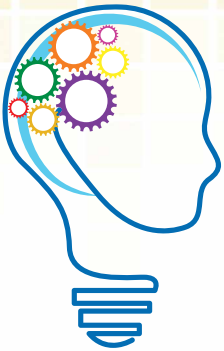
Special Feature



Student's Innovation Lab

Student's Innovation Lab is an environmental innovation pavilion for students providing them with an opportunity to showcase their projects to experts and policy makers from the waste management field.

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Wastewater Treatment Plants (WWTPs)

Hajar Al-Balushi
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Wastewater treatment plants (WWTPs) in most of the developing countries have only primary sedimentation treatments, while in developed countries, many plants are applying strategies to reduce the amount of waste activated sludge. The amount of sludge generated is dependent on the size of the WWTP and the treatment option used. Previous to any land disposal, the sludge must be stabilized. Land application of biosolids is the choice which is most compatible with sustainable development principles, as long as the limitations set by local regulations are complied with, in order to avoid any harm to soils.

Municipal solid wastes (MSW) are another type of residue that is affronting more restrictive legislation with respect to landfill disposal of the biodegradable fraction. Treatment of this organic fraction is currently carried out through aerobic composting or anaerobic digestion. These technologies can maximize recycling and recovery of waste components.

Due to the CO2 emissions associated with the aerobic treatments and the restrictions that will probably apply to these emissions in the near future, anaerobic digestion is proposed in this project as the treatment alternative that is most in line with sustainable development. However; one of the problems most frequently found during the biological processing of the organic fraction of Municipal Solid Waste (MSW) is the high Carbon to Nitrogen Ratio (C: N) ratio of these residues.

To circumvent this problem, several authors have proposed co-digestion of the organic fraction of MSW, either with sewage sludge from Wastewater Treatment Plants (WWTPs) or residues from livestock farms.

The benefits of this project include: dilution of potentially toxic compounds, improved balance of nutrients, synergistic effects of microorganisms, increased load of biodegradable organic matter and better biogas yield.

The Mechanism of Obtaining a Reliable Methane Potential

Mariya Al-Omairi
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The mechanism of obtaining a reliable estimate of methane potential using an anaerobic bio-digester system is of high importance. The universality of the procedure undertaken to determine the methane production using an anaerobic system is essential to ensure inter-laboratory repeatability and Abstract: accuracy of the results. Usually, the Anaerobic sludge from Wastewater treatment plants is used as inoculum for seeding in Anaerobic Digestion (AD). It is challenging to obtain anaerobic sludge with the microbial community for startup of the bioreactor.

This paper study the specific contribution of an innovative microbial community mixing using both the Horse Dung slurry inocula along with primary sludge. The idea is to explore new avenues in cultivating a mixing sets of inoculums and their impact on the biogas production once mixed with kitchen waste.

Municipal Solid Waste Disposed

Wajeeha Anum Qazi
Middle East College of Technology

Municipal solid waste disposed in landfill sites decomposes under anaerobic conditions and produces so-called landfill-gas, which contains 30%–40% of carbon dioxide (CO2) and 50%–60% of methane (CH4). Methane has the potential of causing global warming 25 times more than CO2. Therefore, migration of landfill-gas from landfills to the surrounding environment can potentially affect human life and environment.

Thus, this research aims to determine municipal solid waste generation in Oman over the years 1971–2030, to quantify annual CH4 emissions inventory that resulted from this waste over the same period of time, and to determine the economic and environmental benefits of capturing the CH4 gas for energy production.

It is found that cumulative municipal solid waste landfilled in Oman reaches 3089 Giga gram (Gg) in the year 2030, of which approximately 85 Gg of CH4 emissions are produced in the year 2030. The study also found that capturing CH4 emissions between the years 2016 and 2030 could attract revenues of up to OMR 127.75 million and OMR 111.8 million from the carbon reduction and electricity generation, simultaneously. It is concluded that CH4 emissions from solid waste in Oman increases enormously with time, and capture of this gas for energy production could provide a sustainable waste management solution in Oman.

Reducing the Harmful Smell (due to volatile organic compounds) in Petroleum-Based Products by Using Omani Luban /Frankincense

Salim Abdallah Salim Ali Al Kaabi
Caledonian College of Engineering

Development of Robo-Car to Collect and Separate Ferro-Magnet and Non-Metal Dust on Surface

Ibrahim Ali Alshegadi
Caledonian College of Engineering

We Invented a Smart Container that Senses the Litter and Switch on the Lamppost and USB Connection

Mohammed Ibrahim Al Karousi
Al Musanna College of Technology

Studies on Cellulase Producing Bacteria from Oman Soil Samples

Amira Abdullah Said Alhinai, Asmaa Musalam Salem and Hanan Salem Sulaiman Hamed
Sur College of Applied Sciences

Cellulose is the most abundant natural biopolymer on earth. Cellulase is the enzyme produced by microorganisms that convert cellulose for several industry applications. There has been lots of interests in identifying novel cellulases with optimum activity from various microbes including anaerobic, aerobic and extremophilic ones with an aim to facilitate several industrial processes.

Identification of novel bacterial strains from the soil of different and diverse localities of Oman with maximum cellulase activity in optimum pH, temperature and substrate concentrations. The diverse terrain, vegetation and landscapes of Oman like including beaches, Sinkhole Park (near Sur), Ras-Al-Hadd are promising locations to identify beneficial bacterial strains. A similar study to identify bacterial strains in Oman helped to identify all new 33 general and 58 species with potentials to enhance oil recovery.

Removal of Dyes from Wastewater Using Low-Cost Activated Carbon Derived from Date Pits

Maryan Nasser Al Ufi
University of Nizwa

Tracking the Photocatalytic Degradation of Methyl Orange using NiO-Doped ZnO Nanomaterials

Hajer Yaqoop Al Jabri and Riham Salim Al Hadhrami
University of Nizwa

Wastewater Treatment using Polyelectrolite

Asma Haamdan Al Mufargi and Sara Nasser Al Nabhani
University of Nizwa

Introduce New Device That Can Convert Food Waste and Animal Waste to Produce Fertilizer and Methane Gas

Naama Said Alsyabi , Budoor Salim Aljabri & Tahani Khalfan Albadi
Sur College of Applied Science

The new device has ability to control ph, temperature, and can insert microorganisms to speed the reaction. This device can create new source of energy which is methane that can we use it in electricity and cooking and can produce bio fertilizer which is more safe to our plants.

Waleed and Abdulmalik
A'Sharqiyah University

The to find an alternative product for the laundry powder available in the market because of the damage caused by the environment and soil in general, such as phosphate compounds that help the growth of algae, as well as compounds sodium and soil harmful to the soil and other vehicles have environmental damage in terms of slow decomposition and toxicity and impact on mammals and microorganisms.

As well as harmful effects on human health in particular, side effects on humans such as difficulty breathing and sensitivity of the skin and its impact on the eyes because of the presence of residues. The product of the company to solve this problem is a natural product extracted from an Omani plant and added some other materials to develop its effectiveness, such as potassium hydroxide for acidity equation as well as boric acid, a natural salt and acts as a natural stabilizer of the enzymes that are cleaning

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Automated Irrigation System

Maryam Al Kaabi and Abdullah Al Rashdi
German University of Technology in Oman (GUtech)

The motivation for this project came from the Sultanate's problem of very low fresh water supplies, thus, it is necessary to develop a smart system to help maintain the fresh water supplies without wasting them.

In this project, we focused on several objectives:
1. Increasing agricultural production using small quantities of water
2. Minimizing manual intervention in watering operations with increasing watering speeds
3. Preserving water from being wasted

How does this project work?
This system is based on an intelligent system, which takes into account the amount of water used without it being wasted. This process is done using different types of sensors, which allow the system to operate autonomously without the interference of humans. We are trying to make this project more intelligent by using other sensors connected to the system, for example, by stopping the irrigation process when there is sunlight and high temperature or when there is rain. Moreover, we developed this project to incorporate features such as leak detection, in which the system will know that there's a leak by using a flow meter sensor. In the future, we will make this system work by using solar power.

Cooling Tower

Ahmed Abdulla, Aithar Al Maimani and Alazhar Al Azri
German University of Technology in Oman (GUtech)

The cooling tower was invented in the 19th century. It is defined as a heat transfer device because its primary job is to transfer an amount of heat from one source to another. The

most commonly used fluid in cooling towers is water. The water used in cooling towers is supposed to be filtered to remove particulates, and some chemicals should be added to avoid the growth of Algae, due to the continuous flow during the process. Cooling towers are used in several applications, but they are generally used in large buildings for their central cooling system. They are also used for refrigeration, cold storage facilities, dry cleaning, medical applications, manufacturing and industry.

They range from 400 feet to 4 feet in length. There are 2 common designs of the tower; the first one is a cylindrical shape, which is commonly used. The second design is rectangular in shape. In both designs, an open or closed water circuit can be used. In addition, there are some common difficulties in both designs related to the interaction between the water flow and air.
Our project has two parts; the mechanical part and the programming part. The first mechanical part involved designing the body of the tower and defining the materials inside the tower. The programming part utilized the Arduino system to either increase the suction by the fan by increasing the voltage to it or decrease the suction by decreasing the voltage, depending on the water temperature.

Smart Aquarium System

Abir Al Ansari
German University of Technology in Oman (GUtech)

Smart Aquarium System An aquarium is a living system that needs specific conditions to sustain life for water creatures, therefore, it is necessary for the conditions to be continuously monitored using a control system.

The aim of this project is to make the aquarist (the person who take care of aquarium) aware of any changes in aquarium water conditions. The aqua-e status system uses an LCD to display real time information about the aquarium water conditions, such as temperature and pH value.

This information will make the aquarist aware of any changes in the water conditions. Since any change in water temperature or pH cannot be observed by sight, the sensors will help detect these changes, which can be critical in some cases. In critical situations the system will activate a buzzer to warn the aquarist of the problem. In addition, water level changes will be detected and the system will respond to any reduction in water level by activating the water pump.

The Aqua-e status system provides a secure and healthy living environment for aqua creatures in the aquarium by monitoring the most important environmental factors in the aquatic environment. From the aquarist side, the system will make them feel confident that their aqua creatures are living in an optimal aquarium condition.

Smart Irrigating Robot

Budoor Al Bulushi and Nasser Al-Harmali
German University of Technology in Oman (GUtech)

Smart Irrigating Robot Agriculture is one of the most important sectors in the Sultanate's economy, and it is our responsibility to take care of it. By combining modern technology with our knowledge of the environment may solve many issues. One big issue that we are facing is that people do not irrigate their land, which results in a lot of undesirable consequences. In order to resolve this issue, plants on the land can be maintained, which may solve or reduce the effect of many other issues too, such as global warming.

In order to achieve this, we programmed a robotic car that will irrigate the plants without human interaction. The smart robotic car has an arm for watering the plants. Furthermore, it has its own tank for storing the water. The robotic car works when the soil is dry by sending a signal from the sensor next to the plant to the robotic car. When the robotic car receives the signal, it will activate itself and it will water the plant. In addition, the robotic car has a sensor that sense when the level of the water is low. In this case, the robotic car will active an alarm sound to tell the user that it needs to be filled by water.

Future Work:
We are planning to program the robotic car so that it can automatically fill itself with water when its water level is low.

Smart Weather Station

Hawra Al Balushi, Reem Al Qamshouai, Maryam Al Jufaili and Alzahraa Al Aufi
German University of Technology in Oman (GUtech)

Smart Weather Station The project has been proposed and developed by Environmental Engineering students who were chosen to build a Smart Weather Station by using modern instruments to improve the accuracy of the readings and data. Since weather boxes have to be placed far away from buildings, you have to check the reading manually by going personally to the place where the shelter is placed. In order to remove the need to do this, we added a transmitter, which is called an X-bee.

The X-bee shield transfers the data from the shelter to the assigned computers using serial ports and Wi-Fi, which will allow the user to receive and send the weather data wirelessly. In addition, we have added sensors like DHT22 and MQ2. Furthermore, we attached an LCD for visualizing the data. All of these instruments are connected with the Arduino.

For the future, we will improve the visualization of the data so that it is organized in charts and graphs. In addition, we aim to solve the problem of the limited data transmission distances of 90 km, by transmitting the data through mobile (phone) networks instead.

Water Purification and Solar Heating System

Aisha Al Harthy, Sharifa Al Rumhi and Almehdiya Al Said
German University of Technology in Oman (GUtech)

We need clean water in everyday life in all kinds of activities like cooking, drinking, bathing and much more. However, since The Sultanate of Oman is located on the South-eastern coast of the Arabian Peninsula, it is known for its high temperatures, which can cross the 40 Degree Celsius mark, as well for its low rainfall. The sultanate depends on rainwater as a main supply for its water resources and it has not put enough consideration into looking for other alternatives sources, which may result in a major catastrophe in the future.

The main idea behind our project is to purify the grey water (the water resulting from domestic kitchens) and heat it in order to make it useful. The structure of the project consists of two systems; the first one is a purification system and the other one is a solar heating system.
Five accessories have been attached to the system and to the Arduino control system in order to increase its efficiency. These additions are one solenoid valve, one water pump, two water level sensors and two water proof temperature sensors.

Thermal Insulation Generator

Muhannad Al Tawqi and Aseelah Al Amri
A'Sharqiyah University

The use of nanotechnology in the manufacture of a solar generator is applied to surfaces such as walls and glass will contribute to reducing our use of fossil fuel electricity. Works as a heat insulator, thus removing the amount of energy lost due to the lack of thermal insulators, low- cost and easy to manufacture.

Paper bags made of wood, which is harmful to the environment, to benefit from these trees environmentally, as well as to reduce the dependence on plastic bags harmful to the environment

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Moatasem Al-Rawahi, Iman Farouk Alshahebi, Sana al-Hatami and Hawa Al Harthy
A'Sharqiyah University

It strives to reduce pollution and damage caused by plastic bags to the environment. Sawar also works on producing paper bags inspired by the trees of the sea by collecting wood and then chemically processing it, and then making environmentally friendly paper bags. Soar paper bags are characterized by biodegradable chemical compounds and are therefore safer to the environment and safer than plastics containing oil sources.