Annual Undergraduate Research Experience Program Competition
2020
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Qatar National Research Fund (QNRF) and Qatar Shell Research and Technology Center welcome you to its 12th Annual Undergraduate Research Experience Program (UREP) Competition. UREP encourages undergraduate students in Qatar to engage in research projects under the supervision of their faculty members.

Since its introduction, in 2006, more than 3,830 undergraduate students from universities across Qatar have received awards under this program. Students have participated in 1090 projects during the 25 UREP cycles that have been held to date, with 871 UREP projects completed in the past 14 years.

In this twelfth annual UREP Competition in 2020, all UREP projects completed in 2019 will compete through presenting a poster presentation only. The competing projects will be categorized under 4 pillars (Energy & Environment, Health, Computing, and Social Sciences) where the top 3 projects of each pillar will be awarded 1st, 2nd and 3rd places.

The evaluation criteria for poster presentations are:

- Scientific merits – The significance of the project
- Research Outcomes – Presentations, conferences, articles, prototypes.
- Experience gained by the student – The presenter thoroughly understands the methods and is aware of the scope and limitations of the findings, and what the next steps might be
- Quality and organization of the poster - The poster is visually effective in communicating the project
- Presentation Skills - The presentation is engaging and effective; you readily understand the project as a result / The presenter responds appropriately to questions posed

QNRF was established in 2006 to advance knowledge and education by acting as a support system for researchers. It is a center within the Research & Development establishment at Qatar Foundation for Education, Science and Community Development. QNRF administers funding for original, competitively selected research and furthers collaborations within academia, the public, private, governmental and non-governmental sectors through effective, mutually beneficial partnerships. While QNRF actively seeks internationally recognized researchers, it is dedicated to funding research that meets the needs of Qatar.
Energy & Environment Participating Projects
Project ID: UREP21-108-2-047

Institution: Qatar University

Project Title: Development of Ni-P-ZrO2 nanocomposite coatings through pulse electrodeposition process

Primary Research Mentor: Dr. Abdul Shakoor

Mentor: Sivaprasad V. N. Menon

Students: Khadija Quddus, Yasmina A. Eltayb, Wiam M. Alrawi

Abstract:

Ni-P coatings have obtained a great concern due to its high mechanical and corrosion resistance, which makes them suitable for pipelines in oil and gas industries, aviation, and automotive. In this research work, Ni-P coatings were developed using pulse electrodeposition technique on the steel substrate in the absence and the presence of different content of ZrO2 (2.5, 5.0, 7.5 and 10 wt.%). The surface morphology, mechanical performance, and the corrosion behavior were investigated systematically for the prepared composites. The results revealed that a compact, dense and homogeneous structure obtained with unobserved surface defects on the surface of the composite coatings, as it can be observed using scanning electron microscope (SEM) and atomic force microscope (AFM) techniques. Additionally, the microhardness was enhanced from 375 HV100 for the Ni-P coating to 660 HV100 after adding 1g/L ZrO2 to the deposit bath. Moreover, the corrosion inhibition efficiency of the Ni-P composite coatings was increased with increasing the ZrO2 deposited content reaching to 92.13% for 1 g/L ZrO2 as it proved using different electrochemical techniques in 3.5 wt.% NaCl solution.
Project ID: UREP21-144-2-056

Institution: Qatar University

Project Title: Fabrication of thermo-electric generator (TEG) and integration with photovoltaic (PV) module for enhanced efficiency in Qatar environment

Primary Research Mentor: Dr. Abdul Shakoor

Mentors: Dr. Zubair Ahmed, Dr. Mansoor Ani Njeeb Nellikkal

Students: Khadija Mohamed, Suzan Ahmed, Maha Matalkeh, won Jang, Mentallah Meslam

Abstract:

During summer in Qatar, the temperature rises above 50°C and causes reduced efficiency of the photovoltaic solar cells. Even though Qatar has abundant sunlight during daytime, the existing PV modules are incapable of harvesting them above 20%. In this research project, we would focus how the heat energy from the sun and the extra solar spectrum that could not be absorbed by an active layer of PV cell should be utilized in thermo-electric (TE) generator efficiently. In this way, the reduced efficiency due to the elevated temperature can be compensated by adding the output power from the TE cell. A thermoelectric generator (TEG), otherwise called a Seebeck generator, is a solid state device which converts heat or temperature differences directly into electrical energy through a phenomenon called the “Seebeck effect”. For the fabrication of TEG, special thermoelectric (TE) materials which have the capability to generate power directly from heat by converting temperature differences into electric voltage are used. They must have both high electrical conductivity (σ) and low thermal conductivity (κ) for better efficiency as TE materials. In TEG one side is made hot, the other side stays cold which helps to generate a large voltage while in a temperature gradient. A thermoelectric module contains of two different thermoelectric materials assembly in their ends: as a negatively charged n-type; and a positively charged p-type semiconductor. When there is a temperature difference between the two materials, a direct electric current will flow in the circuit.
During the proposed project, Na4Co3(PO4)2(P2O7) (where M=Mn and Co) materials were developed, and their physical and electrochemical properties were studied. The materials were synthesized using sol-gel synthesis, and the process parameters were optimized to get phase pure materials. XRD analysis demonstrated the formation of phase pure materials. SEM images demonstrated the development of nano-sized materials with homogeneous particle size distribution. Elemental mapping images show a well homogeneous distribution of different elements throughout the compound. XPS analysis was used to study the chemical oxidation state of cobalt and Mn in Na4M3(PO4)2(P2O7). Galvanostatic charge/discharge measurements were carried out at different C-rates for Na4Co3(PO4)2(P2O7) in sodium half cells, which demonstrated decent rate performance delivering capacity of around 45 mAh g⁻¹ at 0.2C. Moreover, Na4Co3(PO4)2(P2O7) showed excellent cycling performance retaining 90.67% of its initial discharge capacity after 30 cycles.
Project ID: UREP22-007-2-003

Institution: Qatar University

Project Title: High quality treated wastewater for irrigation purposes using an optimized aeration process in membrane bioreactors

Primary Research Mentor: Dr. Alaa Al Hawari

Mentors: Dr. Abdelbaki Benamor, Eng. Abdelrahman Tariq

Students: Alhassan Mahmoud, Mostafa Hussein, Yahya Abdelatty, Tamim Mardini, Abdelrahman Ghandour, Yahia Alraijjo

Abstract:

In comparison to traditional activated sludge processes, membrane bioreactors (MBRs) are better suited for wastewater treatment owing to their smaller volume, low sludge quantity, smaller capital investment and simplicity of operation. In this report, a fouling suppression scheme for the production of irrigation water using MBRs has been investigated. The impact of aeration rate was investigated. Initially continuous aeration was provided at 0.5 LPM, 1.0 LPM and 1.5 LPM with a constant biomass concentration (MLSS) of 10 gm/L. The average normalized permeate flux at 0.5 LPM, 1.0 LPM and 1.5 LPM was found to be 51.28 LMH, 40.74 LMH and 38.36 LMH, respectively. The impact of biomass concentration (MLSS) at a constant aeration rate was also investigated. Using an aeration rate of 1.5 LPM, the effect of MLSS concentration on permeate flux was studied for MLSS concentration of 5 gm/L, 10 gm/L and 15 gm/L. MLSS concentration of 15 gm/L, 10 gm/L and 5 gm/L resulted in average permeate flux of 38.78 LPM, 51.28 LPM and 55.3 LPM, respectively. Finally, the impact of aeration scheme on the membrane flux was investigated. Providing pulsed aeration at 1.5 LPM aeration rate, the average flux increases by 8% and 5%, for MLSS concentration of 10 mg/L and 5 mg/L, respectively. However, when MLSS concentration of 15 mg/L was used, the average normalized permeate flux reduced by 6%. In terms of membrane flux, it was found that the optimum operating conditions were to be 1.5 LPM pulsed aeration with MLSS concentration of 5 gm/L.
Abstract:

Drilling fluids have been used to enhance the drilling process by lubricating and cooling the drill bit, eliminating cuttings, and, most importantly, improving the stability of the well by preventing fluid loss. However, there has been an increase in operational demands and challenges that call for drilling fluids to be more effective, economical, sustainable, and environmentally friendly. Therefore, current oil and water-based drilling fluid technology needs to be reassessed to meet those demands.

The use of nanotechnology has been widely accepted to enhance performance in a variety of scientific and engineering fields. Nanotechnology can be applied to improve the properties of drilling fluids that are limiting its physical-chemical, thermal, and time-dependent stability.

Wellbore instability is an issue that petroleum engineers encounter. When not treated, wells can collapse, causing human, environmental, equipment, and revenue losses. With shales that have infinitesimally small pores, nanoparticle additives in drilling fluids can be crucial in providing the necessary properties to prevent fluid loss and provide wellbore stability. This research examines the use of nanoparticles such as; copper (II) oxide, magnesium oxide, and aluminum oxide in improving well integrity while keeping costs low and sustaining an environmentally friendly well. Based on the results, each nanoparticle sample contributed to the aim of this research with varying effects. The proposed plan aims to expand the knowledge of drilling fluid behavior using nanoparticles as a possible solution to common practical problems in oil and gas industry as well the oil and gas operators in Qatar.
Project ID: UREP22-076-1-011

Institution: Qatar University

Project Title: Development of medical scaffolds with enhanced infection resistance using electrospinning/plasma technology

Primary Research Mentor: Dr. Anton Popelka

Mentor: Peter Kasak

Students: Abdelrahman Adel Beshir Mohamed Mahmoud, Mohammed Jaber Naser, Mahmoud Khatib Ali Abdelrasool, Kahlid Jama Mohamoud, Mohamed Khaled Hussein

Abstract:

Scaffolds were developed as a therapeutic mechanism for repairing and regeneration of tissues. Scaffolds should comply with structural/mechanical match with the native tissue, biodegradability, biocompatibility and infections resistance. The current scaffolds often suffer by lacking of an infection control and antimicrobial activity in natural and synthetic tissue replacements. Therefore, the advanced scaffolds with an enhanced infection resistance have a big potential for an improvement of wound healing and regenerative function of injured tissues. Medical scaffolds based on the polyactic acid (PLA) are often found in tissue engineering applications because of outstanding mechanical properties, favorable biocompatibility and biodegradability. A low wettability of this material makes it susceptible to a bacteria attachment and proliferation leading to many infections. A combination of electrospinning technique with low-temperature plasma technology seems to be a promising method for the surface modification of medical scaffolds leading to the desired surface properties with impact on an enhanced antimicrobial effect. The prepared nanofibers mat was modified by antimicrobial agent using plasma technique representing initiator for a radical grafting mechanism. Antimicrobial agent such as ascorbic and fumaric acid were grafted on the PLA fibers mat surface using low-temperature plasma representing an initiator for the radical grafting mechanism. Ascorbic acid and fumaric acid represent nontoxic compounds widely found in the nature and commonly used in medicine as they are a component of organic biosynthesis in humans. This modification led to the improvement of surface properties of PLA without negative effect on the mechanical properties. Such prepared medical scaffolds complied with antimicrobial properties.
Abstract:

In this study, agricultural wastes e.g. date pits (DPs), potato peels (PP), eggshells (ES), coconut choir (CC), pomegranate peels (PP) were exploited as green adsorbent to clean wastewater samples. The raw material as well as the biochar of each adsorbent were used. Results showed that the biochars are more efficient adsorbents compared to the raw unburnt biomass. With the target of having maximum adsorption capacity, a novel strategy: experimental design was used to establish the experimental pattern of this study. Different factorial design was used for each adsorbent. Used designs included, fractional factorial design (2k-p FFD), Plackett-Burman design (PBD), definitive screening design (DSD), and L16 Taguchi design. Four factors were considered, and one response was measured, maximum % of removal. Significant variables were detected using Pareto chart of standardized effects, normal and half-normal plots together with analysis of variance (ANOVA) at 95.0 confidence intervals (CI). The subsequent step, optimizing (maximizing) the adsorption efficiency of tested adsorbent was performed using optimization plots and Derringer’s function. Scanning electron microscopy (SEM) was used to study the surface morphology of both adsorbents while FTIR was employed to get an idea on the functional groups on the surface and hence the adsorption mechanism. Other techniques such as thermal gravimetric analysis (TGA) was used to study the thermal decomposition behavior of the adsorbent.
Project ID: UREP21-098-2-044

Institution: Texas A&M University at Qatar

Project Title: Effect of nanoparticles on alternative fuel sprays at high-pressure conditions

Primary Research Mentor: Dr. Kumaran Kannaiyan

Mentor: Prof. Reza Sadr

Students: AlReem Al-Dosari, Soltan Mohamed, Buthaina Al-Abdulla

Abstract:

The accelerating demand of air transport has been driving the research interest to reduce the environmental impact of jet fuels combustion. Therefore, in addition to exploring the synthetic alternative jet fuels, nanometer-sized metal particles are added to enhance the combustion process and mitigate the undesired emissions. Studies have shown that nanofuel additive exhibit positive impact when compared to the micrometer sized fuel additive in terms of chemical combustion. Since the nanofuel (i.e., liquid fuel with dispersed nanoscale fuel additives) is still in the pilot phase, the publications that studied the atomization process at elevated ambient conditions for this type of fuel are scarce. Thus, the aim of the research is to study the nanofuel additives on the spray performance at ambient conditions similar to the aviation combustion chamber conditions. The nanoscale fuel additive used in this study is Aluminum Oxide (Al2O3) at two weight concentrations (2&4 wt.%). The spray performance of alternative jet fuel (Gas-to-Liquid, GTL) will be compared with and without the dispersion of nanoscale fuel additive. Furthermore, the GTL fuel spray performance is compared with those of the conventional jet fuel (Jet A-1) and the blend of GTL and Jet A-1 fuels at 50-50% by volume. This project has four major parts: Nanofuel preparation, nanofuel properties measurement, spray experiments, and images analysis. Finally, critical parameters of the spray performance are obtained and analyzed to draw conclusions.
Project ID: UREP22-063-2-023

Institution: Texas A&M University at Qatar

Project Title: Wellbore cleaning prior to completion utilizing surfactant combination

Primary Research Mentor: Dr. Mahmood Amani

Students: Abdul Sattar Alkahala, Abdulkarim Mohamed, Jerahmeel Bautista

Abstract:

In drilling oil and gas wells, rock fragments, cuttings, and other debris are produced. This debris has to be removed for drilling operation to continue as debris can cause erosion to the borehole wall. Hole cleaning is defined as the ability of a circulating drilling fluid to transport rock fragments out of a wellbore (Schlumberger Limited 2017). Many properties such as the carrying capacity, annular velocity, slip velocity, and much more affect hole cleaning. These concepts will be discussed and explained how they affect hole cleaning. The main objective of this research project was to find the most optimal method to clean a wellbore. The solution must be environmentally friendly, cost-efficient, and easy to implement without any safety risks or hazards. Our research was focused on removing cuttings from the well system using a combination of surfactants and caustic soda and investigating their efficiencies as well as any effect they might have on the well-hole formation. Laboratory experiments were conducted with different concentrations of surfactants and caustic soda mixed with drilling water or sea water were used to simulate wellbore cleaning, totaling 32 different mixtures with three steel bars each. The samples were simulated under two conditions: static and dynamic. The cleaning process was rigorously done with a total cleaning of 96 samples. After analyzing the results obtained from the tests conducted, it was found that the solution and condition required for optimum wellbore cleaning included seawater mixed with Safesurf under dynamic conditions.
Project ID: UREP21-047-1-009

Institution: Qatar University

Project Title: Synthesis and size optimization of functionalized silica and magnetic core nanoparticles using chemometrics: Impacts on the removal of pesticides from contaminated water samples.

Primary Research Mentor: Dr. Marwa El-Azazy

Mentors: Dr. Khalid Al-Saad, Dr. Basem Shomar, Dr. Mohamed Alghouti, Dr. Ahmed Abdelatty, Ms. Maitha Al-Sulaiti

Students: Sourour Idoudi, Wiem Fathi, Aya Sorour, Fatma Hassan, Noor Rafik, Maha Al-Mashreky

Abstract:

A smart approach in synthesizing trimethyl-decorated magnetic-core silica nanoparticles (TMS-mcSNPs) was exploited. While the magnetite core was synthesized using the modified Mössbauer method, Stöber method was employed to coat the magnetic particles. Experimental conditions for coating were optimized implementing a Full factorial design (2k - FFD). Four factors were scrutinized; dose of magnetite (Fe3O4), concentrations of tetraethylorthosilicate (TEOS), and ammonia, as well as addition mode. Three responses were measured in terms of the four factors; particle size (PS, measured by scanning electron microscopy (SEM)), particle size distribution (PSD, calculated as the standard deviation ±SD), and magnetic properties (calculated as the attraction weight). The target was to maximize the magnetic properties, minimize the PS (uniform) and PSD (homogenous). Overlaid contour plots as well as composite desirability function (D) were used to consolidate these multiple responses into a single performance characteristic. The IR intensity at 547 and 1057 cm⁻¹ can be used as an indicator for the magnetic properties of the prepared particles. Functionalized mcSNPs were further applied as nanosorbents for trimethyl-magnetic solid phase extraction (MSPE-TMS) of organophosphorus and carbamate pesticides. Instigating this green approach, and under the optimal conditions, particles as small as 14.75±2.90 nm could be synthesized. Moreover, synthesis of propyl methacrylate – functionalized silica nanoparticles (PMA – SNPs) was performed using Stöber method and applying a definitive screening design (DSD). Six factors were considered: concentrations of tetraethyl orthosilicate (TEOS), polymethyl methacrylate (PMA), water, and ammonia, reaction time (RT) and stirring time (ST). Two responses; PS and PSD were measured.
Abstract:

Today Qatar and the rest of the world face an urgent need for renewable energy technologies; solar power—the direct exploitation of the ultimate energy source for nature and our planet—should be one of these. The pursuit of renewable energy sources, with low carbon emissions, such as solar energy is therefore a critical objective for our future. Qatar, with its $1.3 Billion investment in a polycrystalline silicon solar cell production facility is clearly building a global leadership position in the alternative energy marketplace. Many, novel, and efficient materials are developed in recent decades to cover the demands of intensified industrial process, green buildings, and renewable energy utilization, especially the need for new solar technologies. Despite the significant engineering importance of qualification tests, such as thermal stability and prediction-of-service-life for high-temperature and solar technology products, there still lacks certain parameters of great importance that one needs to address for e.g. solar coatings or adequately addressing real conditions (e.g. for photovoltaic modules). Moreover, such data would provide excellent information regarding module design and material flaws, which can eliminate premature failure and degradation. Customized methods are usually adopted to evaluate new materials during the research stage, which are limited to conventional conditions, such as low- to mid-temperature, dark measurements, and short periods. The current problem associated with the methods available is how to make up the scarcity of test procedures for performance evaluation and prediction-of-service-life of high temperature and solar energy materials. In particular procedures that have to be equivalent to long exposure periods and evaluate light induced aging mechanisms. The development of a new set of accelerated aging techniques, based on concentrated light and able to handle small and medium size materials and components is of great interest.
In this study, hydrothermal liquefaction (HTL) technique was chosen to simultaneously recover energy and recycle nutrients from municipal sewage sludge (MSS). A slurry containing 16 (wt.%) dry MSS in 7 mL deionized water was loaded into 10 mL Swagelok reactors. HTL reactions were conducted at 275 - 400 °C temperatures. Biocrude oil, biochar, aqueous phase, and gaseous products were obtained from the HTL process. A maximum biocrude yield of a 44.8 % was obtained at 350 °C; furthermore, HTL experiments were conducted at 350 °C at different reaction holding times (30-120 minutes). Higher heating values (HHV) for biocrude were found to increase from 32.9 to 36.8 MJ/kg with increasing HTL holding time. Maximum energy recovery (ER %) and energy return on investment (EROI) values 59% and 3.5 were obtained at 350 °C and 60-minute. From MSS, 56.3% nitrogen and 29.2% phosphorus partitioned to the HTL aqueous phase. Picochlorum and Chlorella sp. were cultivated in growth medium containing HTL aqueous phase for nutrient recycling. Picochlorum sp. could effectively utilize 95% of total nitrogen from HTL aqueous phase, whereas Chlorella was less effective. From MSS, 4.1 - 14.7% of total nitrogen and 24 - 65% total phosphorus was partitioned to biochar. Metal concentrations in biochar were also lower compared to MSS, therefore, it could be used as a soil conditioner. Overall, HTL was found to be a promising technique, as it could not only recover energy but also recycle nutrients from HTL aqueous phase by selective microalgae cultivation.
Project ID: UREP20-069-2-017

Institution: Qatar University

Project Title: An investigation into Boil-off gas recycling into LNG plant stability

Primary Research Mentor: Dr. Saad Ali Al-Sobhi

Students: Mohamed Shamlooh, Khalid Al-Nuaimi, Abdullah Al-Mulla

Abstract:

The world consumption of natural gas (NG) is at its highest levels, and future forecasts show an increasing demand for this fuel. Boil-off gases (BOG) are associated with energy loss in addition to environmental impacts related to the flaring of such wasted gas stream. Current economic and environmental restrictions are major drivers in the liquefied natural gas (LNG) production industry, to minimize the amounts related to boil-off gas in an attempt to reach the zero-flaring targets. This study explores the effect of recycling the boil-off gases (BOG) into the LNG process and it addresses the benefits on economic, energy, and environmental metrics. The assessment was facilitated via a complete LNG process simulation using ASPEN HYSYS. The simulation results included mass and energy balances, unit sizing, and sensitivity analyses to improve the design of the base configuration. Three scenarios are addressed in this study. The first scenario is recycling BOG before the liquefaction section. The second scenario is the consideration of a separate cooling cycle for the BOG. The third scenario is the application of heat integration within the base plant by utilizing the existing cold stream in the process to condense the produced BOG. An illustrative case study was analyzed for the assessment of various design alternatives to recycle 52,000 tons of BOG annually while accounting for and reconciling the economic, energy, and environmental objectives. The analysis showed promising results such as 2.9 million dollars as potential economic savings and 3504 carbon ton reduction as potential emission reduction annually.
Project ID: UREP21-089-2-039

Institution: Qatar University

Project Title: Shear behavior for fiber reinforced concrete beams with basalt FRP reinforcing bars

Primary Research Mentor: Dr. Wael Alnahhal

Mentor: Eng. Abathar Al-Hamrani

Students: Alhassan Mahmoud, Mohamed Elsayyad, Tamim Mardini

Abstract:

Qatar suffers from a harsh environment in the form of high temperature that prevails almost all year round in addition to severe humidity and coastal conditions. This exposure leads to the rapid deterioration and the reduction of the life span of reinforced concrete (RC) infrastructure. With the developments in materials science, the advanced composites, especially fiber reinforced polymer (FRP) materials are becoming viable alternatives to the traditional construction materials. Having superior durability against corrosion, versatility for easy in-situ applications and enhanced weight-to-strength ratios compared to their counterpart conventional materials, FRPs are promising to be the future of construction materials. This study investigates the shear behavior of 14 basalt fiber reinforced concrete (BFRC) beams reinforced with basalt FRP (BFRP) bars and glass FRP (GFRP) stirrups. The investigated parameters were the volume fractions of basalt macro-fibers (BMF) (0, 0.75, and 1.5% per volume), reinforcement ratio (2.05, 3.11 and 4.53 ρbf where ρbf is the balanced reinforcement ratio), the shear-span-to-depth ratio (a/d) of (2.5 and 3.3) and the stirrup spacing (170 and 250 mm). Test results showed a significant increase in the shear strength as the reinforcement ratio increases. In addition, using lower span to depth ratio resulted in an increase in the shear capacity. It has also revealed that using higher percentages of BMF enhanced the shear capacity, reduced the beam deflection, reduced the cracks width and propagation, and improve the beam ductility before failure. An empirical equation predicting the shear capacity of FRP reinforced concrete beam with a better accuracy was proposed.
Abstract:

The rapid development of the construction sector in the State of Qatar has produced excessive quantities of waste steel slag. More than 400,000 tons of steel slag are being generated annually by Qatar steel companies. One of the potential applications of steel slag includes railway ballast. On the other hand, Qatar has a particular problem in securing natural aggregates, which are being used extensively in railroad and concrete applications. Currently, Qatar is depending on the neighboring countries in securing its need from the natural aggregate. However, the importation of aggregates has become costly to Qatar because of the blockade of Saudi Arabia. Therefore, there is a substantial need of examining the feasibility for utilizing steel slag as railroad ballast, as millions of tons of aggregates will be needed to provide the necessary vertical and lateral supports for the rail. Steel slag are widely used in many countries in road and railway construction. However, there is a lack of the behavior of steel slag as railroad ballast in Qatar. Therefore, this research was needed to investigate the utilization of steel slag as railroad ballast in railway applications. On this basis, physical, chemical, environmental, mechanical and durability tests and life cycle assessment (LCA) analysis of the locally generated steel slag were conducted to evaluate the potential application of steel slag in railway projects. Test results have shown the applicability of steel slag in railway applications, as it meets the specification in QCS 2014 as well as mechanical tests.
Azo dyesyes are used in cosmetics industry. Some azo dyes possess antibiotic or anticancer activities, and they find application in thermodynamic therapy. Azo dyes are an important class of compounds used to color fabrics. Due to their vivid color they are used in textile industries to color fibers. Eugenol is a natural oil isolated from cloves and nutmeg. Other applications e.g. flavoring materials, perfumes, and essential oils. Eugenol is used in dentistry as local anesthetic and antiseptic. Synthesis of functionalized azo dyes conjugated with other molecules comprising useful functional groups can add new features like enhancing activity or functional handling. The presence of allyl group double bond will make it a versatile material to incorporate such moiety in polymerization and related compounds. This will give such material intrinsic color and special properties that allow its use for processing of further transformation. This work focused on conjugating variety of azo dyes to eugenol to enhance their properties and create new applications. We are reporting the synthesis and characterization of Eugenol azo dyes conjugates. In addition, the structural confirmation and application in anion sensing for detection of cyanide and other significant analytes will be tested. The spectroscopic data, colorimetric, UV-Vis titrations as well as binding constants will be reported. We would like to thank QNRF and Qatar University for support. This project was made possible by the supporting grant, UREP award # [UREP21-028-1-006] from the Qatar National Research Fund (member of The Qatar Foundation).
Abstract:

Blue carbon habitats in the central Arabian Gulf play a crucial role in the capture and sequestration of the atmospheric carbon. The mangrove and saltmarshes habitats in the east coast of Qatar covers more than 1000 hectare. Blue carbon reserves in the saltmarshes and mangrove were estimated in the 50 cm below surface sediments, for the first time, in the central Arabian Gulf. The mean TOC in 50 cm cores from the salt marsh (6.8 mg C/gm sediment) was about 25% less than the average carbon concentration in the mangrove sediments. The average percent moisture was also higher in the mangrove than in the salt marshes (26 % and 18% respectively). The highest TOC concentration was reported at the surface while there was general decrease with depth in saltmarshes and mangroves. TOC levels mean concentration was significantly higher in the surface sediments of the mangrove than those in saltmarsh. The TOC also showed exponential decrease with depth. Comparison of the sediment TOC in the Gulf environment seems to be in the lower limit of the world reports. This is probably due to the higher salinity and temperature affecting the stability and the metabolism of TOC in the sediments. Despite the effect of harsh conditions on the carbon accumulation in the Gulf environment, the coastal wetlands remains a vital sink for the atmospheric CO2.
Project ID: UREP 21-033-2-011

Institution: Qatar University

Project Title: Flexible organic photo-thermo-galvanic cells for low power generation

Primary Research Mentor: Dr. Zubair Ahmad

Students: Abdirahman Abdullah Said, Maymouna Mohamad Naji Ezeddin, Tasnim Nizar Ibrahim Al-Qabbani, Manal Abbas Khalif, Kahlid Jama Mohamoud, Razen AL-Qudah

Abstract:
Thermo-electric technology is considered as highly vital due to the world’s constant demand for sustainable, renewable, and eco-friendly solutions for electricity generation. Thermo-electric technology allows utilizing the extra and waste heat from several sources like sunlight, human’s body and factories. However, for market penetration, this technology has to reduce production cost and increase electrical conversion efficiency. In this research work, flexible thermo-galvanic cells using tris(1,10-phenanthroline)cobalt bis(hexafluorophosphate) (Co(phen)3(PF6)2 ) and anadyl 2,9,16,23-tetraphenoxy-29H,31H-phthalocyanine (VOPcPhO) have been fabricated to improve the energy conversion efficiency at a reduced cost. The thermo-electric effect has been investigated under temperature gradients (ΔT) up to 66 °C. A linear change in thermo-electric voltage was obtained as a function of gradient of temperature. The conversion efficiency of the cells primarily depends upon the electrode potential, temperature gradient and concentration of cell’s solution.
Project ID: UREP21-119-2-050

Institution: Qatar University

Project Title: To study the charge transport properties and physical variables affecting the performance of polymer solar cells

Primary Research Mentor: Dr. Zubair Ahmad

Mentor: Mr. Abdullah al ashraf

Students: Chakib Hamadi, Mohammed Abusultan, Mahmoud Masoud

Abstract:

Renewable energy is considered as a revolution in the energy world nowadays. Solar energy is one of the important types of renewable energy, especially in Gulf countries. Organic solar cells (OSCs) are type of solar cells that can produce electricity from the visible light. The aim of this work is to develop the research skills of the undergraduate students to study the solar cells by exploring the way to investigate the properties of the solar cell material, fabrication procedure and effect of the variable condition on their performance. Among the OSCs technologies, donor/acceptor (D/A) blend based bulk heterojunction (BHJ) solar cells have undertaken widespread study. The formation of interpenetrating D/A networks increases the charge transfer and permits the efficient transport of the produced charges to their corresponding electrode. The researchers can enhance the stability of the OSCs by making use of the higher mobility polymers. The operating temperature is a crucial factor for photovoltaic (PV) conversion efficiency of the OSCs. Very less efforts have been made for improvement of an OSCs to give its maximum output. We have fabricated in-house OSC solar cells with Poly[2,6-(4,4-bis-(2-ethylhexyl)-4H-cyclopenta [2,1-b;3,4-b′]dithiophene]-alt-4,7(2,1,3-benzothiadiazole)] (PCPDTBT) and [6,6]-Phenyl-C71-butyric acid methyl ester (PC71BM) using standard spin coating techniques. The fabricated cells were characterized using current-voltage curves. Initial results gave an efficiency ~ 1.75 % at room temperature with a short-circuit current of ~4.2 mA/cm² and open-circuit voltage of 0.57 V. While the best operation temperature was found ~close to 50 °C.
Project ID: UREP21-056-2-021

Institution: Qatar University

Project Title: Storage of Solar Thermal Energy Using Phase Change Materials

Primary Research Mentor: Dr. Rahul Bhosale

Mentor: Dr. Anand Kumar and Prof. Fares AlMomani

Students: Tooba Qureshi, Rokaya Abdelatty, Zaenab Alemadi, Sumayya AbdulRahim, Zaineb Lanouar, Sohila Fouadi

Abstract:

Storage of solar energy via cold or hot thermal storage provides a significant support to the demand and supply of energy in both domestic as well as industrial sector. Improvement in the existing energy system through thermal storage of solar energy is essential since renewable energy sources are irregular in nature and non-renewable energy sources are limited. Thermal energy storage of solar energy has the potential to match the energy demand and supply and it will surely reduce the primary electricity load required for heating and cooling purpose. Hence, long or short-term thermal storage of solar energy is very crucial and important for energy conservation. Solar energy is abundantly available during the daytime for 6 to 8 hours. Hence, conversion and storage of this energy during daytime via thermal energy storage option and utilization in the nighttime for the continuous heating and cooling will reduce the burden on the currently existing energy supply system. In this project, PCMs will be prepared and then characterized. Furthermore, thermal stability of the derived PCMs during thermal cycling related to melting and solidification will be investigated using a high temperature TGA/DSC available in our laboratory. By utilizing the DSC analysis, the melting/freezing temperatures and the latent heat associated with the phase change of PCMs will be determined. The accelerated thermal cycling tests needs to be conducted to study the thermal reliability of prepared PCMs. It is expected that the PCM materials utilized for thermal energy storage should have a life span of more than 5 years and performing 1 cycle (melting and freezing) per day. In summary, this proposed research has an aim of producing compact, efficient, and economical thermal energy storage system for heating and cooling applications. A perfect combination of PCMs with additives will result into excellent thermochemical properties which will further enhance the latent heat storage capacity for low to moderate temperature (-10°C to 250°C).
Social Sciences, Arts and Humanities Participating Projects
Project ID: UREP22-009-5-004

Institution: Qatar University

Project Title: Tamim Al Majed portrait and its role in shaping the relationship between the political leadership and the people (a historical, social and analytical study)

Primary Research Mentor: Prof. Kaltham Ali Al-Ghanim

Mentor: Dr. Sherine El-Menshawy

Students: Zainab Al-Abdulla, Lulwa altamimi, Munira Hezam Al-marri, Bakhita Saeed Al-Qoz, Shaikha Al-Qorh, Bashair Almarri

Abstract:

On June 5, 2017, Saudi Arabia, the United Arab Emirates, Bahrain and Egypt severed diplomatic relations with Qatar and imposed a blockade on them by air, land and sea. All residents of Qatar were affected by this decision. However, the Qatari artist Ahmed bin Majid al-Maaedid has translated his feelings about these events by drawing a portrait of Emir of the State of Qatar Sheikh Tamim bin Hamad Al-Thani. The painting has spread everywhere in the State of Qatar, on the facades of the walls of the buildings, a poster on the windows of the cars, shops, mobile phone covers and inside commercial complexes, companies and state institutions. The murals of Tamim al-Majd were illustrated in most of Qatar's streets, where Qataris and residents sought to stand up and freely write statements that reflected their feelings about the blockade. Therefore, this study aims to: Study and document the emergence of the “Tamim al-Majd” portraiture till now, while linking it to the historical and political events that led to its appearance and spread. Documentation, classification and analysis of the phrases that were written on the murals of Tamim al-Majd as a primary source to study this historical period. This research project will be part of the multidisciplinary research using the historical-social analytical approach in the study. Finally, Portrait “Tamim al-Majd” is worthy to study because it reflects a form of communication between the leadership, the people and the residents at a precise historical moment worthy of documentation from its primary sources for future generations.
Project ID: UREP21-120-5-016

Institution: Qatar University

Project Title: Impact of ICTs and urbanization level on environmental quality in Qatar

Primary Research Mentor: Dr. Charfeddine Lanouar

Students: Asma Al-Maadid, Yosra Hamana, Aisha Al-Thani

Abstract:

The objective of this project was to investigate the impact of Information and Communications Technology (ICT) and Urbanization on Qatar environmental quality. Several reasons motivate this research question. On one hand, since many years, Qatar continue to be ranked at the top of world countries characterized by high levels of CO2 emissions per capita, Ecological Footprint, and other local air pollutants. On the other hand, Qatar has made livability and sustainability at the top priorities of the country, e.g. the Qatar National Vision 2030 pillars are directly or indirectly related to improving environmental and life quality. In addition, in the last two decades Qatar has heavily invested and has rapidly expanded the use of ICTs in the country, e.g. the efforts include Lusail’s “smart city” and Msheireb which both show an incredible ICT infrastructure and serve as templates for sustainable urban living. Empirically, to investigate this relationship between ICTs, urbanization, and environmental degradation, we extend the STIRPART model to include both ICTs and urbanization variables. The proposed model is estimated using cointegration with structural breaks approach over the period 1970-2016. As a proxy for environmental degradation, we used ecological footprint, carbon footprint, and CO2 emissions per capita. Regarding the ICTs variables, we used the internet users per 100 people and mobile cellular subscriptions per 100 people. The percentage of urban population on total population and population density are used as proxies of urbanization. Our empirical results show evidence that ICTs and urbanization have a negative impact on CO2 emissions and carbon footprint but not ecological footprint. This means that ICTs and Urbanization only reduce CO2 emissions and carbon footprint (second order effect) but increase pollution related to water and land (first order-effect). Several energy and environmental policies designed to facilitate transition towards the adoption of a sustainable urban planning approach that is based on the use of ICTs are proposed and discussed.
Abstract:

No doubt, cultural illiteracy suffered by the new Arab generation may be more dangerous to the Arab and Islamic nation than the illiteracy of reading and writing, that requires to focus on and its causes and how to overcome. Cultural illiteracy is no longer an educational issue, it is an issue that has its social, economic and political dimensions, and its implications on the identity of individuals and communities. By identity we mean the qualities that distinguish a nation from other nations to express its cultural identity. There are three core elements that combines Identity: the creed that provides a vision of existence, the language in which it is expressed, and its long-term cultural heritage. [Globalization and the world without identity, Mahmoud Samir Mounir: 146] The emergence of extremism movements among youth, is an alert of dangers our nation would suffer from absence of the culture and identity that supports the moderate thought, and distancing its followers from the causes of extremism. Free reading is at the forefront of the features that are reliable to combat cultural illiteracy, since it contains elements that may not be available in other means that challenge cultural illiteracy, such as being based on an internal sense of importance, the ability to choose the reading material, and not forced on reading that could impact on lose or delusion of the consciousness. Free reading is a tool for advancement to both individuals and communities. The more the new generation is interested in it, the greater and deeper the hopes for this generation. The aim of the research is to detect the level of free reading among Qatar University students and to indicate the relationship between what is being read with the Arabic and Islamic identity, through utilizing analytical descriptive approach. Which will impact on result and recommendations some of which are carried out during the research, such as: (student awareness campaign to encourage reading) to raise the level of reading among Qatar University students; to achieve the knowledge and cultural excellence Qatar seeks in accordance with the Qatar 2030 Vision.
**Project ID:** UREP21-103-5-011

**Institution:** Georgetown University in Qatar

**Project Title:** Breaking down the stereotypes: Experimental approach to discrimination on the basis of nationality and accent

**Primary Research Mentor:** Dr. Mongoljin Batsaikhan

**Mentor:** Solanga Mookerjee

**Students:** Awaatif Al Habsi, Yara Al Kahala, Mohammed Ali Taimur, Yara Abdelmajed

**Abstract:**

The confluence of nationalities and cultures within the Gulf Cooperation Council (GCC) has given rise to a deeply rooted social hierarchy in the region that often leads to discrimination. This is of particular concern for Arabs living in the GCC because Arabic dialects can easily be used to infer nationality. A person’s dialect can consequently make him or her the target of discrimination. We implemented a trust game in a lab-in-field experiment in Qatar to study whether interacting with a counterpart by listening to his accent and knowing his nationality impacted levels of trust. In our control group, subjects played the trust game with no information about their counterpart. In the first treatment, they were informed that their counterpart was Egyptian before they made a decision about how much money to send him. In the second treatment, they heard a recording of their counterpart speaking in a distinct Egyptian dialect before making their decision. Our results show that hearing an actual voice increases trust between strangers, and that increased trust depends on the attributes of the voice. We find no evidence of discrimination against Egyptians in Qatar, as knowledge of nationality did not reduce the amount sent on average.
GU-Q student members of a recently concluded Undergraduate Research Experience Program (UREP) research grant project were invited to take part in a research outcome seminar at the HBKU Student Center. Held under the overarching theme of preserving Qatari identity in a globalized world, the seminar was hosted by the Qatar National Research Fund (QNRF), and featured a selection of some of the most outstanding UREP-funded research projects from across Education City, one of the main research funding programs at the undergraduate level offered by QNRF.

Titled “Jidariya: Every Day is National Day in Qatar,” the faculty-mentored student research project examined the ways in which the iconic jidariya, meaning billboard, of “Tamim Al-Majd” served to solidify the idea of the nation through researching the visual, linguistic and anthropological significance of the billboard, particularly in the wake of the blockade.

The project used visual anthropology methods to gather footage on the billboard’s political and social impact on individuals living in Qatar, including Qatari nationals and expatriates of all ethnicities. The gathered footage was used in the production of a short documentary film that documented their efforts and captured the broadly shared sentiments of unity and solidarity that swept the country in the wake of the land, air, and sea blockade launched by neighboring countries.

The students benefited from the GU-Q mentorship and guidance of Dr. Rogaia Abusharaf, professor of Anthropology, Dr. Suzi Mirgani, managing editor at the Center for International and Regional Studies (CIRS) at GU-Q, and Dr. Yehia A. Mohamed, associate professor of Arabic.

Reflecting on his UREP experience, International Economics senior Mohammed Al-Khulaifi said that the project “is a testament to the unity Qatar witnessed during the blockade from all segments of society under the symbol of Tamim Al-Majd. Not only did this go against the calculations of the blockading countries, but it also boosted our morale and set a precedent for future projects.”
**Project ID:** UREP22-098-5-023

**Institution:** Qatar University

**Project Title:** The relationship Between ICT use (including after-work hour emails) and employees’ work-life balance, stress, and occupational health: An exploratory study in the higher education sector in Qatar

**Primary Research Mentor:** Dr. Shatha M. Obeidat

**Mentor:** Dr. Allam Abu Farha

**Students:** Shaikha Almarri, Amna Al-sheeb, Lamis Khaled, Reem Aljelham, Sara Almarri, Alaa Dalloul

**Abstract:**

This study investigates a comprehensive model for the effect of ICT use on employees’ work life balance, job satisfaction, personal burnout, and intentions to leave. An empirical study was conducted. Particularly, a model was developed and tested using the survey methodology. Our data from 87 employees and faculty members working at Qatar University in Qatar were analyzed using the SEM through PLS software. The study results showed that ICT use have a direct effect on perceived employees’ related outcomes (i.e. Job satisfaction, Work-Life Balance, Personal Burnout, and intention to leave). This study is exploratory in nature; thus, several limitations have been highlighted and discussed. The findings will help managers carefully examine the logic of using ICT. To authors’ knowledge, this is one of the rare studies that examined this topic in a new context, particularly the higher education sector in Qatar.
Project ID: UREP21-092-6-008

Institution: Qatar University

Project Title: Disability Inclusiveness at Qatar University

Primary Research Mentor: Dr. Ahmad Mohammad Ahmad

Mentor: Lizmol Mathews

Students: Shimaa Abdelkerim, Nancy Makhoul, Maryam Al Nuaimi

Abstract:

Accessibility for disabled people in education or other public spaces is human right rather than a luxury. There are growing opportunities for students with disability to study in educational institutions. However, accessibility for disabled students could pose a challenge towards ease of facility use in educational set-ups. There is a need to assess student facilities in educational institutions to verify accessibility and inclusiveness. There are several detailed assessment tools that focus on several aspects of accessibility criteria. However, a simplified and quicker assessment framework is required that is objective rather than subjective to the facility users. The study focuses on physical disability and aims to develop a simplified assessment framework for education buildings in higher institutions, it focuses on specific Key Performance Indicators (KPIs) across three criteria items. These are internal (indoor), external (outdoor) and connecting features. The methodology included comparative (disabled and non-disabled) survey at Qatar University campus (female section). The study adopted a multi-criteria tool for the assessment. Due to the subjective nature of the criteria, there was a need to develop criterion that is objective and meets educational standards. A workshop with eight industry experts was conducted to develop simple assessment criteria for educational buildings. The findings of this paper can be used to assess educational buildings within higher institutions. The assessment tool can provide ratings to buildings that encourage awareness and availability of facility support towards inclusiveness of the disabled within an education set-up.
Project ID: UREP21-095-5-009

Institution: Qatar University

Project Title: Arabic language issues: A study of newspaper layout styles and linguistic content (The culture pages in Qatari newspaper: A case study)

Primary Research Mentor: Dr. Elsayed Abdelwahed Elkilany

Mentor: Dr. Radwan Menisy Abdalla Gaballa

Students: Elmoutasem Moussa, Kaltham Alfadala, Mohammed AlMarri, Jaber Ahmad Al Yafei, Khadija wahba, Hana Aladhba

Abstract:

This is a research project funded by Qatar Foundation within the Undergraduate Research Experience Program (UREP). It is an interdisciplinary research between two disciplines: Journalism and Arabic language. It aimed to analyze the journalistic treatment of topics related to Arabic Language in three of the Qatari newspapers namely ‘Al-arab’, ‘Al-raya’ and ‘Al-sharq’ during 2017. The research team from Qatar University (QU) consisted of two researchers and two groups of students; one from the Mass Communication Department, and the other from the Arabic Language Department. The research employed the descriptive analytical approach to analyze the published contents that relate to the Arabic Language. These contents covered ten types of topics (Poetry, Rhetoric, Story, Novel, Popular literature, Narration, Translations, Drama, Thoughts and others). The research explored the editorial and layout techniques employed with such content and examined how this helped to emphasize the content. This project achieved four important outcomes. 1) The statistical analysis of the topics related to Arabic language published in the three Qatari newspapers during 2017 with regard to applied editorial and layout techniques. 2) Training six students from two disciplines on different research tools and gaining experience in interdisciplinary research. 3) Sharing the study results in three different scientific events including: a) the annual research forum & exhibition 2019 at QU, b) the National Identity in Qatar 2019 conference and 3) the Scientific Research Day of the College of Arts and Sciences, QU. 4) Publicizing the project through different media channels. 5) Proposing three researches based on the collected and classified data.
Project ID: UREP21-019-5-001

Institution: Qatar University

Project Title: University experiences of adults with disabilities: A recipe for success

Primary Research Mentor: Dr. Elsayed Elshabrawi Ahmed Hassanein

Students: Shahd Abubaker Elamin, Marwa Magdy Elkhouly

Abstract:

The college experiences of students with disabilities (SWD) is full of challenges. It is essential to explore what aids and hinders students’ success/satisfaction of their education journey. This study reports the findings of disabled student’s experiences and views of higher education at Qatar University (QU). The study aims to investigate and describe the experience of higher education from the perspective of SWD at the university level, presenting the usage of services/accommodations utilized and their barriers to usage. The sample consisted of (37) students enrolled in QU’s Inclusion and Special Needs Support Center. A mixed methodology was used: surveys were collected to reflect the usage of services, their barriers, and students’ Quality of Life; while qualitative data (interviews) and extracted themes were conducted for more in-depth analysis. Results of the survey showed that most students were Arts and Sciences female students with visual impairments. The most utilized services by students were those exam-related (e.g. extending times, separate rooms, and reading/writing assistance). Major barriers included two categories: negative attitudes of the university community, and availability of services. The Quality of Life Questionnaire showed average to higher average levels for students. Interviews concluded that students were satisfied with facilities provided but faced some obstacles that might hinder achieving their current and future goals. In conclusion, there are many services provided by the university to SWD. However, more efforts should be put into communicating what the center provides and what the students need- to achieve the highest benefit to the students.
Project ID: UREP 20-121-5-027

Institution: Northwestern University in Qatar

Project Title: Assessing and improving migrant workers access to and utilization of health information and resources

Primary Research Mentor: Dr. Susan Dun

Mentor: Amal Zeyad Ali

Students: Thani bin Hamad AlThani, Muhammad Muneeb Ur Rehman, Muhammad Humam, Sana Zehra Hussain, Bothayna Talal Al Mohammadi

Abstract:

The goal of this study was to understand migrant workers' beliefs about their health, how much they value it and the barriers they faced towards being healthy as well as their physical and leisure time activities in Qatar. The literature indicated that migrant workers are vulnerable populations and may experience difficulty in accessing basic services such as healthcare, have a high risk of injury and often avoid using healthcare facilities. Through semi-structured interviews which were translated into seven languages due to low literacy levels of the participants and diverse linguistic backgrounds, a sample of (n=96) of workers were asked a series of questions relating to their health, physical activity/sport participation, fan/spectator behavior. The results show that a majority, 62.5% (n = 60), of the participants reported participating in a variety of types of physical activity while in Qatar. Despite their participation, participants indicated that they would like to engage in more physical activity. However, lack of time was cited by almost all of them as a barrier to increased activity, followed by money, facilities and transportation in that order. Many of our participants have faced a variety of issues when attempting to utilize health resources. 87%, of the participants have Hamad Medical Corporation cards but about half of them do not use these cards, and instead use their own money to pay for the medical expenses. Participants are also less likely to go to a medical professional if their illness is acute.
Biomedical & Health Participating Projects
Biomedical & Health Participating Projects

Project ID: UREP21-050-3-010

Institution: Qatar University

Project Title: The effects of cell mechanical property alterations on the survival of lung epithelial cells under shear stress

Primary Research Mentor: Dr. Huseyin Yalcin

Mentor: Dr. Ala-Eddin Al Moustafa

Students: Mahmoud Abdelrasool, Mohamed Ahmed, Maha Hussein, Salma Salman

Abstract:

Acute Respiratory Distress Syndrome (ARDS) is a serious condition manifested by the accumulation of edema fluid inside the lung due to inflammation. ARDS patients cannot inflate their lungs and therefore must be mechanically ventilated. However, stresses associated with enforced displacement of edema liquid via mechanical ventilation can damage delicate epithelium lining the walls of the small airways and alveoli. A solution for this case is proposed through the alteration of the cells' mechanical via steroidal drugs to decrease cell's mortality upon mechanical ventilation. In our work, cultured rat L2 alveolar EPCs were exposed to airway reopening conditions using a parallel plate perfusion chamber. Cells were pre-incubated with two selective anti-inflammatory steroids Dexamethasone (DEX), and Trans-Dehydroandrosterone (DHEA) that are expected to alter cell cytoskeleton hence mechanical properties. Cellular injury and cytoskeleton reorganization were assessed via fluorescent microscopy, whereas Atomic Force Microscopy was used to study cell mechanics. According to our results, pre-exposure of either DEX or DHEAS to cultured cells significantly decreased cellular injuries associated with mechanical ventilation as cell mechanics were significantly altered for both DEX and DHEAS exposed cells, with increased stiffness for DHEAS and decreased stiffness for DEX treated cells, suggesting altering cell mechanical properties via cytoskeleton reorganizations have potential benefits for cell survival against VILI. These results provide evidence for potential beneficial effects of anti-inflammatory agents DEX or DHEAS against for ARDS treatment. Results from this study are critical for VILI and be readily applicable to future clinical studies for VILI.
**Biomedical & Health Participating Projects**

**Project ID:** UREP21-060-1-012  
**Institution:** Qatar University  
**Project Title:** In-vitro Assessment of Qatari halophytes for antifungal activities  
**Primary Research Mentor:** Dr. Mohammed Abu-Dieyeh  
**Mentor:** Dr. Fatima Al-Naemi  
**Students:** Oumaima Mabrouk, Israa khatib, Amani Al-Muree, Eiman Al-Hajri, Jawahir Alshammeri, Lozan Riyad

**Abstract:**

Despite emphasis on research of synthetic antimicrobial drugs, a certain interest in medicinal plants has been re-born, in part because many synthetic drugs are potentially toxic and are not free of side effects. Therefore, searching for new antimicrobial substances from natural sources and evaluating their efficacy on microorganisms have been encouraged. Ten (10) Halophytic plants were sampled from Qatari environment, dried, grindend and aqueous and ethanolic extracts were prepared. The antifungal activities of the extracts were tested against a wide spectrum of fungal species. 10 mg/ml of ethanolic extracts of more than one plant species was enough to completely prevent the growth of certain fungi and exhibited about 70% growth inhibition on others. The main finding of this research is the presence of antifungal activities in all studied species. An interesting finding is that the ethanolic extract of almost all plants is more influential against fungal growth compared to aqueous extracts. More over in most studied plants, ethanolic root extract exerted greater inhibition on fungal growth than ethanolic leaf extract. Qatari halophytes are promising for developing natural fungicides that can be utilized in different therapeutic and pharmaceutical products like medicine, cosmetics, toothpastes, creams and lotions to suppress or prevent fungal infection. Based on our findings, we hypothesized that the antifungal compounds of halophytic plants is not mainly dissolved in water and retained in the roots instead of aboveground foliage to avoid being lost by desiccation in an arid environment. Further research is needed to test the above-mentioned hypothesis.
Project ID: UREP21-080-1-015

Institution: Qatar University

Project Title: Effect of crude extract from Qatari medicinal plants on breast cancer cell proliferation

Primary Research Mentor: Dr. Haissam Abou-Saleh

Mentor: Dr. Allal Ouhtit

Students: Lubna Zarif, Afnan Barhoush, Amira El-Shayeb

Abstract:

Cancer is an increasing epidemic worldwide. It was estimated that around 8.2 million individuals died in 2012 due to cancer. Breast cancer (BC) is the most common type of cancer affecting women worldwide and has the second highest cancer mortality rate. The rate of breast cancer among the Qatari residents and citizens is 39.41%, with a survival rate of 98% during early stages of diagnosis and 58% in late stages. In 2015, 19% of cancer related death was due to breast cancer. Conventional treatments of breast cancer are hindered by systemic side effects and decreased quality of life for patients during the course of the treatment. Therefore, there has been a shift in interest in using complementary and alternative medicine (CAM). This study was conducted to identify the anti-proliferative effects of crude extract isolated from Qatari medicinal plants, Plantago ciliata and Convolvulus pilosellifolius on breast cancer cells MDA-MB-231. The crude extracts from both plants were prepared using 3 solvents: methanol, acetone, and water. These extracts were then tested on MDA-MB-231 BC cells, and a dose-response curve was obtained. Significant inhibition was obtained with a concentration of 60 mg/ml for water and 20 mg/ml for both methanol and acetone. In particular, water extract from both plants showed the most potent effect on the cells. The long-term objective of this study is to build a foundation for further research aiming towards chemoprevention approach, to recognize target that can guide in anticancer therapeutic strategy.
Project ID: UREP21-011-3-005

Institution: Qatar University

Project Title: Prevention and screening recommendations in type 2 diabetes: Review and critical appraisal of clinical practice guidelines

Primary Research Mentor: Dr. Bridget Paravattil Javed

Mentor: Mohammad Diab, Kyle John Wilby

Students: Nancy Zaghloul, Sawsan AlMukdad, Huda Barhoosh, Mayar Ashour, Iman Abdelrahman, Balqis Daoudi

Abstract:

Background
The management of type 2 diabetes (T2DM) is guided by clinical practice guidelines (CPGs). Recommendations contained within CPGs should be based on the best available scientific evidence. However, CPGs are not always subjected to rigorous evaluation prior to dissemination and lack information regarding how recommendations can be translated into key performance indicators (KPIs) for international contexts.

Objectives
The objectives were to identify and appraise guidelines reporting recommendations for screening and prevention of T2DM and to translate appraised guideline recommendations into KPIs.

Methods
This was a multi-phase project in which investigators conducted a systemic review of published diabetes screening and prevention guidelines, critically appraised the identified guidelines using the AGREE II tool, and conducted two focus groups to determine key diabetes performance indicators relevant for practice in Qatar.

Results
The highest scored domain across all appraised guidelines was ‘clarity of presentation’ while the lowest scored domain was ‘rigor of development’. Results were similar for prevention and screening recommendations. All appraised guidelines were recommended for use or recommended after incorporation of specific modifications. According to the academic clinicians, key performance indicators focusing on interventions to prevent T2DM were more important than performance indicators related to screening which contrasted with healthcare providers who ranked screening indicators above prevention indicators.

Conclusion
Diabetes Canada Guideline (DCG) was identified as the highest quality guideline based on the AGREE II instrument. Accordingly, healthcare providers and academic clinicians agreed that many of the key recommendations from the DCG are relevant for practice in Qatar.
Project ID: UREP21-059-1-011

Institution: Weill Cornell Medicine Qatar

Project Title: Role of the gut microbiota in autism spectrum disorders and inflammatory bowel diseases.

Primary Research Mentor: Ghizlane Bendriss, PhD

Mentor: Dalia Zacharia, PhD; Noha Yousri, PhD

Students: Dana El Ali, Ameena Shafiq, Nada Mhaimeed, Mohammed Salameh, Zain Burney, Krishnadev Pillai

Abstract:

Studies exploring the ‘Gut-Brain axis’ suggest that gut dysbiosis could be involved in pathogenesis of diseases. This pilot study was composed of two study arms: 1/ Assessing and raising awareness among healthcare professionals, scientists and public on the role of gut microbes in health and diseases. 2/ Profiling and comparing the gut microbial composition in a cohort of 55 volunteer patients with neuropsychiatric disorders (ASD/ADHD), gastrointestinal disorders (IBD/IBS) or healthy individuals (controls).

A total of 157 participants were recruited for the two legs of the study via social media, email, and seminars to answer a questionnaire; 55 of them provided a stool sample for analysis. DNAs were extracted using the Qiagen stool-minikit; samples were sent for 16s rDNA as well as ITS sequencing. A linear regression analysis was done using the R package for correlation analyses. We identified a list of taxonomic groups and ratios that are associated with the ASD/ADHD or IBD/IBS groups (p-value < 0.05). We identified unique bacterial and fungal operational taxonomic units (OTUs) to each group, which could constitute good candidates for new biomarkers. The abundance of species in the ASD/ADHD group and the IBD/IBS group are significantly decreased which confirms a decreased biodiversity shift. Awareness and readiness of healthcare professionals and general public on the importance of gut microbes is significant enough in Qatar for considering the launching of a clinical trial involving dietary modulation of the gut microbiota in these two groups of conditions. A literature review was published for our awareness campaign.
Biomedical & Health Participating Projects

**Project ID:** UREP22-109-1-016

**Institution:** Qatar University

**Project Title:** In-vitro plant tissue culture: An Alternative source of bioactive molecules in the rare medicinal plants in Qatar

**Primary Research Mentor:** Dr. Talaat Ahmed

**Mentor:** Dr. Amjad Shraim and Dr. Mohammed Alsafran

**Students:** Aziza Al-Aidaroos, Ghada Deeb, Marwa Elbasha, Aisha Alhelabi, Lina Layth, Aya Ali

**Abstract:**

An efficient in-vitro culture system to induce callus from three desert plant species (Convolvulus pilosellifolius Desr, Prosopis cineraria and Glossonema varians) was established to test their abilities to accumulate bioactive molecules compared with intact plant growing in nature. Results indicated that in Glossonema varians the MS media supplemented with 0.5 mg/L, 1.0 mg/L and 2.0 mg/L of 2,4-D with NAA combination were the best medium for callus induction from cotyledons and root tissues. In, Convolvulus pilosellifolius Desr the highest callus induction (100%) was obtained from leaves on MS media with 0.5 mg/L (2, 4-D + BAP) combination. Moreover, Prosopis cineraria, results showed that the maximum callus induction was under 1 mg/L of 2, 4-D. Qualitative analysis by HPLC showed a significant difference between Glossonema varians callus and leaves extracts. It was clear from the number of peaks that the number of compounds in each mixture were different. Callus extract showed 28 peaks, while leaves extract showed 28 peaks that are different in concentrations and types. Regarding Convolvulus pilosellifolius Desr, the callus and leaves extracts gave different extraction yield and intensity. In case of Prosopis cineraria, there were significant differences in peaks intensities of both callus and leaves, which propose the variation in the amount of metabolites for each sample. In conclusion, to avoid the need of relying on wild plants and save our environment, plant tissue culture technique could be an excellent alternative for production of the natural bioactive compounds, as it does not depend on the geographical environments.
Biomineralization plays a key role in modifying geological properties of soil and evaporitic environments (i.e sabkhas), thereby stabilizing soil against wind erosion, especially in area characterized with harsh weather and soil; i.e. Arabic Gulf region. In Sabkhas, biomineralizing bacteria are involved in minerals formation, with a special focus on dolomite, the reservoir of Gulf oil and gas. In this work, we showed that among Qatari soil microorganisms, ureolytic bacteria are capable of modifying soil characteristics and thus, inducing biomineralisation. Occurrence and diversity of ureolytic bacteria in Qatari soils were investigated, especially to study their acquired potential to adapt to harsh conditions exhibiting ureolytic activity. Soil samples were collected from various locations in Qatar and used to isolate the indigenous ureolytic bacteria. MALDI-TOF MS was used for identification and differentiation of isolated bacteria. Therefore, we demonstrated biodiversity and recorded the indigenous ureolytic bacteria in Qatari soil that have the ability to perform biomineralization and thus can be helpful to stimulated, to enhance soil stabilization, and for other local applications as well, since they are adapted to soil and weather conditions. A collection of indigenous bacteria from Qatari soils, identified and categorized based on their protein profiles, responsible of soil stabilization by Microbially Induced Carbonate Precipitation (MICP) and mineral formation inducing bacteria was constructed and applied at local harsh weather and soils. We demonstrated for the first time in the field conditions, that Qatari bacteria can stabilize soil by formation of carbonate minerals, which enhanced the strength and stability of the soil.
Abstract:

Introduction and Objectives:
Pulmonary Arterial Hypertension (PAH) is an aggressive disease with poor prognosis, no available cure, and low survival rates. Several classes of vasodilator drugs are commonly used as treatment strategies for PAH including sildenafil (Sil), a phosphodiesterase type 5-inhibitor. Despite their clinical benefits, these therapies are hindered by their side effects. This limitation could be overcome by controlled drug release using a nanomedicine approach. In this study, we evaluated the potential use of a highly porous nano-sized preparation of iron-based metal-organic framework (MOF) commonly referred to as nanoMIL-89. We examined the cellular uptake of MIL-89 by PAH relevant cells using light, confocal and transmission electron microscopes. We assessed the viability, cytotoxicity and anti-inflammatory effects of MIL-89 and Sil-nanoMIL-89 conjugate on PAH relevant cells in vitro using AlamarBlue™, LDH and cytokine release. Furthermore, the toxicity of nanoMIL-89 was assessed in vivo using zebrafish embryos.

Results:
Microscopic images showed a higher cellular uptake of MIL-89 and transfer to daughter cells in PAH relevant cells. Although nanoMIL-89 affect the cell viability at high concentrations; it does not cause any significant cytotoxicity. Moreover, nanoMIL-89 and Sil-nanoMIL-89 were shown to have anti-inflammatory effects as they reduce the cytokine release by PAH relevant cells. The in vivo study showed that high concentrations of nanoMIL-89 delay zebrafish embryos hatching and cause heart deformation, which is currently under investigation using cardiotoxicity markers.

Conclusion:
nanoMIL-89 is a promising formulation prototype for drug delivery. This study indicates that nanoMIL-89 are safe nanoparticles with anti-inflammatory effects. Further investigations, including diseased models and drug-loaded formulations are required.
Project ID: UREP22-143-3-024

Institution: Qatar University

Project Title: Anti-breast cancer effect of selective qatari medicinal plant crude extracts

Primary Research Mentor: Dr. MD Mizanur Rahman

Students: Arshiya Sayed Anwar Husaini, Ruqaia Shoheeduzzaman

Abstract:

Breast cancer is the most commonly diagnosed cancer among women around the world, including Qatar. Although numerous treatments exist, these conventional treatments are often ineffective over time, are toxic to normal cells, and have severe side effects. Therefore, Complementary Alternative Medicines (CAM) are gaining attention due to their safety and effectiveness. This study aims to determine the anti-breast cancer effect of some Qatari medicinal plants. We tested the alcoholic crude-extract of Nigella sativa (NS) seeds, Senna italica, Glossonema edule, and Convolvulus Glomeratus Choisey leaves against breast cancer cell survival, proliferation, and migration. Our data revealed that crude extract of Glossonema edule did not have any significant effect on breast cancer cell killing. However, crude extract of Senna italica and Nigella sativa had minimal breast cancer cell killing effect. Interestingly, crude extract of Convolvulus Glomeratus Choisey showed strong breast cancer killing effect. Surprisingly, scratch wound migration assay showed that all the crude extracts tested had the capacity to inhibit breast cancer cell migration. We further analyzed the molecular mechanisms of anti-breast cancer effect of Convolvulus Glomeratus Choisey as it showed the best effect. Pro-apoptotic effect of Convolvulus Glomeratus Choisey crude extract was confirmed by fluorescence activated cell sorting (FACS) using Annexin V/PI staining, and by western blot for pro-apoptotic marker caspase 3. Further fractionation studies are required to determine the active compounds of these medicinal herbs, which exert its anti-breast cancer effect. After successful animal and human studies, this Qatari native plant could be a promising natural remedy against breast cancer.
Abstract:

Adults spend about one third of their lives sleeping. Sleep has an important role in homeostatic mechanisms. Several studies have shown that sleep duration has declined over the years at the same time as obesity prevalence has increased. Previous studies have also shown an association between sleep duration and obesity, hypertension, and reduced cognitive function. The aim of this study was to examine the association between sleep duration and obesity and cognitive function in university students. We recruited 161 students whose sleep was assessed using actigraphy (wrist-worn accelerometry). Cognition was tested using the CANTAB battery of tests. We analysed 95 actigraphs. Further actigraphy and CANTAB analysis are ongoing. The data collected were analysed using t-tests, Fisher’s exact test, and univariate and multivariate regression. We observed that sleep duration was negatively associated with waist circumference and systolic (but not diastolic) blood pressure. The associations observed confirm sleep’s role in body weight and blood pressure regulation. Further analyses are underway to confirm these findings as well as examining the impact of sleep on cognition. If confirmed, improving sleep duration may be an important approach for prevention and treatment of obesity and cardiometabolic disease.
Information & Communication Technology
Participating Projects
Project ID: UREP 21-062-2-022

Institution: Qatar University

Project Title: Development of independently controlled four wheel drive system for autonomous electric vehicle

Primary Research Mentor: Prof. Atif Iqbal

Mentor: Dr. Mohammed Al-Hitmi

Students: Ajad Hossain, Jasem Zaman, Nehaja Joglekar, Aya Amer, Mohammed Al-Mahfooz

Abstract:

Electric Vehicles have always been considered a better transport system compared to Internal combustion engine, because of simple system, low rotating component count, high reliability, better and flexible torque control, faster and quicker acceleration and environmental friendly nature. The present global circumstances have compelled faster development in the area of EVs. EVs require motor drives, energy storage and embedded controllers. Continuous research effort is being made in all these areas of EVs. High efficient motor drive system have been developed, energy dense storage is coming up and fast embedded controllers have been built and available. Growing environmental concerns and govt. regulations on reducing carbon footprint are the driving forces behind the development of alternative clean transportation system. Environmental factors coupled with technological breakthrough are driving growth in EVs. The future of transport will be mainly Electric vehicles. This project has developed a semiautonomous electric vehicle with four Brushless DC motor with in-wheel arrangement and controlled synchronously (for straight-line track) and control independently with different positions and speeds for non-straight line locus. Master and Salve control strategy was adopted using Microcontroller. Speed, torque and position control was done using different techniques such as hysteresis and PWM control methods etc. Prototype was successfully developed and tested in the laboratory at Qatar University. The four wheels of the motor can be controlled independently and hence this electric vehicle can be proved useful in difficult terrain such as desert, muddy land and in defense applications. A user-friendly software was prepared using Lab View to control the vehicle as per the desire of the operator.
Project ID: UREP 21-136-2-055

Institution: Hamad Bin Khalifa University

Project Title: Line-tracking smart car with edge based path recognition and dual-PID control strategy

Primary Research Mentor: Dr Bo Wang

Mentor: Dr. Yin Yang

Students: Augusto Lucas, Mohamed Amara, Omar Elshal, Abdulrahman El-Kelani

Abstract:

“This project is to design a smart autonomous line tracking car for speed racing. The technology adopted in this project involves several domain knowledge, including physics, electronics, computer science and mechanical engineering. Currently, the team tested both the 1st generation of the smart car and the 2nd more advanced prototype using MCUs. All the devices are measured in the lab and the whole smart car system is working. Fundamental device operation principle as well as algorithms to control the smart car are investigated and/or developed in this project, especially the processing of raw image of a camera to extract the black lines of the track. As automatic vehicles will be the future, we will explore more skills based on this project and prepare for the future.”
Project ID: UREP20-019-1-006

Institution: Qatar University

Project Title: Supporting parent-mediated early intervention: A tablet-based application to improve receptive language for autistic children in Qatar

Primary Research Mentor: Dr. Saleh Al-Hazbi

Mentor: Eng. Abdulahi Mohamed

Students: Amr Aboeleneen, Ayman Al-Kababji, Muhammad Khadr

Abstract: Autism Spectrum Disorder (ASD) is a pervasive neurodevelopmental disorder associated with difficulties in social communication, as well as limited, repetitive patterns of behaviors, and interests. The cause of ASD is still unknown, and there is no medical cure to this moment. According to The Centers for Disease Control and Prevention in the US in 2014, they estimated that 1 in every 68 children in the US is suffering from autism, which represents an increase of 22% approximately since their last statistics two years ago. This growing number of children with autism represents a challenge for health care systems to provide enough support and therapies for families that have autistic children. Not only that, but it also places a heavy financial burden on such families where the current therapy programs cost a huge amount of money. However, a range of traditional special education and therapeutic behavioral programs proved their efficacy in improving autistic children’s skills and in reducing inappropriate behaviors. Moreover, due to the fast advancement in computer technology, there has been growing interest among researchers and educators to utilize such technology in therapeutic interventions. In this context, Faheem, a tablet-based application, is proposed to support parent-mediated early intervention that will help in improving the receptive language for Arabic-speaking autistic children in Qatar and around the world. It tries to establish an incentive for the autistic children to enjoy therapeutic learning through the smartphones that they feel comfortable with.
Project ID: UREP22-003-2-001

Institution: Qatar University

Project Title: Human circulatory system simulation for extracorporeal membrane oxygenation therapy

Primary Research Mentor: Dr. Faycal Bensaali

Mentor: Prof. Guillaume Alinier, Prof. Abbes Amira

Students: Abdulrhman Mahmoud, Elshaikh Mohamed, Omrane Abdallah, Aiman Abducarim

Abstract:

Extracorporeal Membrane Oxygenation (ECMO) is a lifesaving procedure developed for the care of patients with short-term respiratory and/or cardiac issues. ECMO patients must be monitored twenty-four hours a day by an ECMO-trained multidisciplinary team. The trained healthcare professional needs to watch over fifty variables and rapidly intervene to assess and resolve any given emergency. Hence, hands-on training is very important for ECMO professionals to develop rapid and correct actions upon different scenarios. Simulation-based training (SBT) offers ECMO practitioners an opportunity to develop the skills needed for the initiation of the ECMO procedure and the care of ECMO patients without exposing patients to undue risks. For ECMO to work, cannulation is required to reroute the blood flow to the machine rather than the lung and/or heart. Cannulation is the insertion of a cannula through the blood vessels. In collaboration with Hamad Medical Corporation (HMC), the main healthcare provider in Qatar, the team designed and implemented to develop an effective, economical realistic, user-friendly, low-cost, and a multi-functional high-fidelity cannulation simulation mannequin. The novel features of the proposed cannulation simulator set it apart from currently available commercial solutions in terms of realism, cost, and user friendliness. As an overarching goal, it is aimed to utilize this system as a cornerstone in establishing a regional training center that will reshape ECMO education locally, and internationally.
Project ID: UREP22-062-2-022

Institution: Qatar University

Project Title: Driver distraction among young drivers

Primary Research Mentor: Dr. Khaled Shaaban

Students: Majed Thanean Alanazi, Moaz Mohamed Karamalla, Yousef Salman Yousef Salman Eltettr

Abstract:

Distracted driving is considered one of the key reasons for traffic crashes in modern societies, especially among young drivers. The objectives of this study are to understand the reasons the young drivers get distracted while driving, and investigating the reaction of young drivers towards different enforcement policies and campaign strategies. The data were collected through administered questionnaires. Most of the participants reported using their cell phone all the time or occasionally while driving. Other significantly cited activities included listening to audio devices, talking with passengers, eating, drinking, and smoking. Using the cell phone was listed as the most distracting activity followed by mental activities and adjusting audio devices inside the vehicle. Suggesting viable solutions that can be adopted to improve the young drivers’ behavior include conducting road safety campaigns to educate young drivers about the risk associated with distracting driving, and developing training programs that involve the young drivers related to distracted driving. They also include modifying roadway designs (adding speed bumps and adopting a road diet design, etc.), providing more operational restrictions (speed radars and more police patrols) to reduce vehicles' speed, toughening punishments and fines, and improving the automated monitoring and reporting systems. As far as post project plans, the project ended but the research team did not stop working on it. Multiple social networking pages (Instagram, YouTube, Twitter, and Facebook) were developed in December 2018 and still operating until today with over 150 posts and over 250 followers. These pages were promoted using brochures and local campaigns.
Project ID: UREP22-025-2-010

Institution: Qatar University

Project Title: Securing biometrics using Intel's SGX enclave technology

Primary Research Mentor: Dr. Qutaibah Malluhi

Students: Asma Al-Othni, Aisha Al-Mohannadi, Mzna Al-Saaq

Abstract:

This project develops a secure biometric identification system that offers a balance between security and convenience. To ensure security of the system, the project employs the new Intel SGX technology that will increase protection of biometric data against physical or remote attacks. The project involves performing functions like the biometric matching and feature extraction functions inside the SGX in such a way that shields the biometric data and image extractions from attackers. The project can be deployed in two different scenarios. In the first scenario, the biometric scanner has the SGX technology inside it and it performs the sensitive functions as well as the remote authentication. Thus, it creates a safer system since there is no communication outside the device. However, this scenario is only suitable for managing access to a single resource. The second scenario is suitable for accessing multiple resources because the biometric scanner only scans the image, encrypts it, and sends it to the cloud server. The cloud server has SGX technology and the database of biometrics. Thus, the cloud server is responsible of performing the sensitive functions for remote authentication. In our solution, the used biometric pattern-matching algorithm has gone through multiple tests and evaluations in order to determine the accuracy by using two parameters namely, the False Acceptance Rate (FAR) and False Rejection Rate (FRR). The results that were reported for the parameters FAR and FRR were 16% and 15% respectively, with a system accuracy of 84.5%. The accuracy can be further enhanced by improving the matching algorithm.