am deeply in debt to the staff of the College of Engineering for their self-motivation, cooperation and continuous efforts leading to the improving of research quality in addition to their participation by presenting their work.*

*Dr. Ihab M. T. A. Shigidi  
Director, College of Engineering Research Center.*

## Program Schedule

Time					
9:00 to 9:20		Registration, Tea and Coffee			
9:20 to 9:35		College of Engineering Dean's Speech			
		Title	Speaker	Department	Chairman
9:35 to 9:55	Presentation session 1	Water Desalination Using Solar Energy	Dr Ashraf Lashin	Mechanical Eng.	<b>Dr. Ibrahim Elsisi</b>
9:55 to 10:15		Renewable Energy Applications in Rural Areas	Dr. Zakaria Salem	Electrical Eng.	
10:15 to 10:35		Emissions, Performance and Cylinder Pressure of Diesel Engine Fuelled by Biodiesel Fuel	Dr. Mohamed S. Shehata	Mechanical Eng.	
10:35 to 11:20		Poster & Tea Break			
11:20 to 11:45	Presentation session 2	GIS-Based Hydrological Modelling and Analysis of Contributing Environmental Factors: A Case Study of Abha, Saudi Arabia	Dr. Javeed Mallick and Dr. Ram K. Singh	Civil Eng.	<b>Dr. Yasser Alashker</b>
11:45 to 12:05		The Role of Sustainable Energy in Environmental Engineering	Dr. A.K. Shaik Dawod	Industrial Eng.	
11:05 to 12:25		An Innovative Concrete Curing Technique for Arid Environment	Mohd. Ahmed	Civil Engineering	
12:25 to 1:35		Prayer & Lunch Break			
1:35 to 1:55	Presentation session 3	Monitoring Industrial Disasters Through Remote Sensing	Dr. Mohammad Arshad	Chemical Eng.	<b>Dr. Mohamed K. Al Mesfer</b>
1:55 to 2:15		Assessment of Wind Power Penetration Level in Distribution Network with Consideration of Composite Loads	Dr. Abdelaziz S. Saidi	Electrical Eng.	
Closure					

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# Water Desalination Using Solar Energy

Ashraf A. Lashin  
King Khalid University, Mechanical Engineering Department Abha, Saudi Arabia  
ashraff@kku.edu.sa

## *Abstract*

This presentation addresses the need to utilize clean energy in solving a universal problem, that is water scarcity using desalination. Many clean technologies have been adopted recently in solving this problem, among them but not limited to wind energy which is rapidly growing by 48% every year. Solar energy on the other hand is growing by 28% each year. The use of solar energy is known to be a very viable option specially in the Middle east region. Results showed great potentials in applying solar desalination process in many countries.

***Keywords:*** *Water desalination; Renewable energy sources; Solar energy; Water cycle.*

## Renewable Eenergy Applications in Rural Area

Dr. Zakaria Elbarbary  
King Khalid University, Electrical Engineering Department Abha, Saudi Arabia  
albrbry@kku.edu.sa

### *Abstract*

Rural and Remote Areas need to use electric energy in agriculture and livestock production. Pumping water from wells to process agricultural irrigation, heating in poultry farms needs electrical energy. Extension of electrical energy from the power stations to these places is highly cost . Where, we need to towers , cables , transformers and distribution panels. Less number of users means High cost to consumer. In addition to maintenance problems of electrical network. So , use of renewable energy ornaments ideal for these problems. Where you can use solar energy or wind power. Normally, solar energy is used to produce electrical energy . And solar energy can be used in several ways:-

1. Drying of agricultural products.
2. Water heating.
3. Animal farms warming.
4. Agricultural greenhouses.
5. Electrical power generation as well as directly or indirectly.

Photovoltaic is used in direct method convert the sun's energy into energy, electric energy. Indirect method used in large scale , where , solar energy is used to steaming water, then run steam power plants Electrical energy generated by solar energy is direct current (DC) , and needs to be converted into AC power, which we introduce in this presentation.

*Keywords: renewable energy, Solar energy, Indirect photovoltaic, Rural area*

# Emissions, Performance And Cylinder Pressure Of Diesel Engine Fuelled By Biodiesel Fuel

Prof. Dr. M. S. Shehata  
Mechanical Engineering Department, Faculty of Engineering,  
King Khalid University, Kingdom of Saudi Arabia  
Email: M3ohamed4@yahoo.com

## *Abstract*

Experimental studies have been carried out to investigate effects of biodiesel fuels on diesel engine performance, Carbon monoxide (CO) and nitric oxide (NOX) emissions, exhaust gas temperature (T<sub>Exhaust</sub>), oil temperature (T<sub>Oil</sub>), wall temperature (T<sub>Wall</sub>), and cylinder pressure with/without exhaust gas recirculation (EGR). Biodiesel fuels are prepared from cotton seed oil, palm oil and flax oil. All the measured parameters for biodiesel fuels are compared with the base diesel fuel with/without EGR for different engine speeds. Fuel inlet temperature of 120°C gives minimum viscosity different between diesel and biodiesel fuels. Biodiesel fuels give slightly less brake power (BP), brake thermal efficiency ( $\eta_{Bth}$ ) and slightly high brake specific fuel consumption (BSFC) and high fuel mass flow rate per cycle. Diesel fuel gives CO higher than biodiesel fuels due to less O atoms in fuel molecules. Biodiesel fuels give NOX higher than diesel fuel due to high oxygen content in biodiesel fuels molecules and cetane number (CN). As EGR increases, CO increases while NOX decreases due to decrease flame temperature and O<sub>2</sub> in fresh air charge. For biodiesel fuels, T<sub>Exhaust</sub> and T<sub>Oil</sub> are higher than for diesel fuel. T<sub>Wall</sub> for diesel fuel is higher than for all biodiesel fuels. Biodiesel fuels give peak cylinder pressure higher than diesel fuel. The position of peak cylinder pressure is arrangement as 11 crank angle degree (CAD) after top dead center (ATDC) for flax, 12 CAD ATDC for cotton, 14 CAD ATDC for palm and 20 CAD ATDC for diesel fuel respectively. The present work contributes in using biodiesel fuels as alternative fuel for diesel engines without major change for engines parts. For comparison between biodiesel and diesel fuels, the viscosity isn't the main parameter affecting on engine performance and emissions.

**Keywords:** *Diesel, Biodiesel, Engine, Pressure*

# GIS-Based Hydrological Modelling and Analysis of Contributing Environmental Factors: A Case Study of Abha, Saudi Arabia

Dr. Javed Mallick & Dr. Ram Karan Singh

Department of Civil Engineering, College of Engineering, King Khalid University, Abha, Kingdom of Saudi Arabia  
Email: javnaffi@gmail.com

## *Abstract:*

Natural resources, land and water, is of critical importance to the society because these systems maintain the environment and humankind. Understanding the inconsistencies of these resources has significant importance for regional planning and land management. Though their relevance, there is no updated data and organized method for characterization and mapping of hydrological system and Analysis of Contributing Environmental Factors in Abha mountainous watershed area. The objective of this study is to develop hydrological zones and analysis of contributing environmental factors. The methodology is based on the Geoinformatics techniques to determine the causative factors that affect the hydrology and to delineate hydrological zones. Ten themes were considered based on the literature review and discussion with the hydro-geologist. The themes and their classes were assigned suitable weights on Saaty's scale according to their relative importance. The assigned weights of the themes and their classes were normalized by analytic hierarchy process and eigenvector method. Thereafter, the all themes were integrated in GIS using weighted linear combination method to create the hydrological map. The results provide valuable information of Abha watershed about the hydrological zone and soil database at large scale for the first time. Generated maps will assist to formulate effective runoff utilization plans so as to ensure long-term sustainability.

*Keywords: Hydrological zones; Environment; Geoinformatics; Watershed*

# The Role Of Sustainable Energy In Environmental Engineering

Dr A.K.Shaik Dawood  
Department of Industrial Engineering, King Khalid University, Abha  
[shaik.dawod@yahoo.com](mailto:shaik.dawod@yahoo.com)

## *Abstract*

Energy technologies have a central role in social and economic developments at all scales. Energy is closely linked environmental pollution, degradation to economic development and quality of living. We are dependent on nonrenewable fossil fuels that have been and will continue to be major cause of pollution and climatic change. Petroleum supplies are dwindling. Thus finding sustainable alternatives is an urgent concern. To develop technology for integration, control of renewable energy sources, control of energy consumption and load management. To empower energy user for a sustainable living. Developing Distributed Generation system where energy user is also an energy producer. This work focuses on some of the challenges and efforts needed to harness renewable energy sources for a sustainable human society. The overarching goal of sustainable development is enabling all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generations.

*Keywords: Sustainable Energy, Traditional Engineering, Sustainability indicators, Design of environment*

# An Innovative Concrete Curing Technique For Arid Environment

Mohd. Ahmed\* and Mohd Abul Hasan

Department of Civil Engineering, Faculty of Engineering, King Khalid University, Abha, KSA

Email: moahmedkku@gmail.com

## *Abstract*

The hydration of cement used in the concrete can take place only in water-filled capillaries and loss of water due to evaporation from the capillaries must be prevented. The strength and durability of concrete will be fully developed only if it is properly cured i.e. by maintaining desired moisture and temperature conditions, both at depth and near the surface of concrete. The curing method such as water curing or membrane curing is not suitable method for curing for region that has scarcity of water resources and human resources. Also, the concreting work in arid and hot environment (high temperature and low relative humidity) results in adverse effect on the concreting process and on concrete green and hardened properties such as rapid hydration of cement, high evaporation of mixing water, slump loss, greater mixing water demand, and high plastic shrinkage, reduction in strength and durability. The study presents the innovative curing methods or so-called internal curing method for arid and hot environment using the porous igneous rocks aggregates. The study evaluates the effectiveness of the internal curing or self-curing method on the concrete performance. The development of compressive strength with age for the control (water), membrane curing, air-curing and self-curing concretes is studied.

*Keywords: Curing Conditions; Concrete Curing; Self-Curing; Porous Aggregate; Arid Environment*

## Monitoring Industrial Disasters through Remote Sensing

Dr. Muhammad Arshad

Department of Chemical Engineering, Faculty of Engineering  
King Khalid University, Abha  
moakhan@kku.edu.sa

### *Abstract*

Chemical industries are considered as the notorious polluter of the environment. In this context one of the largest industrial disasters took place in Europe. In Ajka, Hungary on October 4th, 2010, the retaining wall holding very alkaline liquid waste from Aluminum oxide plant ruptured releasing more than one million cubic meters of red sludge waste. The red sludge flooded many towns and villages resulting in a very complex environmental disaster.

The Satellite remote sensing techniques incorporated with GIS has an advantage over the in situ techniques by providing the disaster response team in a near real time scenario, a wealth of information for monitoring, prevention, analysis and assessment of the environmental disasters.

The current presentation highlights how high resolution satellite imageries were incorporated in monitoring and assessing the extent of the disaster caused by the sudden release of red sludge from the holding reservoir.

*Keywords: Industrial disasters, Pollution monitoring, GIS, Satellite remote sensing.*

# Assessment of wind power penetration level in distribution network with consideration of static, motor and composite loads

Abdelaziz Salah Saidi

King Khalid University, Electrical Engineering Department Abha, Saudi Arabia.

asaidi@kku.edu.sa

## *Abstract*

The complexity of power systems has increased in recent years due to the operation of existing wind generator closer to their limits, and also due to the diversity of load model. This changing nature of a power system has considerable effect on its dynamic behaviours resulting in dynamic interactions between different power system devices. This paper presents an assessment of wind power penetration in a distribution network, with consideration of a static load, exponential recovery load, motor load and a composite load. Motor loads are assessed with respect to their mechanical loads. The wind farm is represented by a variable-speed induction generator based on doubly-fed induction generators. A differential algebraic representation is developed; and the study is based on the determination of bifurcation points and validated by time domain simulations. The bifurcation points indicated the load-generator dynamic interaction and the network permissible wind power penetration. A comparison is made in terms of permissible wind penetration. Various simulation results show that addition of exponential recovery load model improves the wind generation margin. However, the induction motor load and composite load model reduce the voltage stability of the wind integrated system. It has been established that the mechanical load of the induction motor which has a strong linear dependence on speed is the most critical load for the wind system.

*Keywords— distribution network; wind generation margin; variable-speed induction generator; ZIP load; exponential recovery load; induction motor load; composite load*

# Posters Abstracts

# Mass Transfer In Toluene Adsorption Onto Acid-Activated Bentonite: Experimental And Prediction Of Breakthrough Curves

Abdelfattah AMARI

Department of Chemical Engineering, College of Engineering, King Khalid University, Abha, KSA  
aamary@kku.edu.sa

## *Abstract*

In this study, adsorption of toluene onto acid-activated bentonite in fixed bed was carried out using an inverse gas chromatography. Activated bentonite was prepared according to an optimised activation process. Toluene was used as model compound based on the fact it was detected in many industrial sites and it is considered as one of the most often reported indoor VOCs.

The aim of this work is to establish a new model to predict breakthrough curves of VOC adsorption on activated bentonite in a fixed bed. The mathematical model considers the mass conservation for compound and neglecting axial diffusion effects. The resolution of partial differential equations of the model was carried out by the numerical method of Runge Kutta RK4.

***Keywords:*** Adsorption, Toluene, Bentonite, Linear Driving Force (LDF), breakthrough curves.

## Desalination Of Brackish Water Through A Solar Parabolic Collector

Atef EL JERY

King Khalid University, College of Engineering, Chemical Engineering Department.  
*ajery@kku.edu.sa*

### *Abstract*

A desalination unit, provided with a parabolic-concentrator has been designed, produced and investigated. The experimental results obtained were interpreted. Its production of drinking water has been compared to those of other units.

*Keyword: Energy solar, parabolic concentrator, sea water, desalination, drinking water.*

# The Treatment of Domestic Wastewater Using Microfiltration Membrane: Case Study

Ihab Shigidi and Mohd Danish  
Department of Chemical Engineering, College of Engineering, King Khalid University,  
PO Box 394, Abha 61411 KSA  
mdansh@kku.edu.sa, etaha@kku.edu.sa

## *Abstract*

In this work, domestic wastewater taken from Alarein Wastewater Treatment Plant Abha, Kingdom of Saudi Arabia has been investigated. Conductivity, pH, turbidity and TDS properties were measured for various samples. A 0.2 $\mu$ m tangential flow hollow fiber microfiltration system was used for wastewater treatment and permeates were re-tested. Results obtained showed reduction of various wastewater properties. Thus concluding that the use of microfiltration system has proven reliability in improving wastewater quality to be utilized for drinking purposes.

*Keywords: Microfiltration, Permeate Volume, Turbidity, Wastewater*

## Solar Photovoltaic Systems

Abdelaziz Salah Saidi

King Khalid University, Electrical Engineering Department Abha, Saudi Arabia.

[asaidi@kku.edu.sa](mailto:asaidi@kku.edu.sa)

### *Abstract*

As the concern over global warming increases, Renewable Energy Sources are becoming one of the central topics of energy supply. Among these renewable energy sources, photovoltaic (PV) generation is attracting a growing amount of political and commercial interest. Photovoltaic generation with a lot of advantages has been developing rapidly in all over the world. The leading countries are Germany, China, Japan and Italy. The PVs are attractive sources of renewable energy for electric power generation due to their relatively small size and noiseless operation. Their applications are expected to significantly increase all over the world. PV generating technologies have the advantage of being modular (more units can be added) to meet the increased demand. This posters describes the typical structure of a grid connected PV generator, the operating behaviour and characteristic of photovoltaic generation.

*Keywords: Typical structure of PV generator, Open-circuit voltage, Short-circuit current, Characteristic and Efficiency of a solar cell, Temperature dependency of the MPP.*

# An Experimental Investigation of the Factors Which Affect on the Performance of a Single Basin Typical Double Slope Solar Still for Water Desalination

A. S. Zedan , S. A. M. Nasr Eldin  
Mechanical Engineering Department, Collage of Engineering, King Khalid University, Abha, Saudi Arabia

## *Abstract*

Solar energy is very useful in the process of desalination especially for areas that suffer from a lack of clean water resources. In recent years, many people have been using solar still. Therefore the raising of the productivity and efficiency of solar still represents the most important problems that need further research. The present work aims to study the effect of preheating the water entering to still and the effect of reducing pressure inside the still on the productivity of the solar still. Therefore in present work two identical single basin typical double slope solar stills of the inner basin dimensions for each still 2 m × 1 m × 0.08 m, have been designed and fabricated with mild steel plate.

One of them is conventional solar still and the other is modified with flat plate collector and vacuum pump to study the effect of preheating and vacuum on the performance of solar still. The experimental measurements are made to enhance the solar still productivity by firstly preheating the water entering the still using flat plate collector and secondly by integrating the still basin with vacuum pump. The results show that preheating the water entering the still increases the water productivity by amount about 27.7% - 29.3%. The results also show that decreasing pressure inside the still using vacuum pump improves the solar still water productivity by amount about 21.8% - 23.9%.

***Keywords-*** Desalination, Basin Solar Double Slope Still, Vacuum, Water Productivity

# Assessment of Consumption of Polyethylene / Plastic Bags in Abha City (KSA): Quantification, Disposal, Alternatives, Impact on Health and Environment and Mitigation – Through Field Survey.

Majid Khalid Alshehri; Ahmad Metub Alghamdi; Monir Ali Alshahrani and Chandrakant S. Sarkar\*  
Department of Chemical Engineering, College of Engineering, King Khalid University  
chandrakantsarkar@gmail.com, [cssarkar@kku.edu.sa](mailto:cssarkar@kku.edu.sa)

## ABSTRACT

Hundreds to thousands of manufacturers in the world are producing massive quantities of polyethylene/ plastic bags (PB) which are popularly used by the people for shopping purposes because it is freely and cheaply available, light weight, convenient to use, attractive, durable, non-availability of alternatives and lack of awareness of its after effects impacts on the eco-system. However, there are several problems associated with the production, use, and disposal of plastic bags which may not be initially apparent to most users. By knowing it's chemical composition and characteristic we can better understand the negative impact of these bags.

Kingdom of Saudi Arabia (KSA) is the largest producer of plastic in the world. The level of growth is forecast to continue over the next five years at annual rate of around 8%. Recent studies reveal that total investments in the plastic sector have reached USD 50 billion, affirming the strength of the market. KSA represents about 70 % of the Gulf Cooperation Council's (GCC's) total capacity and currently the downstream plastics industry has a production capacity of 2.1 million tons per year (Source: The 12th International Plastics & Petrochemicals Trade Fair, March 1-3, 2015, Jeddah).

An attempt has been made, for the first time in KSA, to assess the consumption of PBs, in Abha City in Assir region through field survey and suggest mitigation/ alternatives to reduce the use of PBs and in turn to reduce the adverse load on the environment. This project is based on the field survey to generate primary data independently (600 number consumers and 100 number shop owners) in Abha city. Abha is situated at an elevation of 2500 meters ( $\approx$ 7500 foot) above mean sea level (MSL) and is considered as a hill station in KSA and has atmospheric pressure of approximately 750 mm Hg. It has a population of approximately 0.36 million which comprises of local Saudis and expatriates from various countries.

*Keywords: Plastic bags, environmental degradation, impact on agriculture, non-biodegradable, sustainable development, alternatives to plastic bags.*

## Using Solar Collector Combined With Solar Water Desalination Still

Mohannad Jar-Allah Al-Qahtani and Ashraf A. Lashin  
King Khalid University, Mechanical Engineering Department Abha, Saudi Arabia  
ashraff@kku.edu.sa

### *Abstract*

In this project a modifications of solar desalination system is presented. A conventional solar system is provided with parabolic trough, oil cycle as a closed loop located at the bottom of the solar still that presents simple heat exchanger. Also combining solar flat plate collector with the conventional still to increase the yield productivity.

A packed layer is formed from glass balls which is considered as simple thermal storage system. Therefore, fresh water productivity and performance of the modified desalination system increase. A packed layer is formed from glass balls which is considered as simple thermal storage system. Four experiments were carried out using climate conditions at ABHA site, SAUDI ARABIA. The result show that the maximum yield was recorded on 26/4/2014 (6.036 Lit/m<sup>2</sup>/day). Consequently the cost of the fresh water was calculated (0.26 S.R) per one Liter.