جامعة الإمام عبدالرحمن بن فيصل
IMAM ABDULRAHMAN BIN FAISAL UNIVERSITY
عمادة خدمة المجتمع والتنمية المستدامة
Deanship of Community Service and Sustainable Development

SDG 6.5.3

Sustainable Water Extraction Technologies

2024-2025

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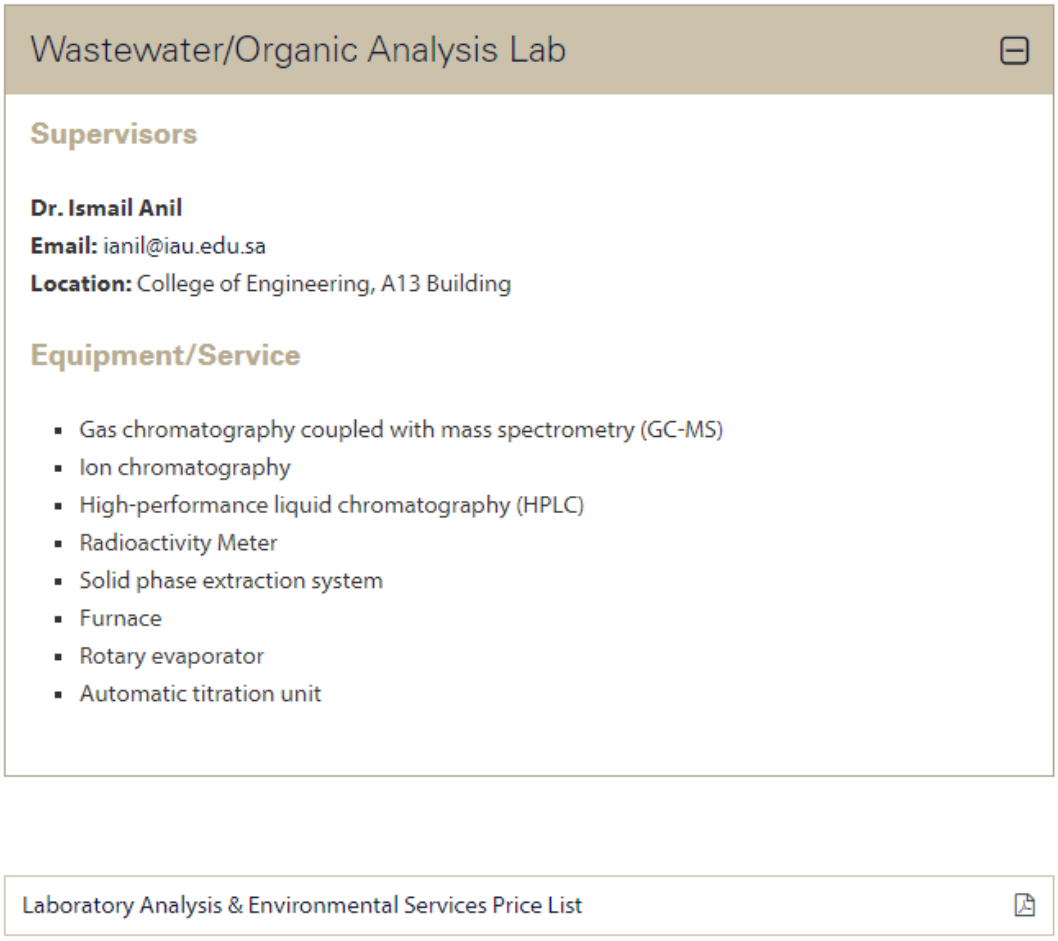


Wastewater / Organic Analysis Lab at IAU

https://www.iau.edu.sa/en/colleges/college-of-engineering/labs-and-equipment/environmental-engineering-laboratories

10. IAU Participation in Sustainable Water Management

IAU Participation in the Middle East Water Week Conference and Exhibition

The Environmental Engineering section of Faculty of Engineering Imam Abdulrahman Bin Faisal University participated in the Middle East Water Week Conference and Exhibition and presented a number of projects aimed at treating water.

https://twitter.com/CE_IAU_SA/status/1736717131863962024

IAU in cooperation with the Saudi Water Academy for "Generations Summer Program" for Children

The Continuing Education Center is pleased to #Imam_AbdulRahman_Bin_Faisal_University In cooperation with the Saudi Water Academy. The announcement of the launch of "Generations Summer Program". The Target group is Children from (7 years to 12 years).

https://twitter.com/IAU_KSA/status/1808112744589070344

9. Marine Pollution control – Field visit

Field Visit to the Marine Pollution Control Department at Aramco by IAU Faculty and Students

I had the honor of organizing a field visit to the Marine Pollution Control Department at Aramco - Tanura Opinion. Many thanks to Aramco for allowing the future engineers to have this unique experience and wonderful organization.

https://twitter.com/Omer2AGA/status/1755169090157637914

10. EnviroSpill conference

Participation of IAU Engineering College Students in the EnviroSpill Conference and Exhibition at Bahrain

Part of the participation of College of Engineering students of IAU in the conference sessions specialized in combating pollution through the EnviroSpill Conference and Exhibition, which was held in the Kingdom of Bahrain to learn about the latest technologies in combating oil spills under the patronage and attendance of His Excellency the Minister of Oil and Environment in Bahrain.

https://twitter.com/IAU_KSA/status/1582358003483029504

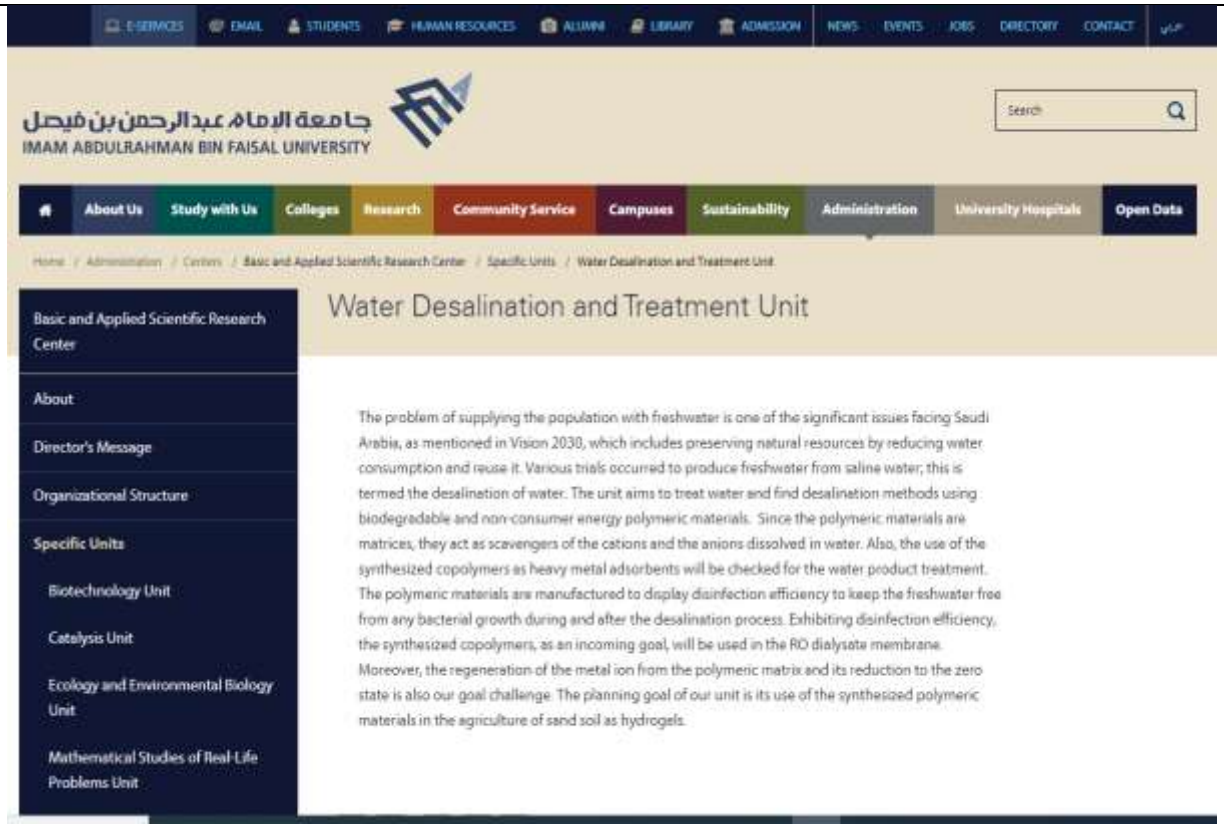
11. Saline water conversion corporation visited IAU

Visit of the Delegation of the Saline Water Conversion Corporation to IAU

Part of the visit of the delegation of the Saline Water Conversion Corporation to Imam Abdulrahman Bin Faisal University, which included a tour of: 1) Research Center, Faculty of Science, 2) Faculty of Computer Science and Information Technology, 3) Faculty of Engineering

https://twitter.com/IAU_KSA/status/1604581022351368192

12. Water Desalination and Treatment Unit of IAU

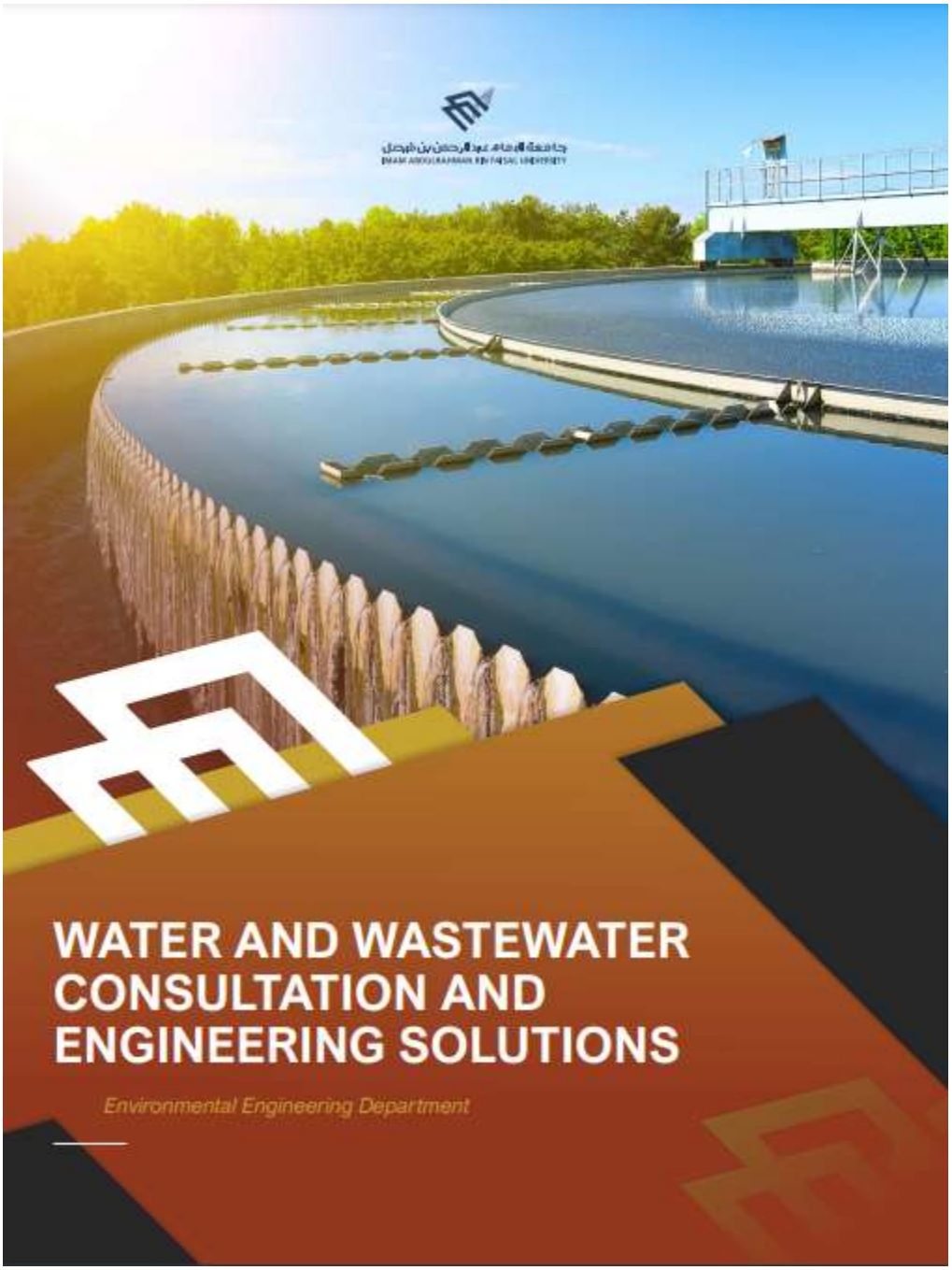


Water Desalination and Treatment Unit

The problem of supplying the population with freshwater is one of the significant issues facing Saudi Arabia, as mentioned in Vision 2030, which includes preserving natural resources by reducing water consumption and reuse it. Various trials occurred to produce freshwater from saline water; this is termed the desalination of water. The unit aims to treat water and find desalination methods using biodegradable and non-consumer energy polymeric materials.

https://www.iau.edu.sa/en/administration/centers/basic-and-applied-scientific-research-center/specific-units/water-desalination-and-treatment-unit

13. Water And Wastewater Consultation and Engineering Solutions




WATER AND WASTEWATER CONSULTATION AND ENGINEERING SOLUTIONS (GAMEP Authorized)
The water/wastewater team in IAU consultation office specializes in providing solutions for the industry's water/wastewater treatment challenges. We can guide you for the operations of wastewater system, provide troubleshooting and can help or manage your analytical testing. We offer consulting services for both water and wastewater treatment plants. Water and wastewater consultation services and laboratory analysis are authorized by General Authority of Meteorology and Environmental protection (GAMEP).
Our services include:
Analytical testing, troubleshooting & solutions
Water and wastewater quality monitoring
Periodic on-site water treatment plant visits
Evaluation of water treatment processes (including chemical analyses)
Preparation and results reporting
Water system maintenance
Sludge removal and dewatering solutions
Expert witness
We also offer short courses related to the area of water and wastewater treatment. The office is part of the Integrated environmental solutions and consultancy center established in 2020 by Imam Abdulrahman Bin Faisal University and accredited by the regulatory environmental accreditation body in Saudi Arabia - General Authority of Meteorology and Environmental protection (GAMEP). All laboratory analyses are conducted following an approved environmental laboratory protocol.
EXAMPLES OF LAB ANALYSIS
Wet analysis
Conductivity
Turbidity (NTU)
Total Solids
Suspended & Dissolved Solids
Settleable & Volatile Solids,
Fixed Solids
Water Content
pH
Ion Mobility
Zeta Potential
Acidity
Dissolved Oxygen
Color
Alkalinity
Total Hardness
Elemental analysis
Total Organic Carbon
CHNS Analysis
Sulfur
Sulfate
Phosphorous
Nitrate
COD
Phenol
Heavy metals
Trace metals
Chromatographic analysis
Florine
Chlorine
Bromide
Mineral oils
Organics
PAHs
PCBs
BTEX
VOCs
Microbiology & Toxicity analysis
Total Coliform
Fecal Coliform
Total Bacteria Count
E. Coli (MPN)
Chlorophyll a, b, and c
Fish Biological Experiment


Wet analysis
Free Chlorine, Total Chlorine, Sulphur, Kjeldahl Nitrogen, Organic Nitrogen, Ammonium Nitrogen, Total Nitrogen, Total Phosphor, Phenols, Oil and Grease, Biological Oxygen Demand (BOD5), Chemical Oxygen Demand (COD), Chromium (VI), Fluoride (F-), Chloride (Cl-), Bromide (Br-), Nitrite (NO2-), Nitrate (NO3-), Sulfate (SO42-), Phosphate (PO43-) and Cyanide (CN-) are all tested in our lab.
Elemental analysis
(TOC Analyzer), analysis by Individual Test Kits (UV Spectrophotometry) (S2-, SO4 2- , P, NO3 - , B, Cr6+, Cl- , CN- , NO2- , COD, F- , Phenol), Heavy & Trace Metals by ICP-OES, ICP-MS, and AAS instrument that includes: Silver (Ag), Indium (In), Aluminum (Al), Potassium (K), Boron (B), Lithium (Li), Barium (Ba), Magnesium (Mg), Bismuth (Bi), Manganese (Mg), Calcium (Ca), Sodium (Na), Cadmium (Cd), Nickel (Ni), Cobalt (Co), Lead (Pb), Chromium (Cr), Strontium (Sr), Copper (Cu), Thallium (Tl), Iron (Fe), Gallium (Ga) and Zinc (Zn).
Chromatographic analysis
F- , Cl- , Br- , NO2 -, NO3 -, SO4 2-, PO42- and cations by Ion Chromatography. Mineral Oil Analysis in Water Samples, Organics; PAHs, PCBs, BTEX, VOCs by HPLC & GC-MS.
Microbiology & Toxicity analysis
HPC, Toxication Thinning Factor (ZSF) among others analysis.
INSTRUMENT
01
INDUCTIVELY COUPLED PLASMA / ICP-MS
The Tisch Environmental PM2.5 and PM10 high volume air sampler is a Federal Reference Method sampler for collecting fine and coarse particulate matter fractions. Its primary uses are for regulatory sampling and institutional studies.
02
INDUCTIVELY COUPLED PLASMA / ICP-OES
ICP-OES offers the highest resolution along with high sensitivity and stability for the most demanding applications. It is trace-level, elemental analysis technique that determines concentrations of trace to major elements in part per million (ppm) and can detect most elements in the periodic table. Applications are drinking water, wastewater, other examples of environmental studies, petrochemistry, food, hydrogeology, and others.
03
GAS CHROMATOGRAPHY MASS SPECTROMETRY / GC-MS
GG-MS covers volatile to semi-volatile analytes, oil, petroleum derivative and petrochemical analysis, in matrices ranging from simple air and drinking water to the most complex food and soil/sludge. Additionally, it is equipped with Gerstel sample introduction system that expands the GC-MS capabilities such as automated sampling handling, head space sampling and solid phase micro extraction "SPME".
04
HIGH PERFORMANCE LIQUID CHROMATOGRAPHY-HPLC
High performance liquid chromatography with photo diode array detector, HPLC-PDA has been increasingly employed for the analytical control of environmental pollution levels. It appears promising for the identification and determination of non-volatile or strongly polar compounds in air and in surface, waste, and drinking water.

05 INDUCTIVELY COUPLED PLASMA / ICP-MS

The Tisch Environmental $PM_{2.5}$ and PM_{10} high volume air sampler is a Federal Reference Method sampler for collecting fine and coarse particulate matter fractions. Its primary uses are for regulatory sampling and institutional studies.

06 ATOMIC ABSORPTION SPECTROMETER

Atomic absorption spectrometry (AAS) is a single element technique that measures the concentrations of elements. Applications; water and environmental analysis, geochemical analysis, food analysis and metallurgical analysis.

07 ELEMENTAR CHNS

Elementar CHNS system is used to detect Carbon, Hydrogen, Nitrogen and Sulfur in inorganic and other types of materials. Being fast and accurate are among the advantages of this system. CHNS can handle a wide variety of sample types including solids, liquids, volatile and viscous samples.

08 ROTARY EVAPORATOR

A rotary evaporator is a device used in chemical laboratories for the efficient and gentle removal of solvents from samples by evaporation. Rotary evaporators are also used in molecular cooking for the preparation of distillates and extracts.
Besides being used in the Rotary Evaporator chemistry laboratories; it is also applied for necessary processes in fields such as pharmaceuticals, cosmetics, food, petrochemical and R&D.

09 MICROBIOLOGICAL TESTING

Our Microbiology lab is equipped with many kinds of microscopes, safety cabinet, laminar flow, incubators, and autoclave to test samples for bacteria, larvae and fungi.

EXAMPLES OF PREVIOUS PROJECTS AND STUDIES

- Corrosion inhibition in oil and gas industries using new fine-tunable pH-responsive polymers
- Beach Well Filtration as Pre-Treatment for RO desalination in eastern province-Saudi Arabia
- Electro-decontamination of toxic phenolic wastewaters under different direct current supply modes"
- Pulsed-current electrokinetic remediation of groundwater contaminated with heavy metals"
- Water quality in higher education institutions

EXAMPLES OF PREVIOUS REFEREED JOURNAL PAPERS

- Systematic modeling of municipal wastewater activated sludge process and treatment plant capacity analysis using GPS-X.
- Sewage sludge ZnCl2 activated carbon intercalated MgFe-LDH nanocomposites: insight of sorption mechanism of improved removal of phenol from water.
- Sustainable wastewater treatment by biochar/layered double hydroxide composites: Progress, challenges, and outlook
- Adsorption behavior and mechanism of methylene blue, crystal violet, eriochrome black T, and methyl orange dyes onto biochar-derived date palm fronds waste produced at different pyrolysis conditions
- Response surface modeling and optimization of sludge activated carbon production conditions for phenolic compounds removal from water

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https://www.iau.edu.sa/sites/default/files/resources/water_and_wastewater.pdf

14. Integrated Environmental Solutions and Consultancy Office

INTEGRATED ENVIRONMENTAL SOLUTIONS AND CONSULTANCY OFFICE (GAMEP Authorized)

The department of environmental engineering is considered as a pioneer since it is the first department to offer the bachelor's degree environmental engineering in the kingdom of Saudi Arabia.

The Integrated Environmental Solutions and Consultancy Center established by Imam Abdulrahman Bin Faisal University in 2020 and Authorized by the Presidency of General Authority of Meteorology and Environment Protection (GAMEP).

The distinguished experience, expertise, and capabilities are utilized to develop engineering solutions that meet the customers' needs and local standards. The services include providing optimum air quality management and solutions on the indoor/outdoor air pollution and industrial emissions from oil and gas, energy, mining, and minerals sectors.

The Consulting and Engineering Office is dedicated to working with clients to implement compliance solutions using innovative approaches and advanced technologies. The measurement and analysis are conducted following stringent environmental laboratory protocol and best quality practice.

The multi-disciplinary consultants engineering office includes:

01 Environment services including environmental studies, design, and supervision

02 Professional training for environmental specialists and technicians

03 Short and long Certificate programs in environmental specialists and engineering filed

04 Third-party inspection and opinion work to ensure compliance with the project specifications, codes, and standards.

05 Physical, chemical, and biological procedures and mechanisms accountable for the proclamation, conveyance, alteration and preservation of pollutants.

06 Pollutant control procedures (predominantly the exclusion of trace & toxins or pollutants).

07 Basic ideologies of physical, chemical, and biological conduct know how for water, wastewater and solid wastes scums or residues from different sources.

08 Pollutant control measures for Air, other contaminants removal from air & its monitoring (gases, Particulate matters & Meteorological parameters etc.).

1. Division of Solid and Hazardous Waste Management

This consultation office offers consultation services, conducting studies, third-party testing, inspection, and training in the field of environmental engineering and waste management, including industrial, medical among all other types of solid waste. In Addition, we offer short courses related to the area of solid waste management. The office is part of the Integrated Environmental Solutions and Consultancy Center established in 2020 by Imam Abdulrahman Bin Faisal University. All laboratory analysis are conducted following an approved environmental laboratory protocol.

Our services include:

- Inspecting, analysis, and assessment of all types of hazardous waste.
- Landfill and incineration design
- Best applicable technology
- Oil waste management and reuse
- Industrial waste collection and disposal
- Medical waste management, disposal, and incineration
- Radioactive waste management
- Contaminated solid purification

2. Division of Wastewater Treatment and Reuse:

water/wastewater team in IAU consultation office specializes in providing solutions for the industry's water/wastewater treatment challenges. We can guide you for the operations of wastewater system, provide troubleshooting, and can help or manage your analytical testing. We offer consulting services for both water and wastewater treatment plants. We offer consultation services, conducting studies, measurements, and training in the field of wastewater engineering, treatment, optimization, reuse, and design.

Our consultation services and laboratory analysis are authorized by the Presidency of Meteorology and Environment (GAMEP).

- Conducting analysis and modelling on the existing design of wastewater engineering systems and finding cost-saving opportunities that provide a return on investment.
- Designing, implementing, and upgrading wastewater treatment systems
- Advice on best practicable and cost-effective solutions for wastewater treatment.
- Wastewater analysis and characterization
- Marine pollution and deep discharge design
- Blue flag services and consultation
- Water footprint calculations and simulations
- Wastewater plant modelling and simulation studies

3. Division of Air Quality and Emission Control

Offering consultation services, conducting studies, third-party testing, inspection, and training in the field of environmental engineering, indoor and outdoor air quality assessment, emission inventory calculation, dispersion modelling, health risk assessment, dose calculation.

- Mobile station air quality monitoring for EIA studies
- Stack Gas Monitoring
- Designing Innovative Air Pollution Control Technologies
- Optimizing Current Air Pollution Control Technologies
- Short courses and training
- Calibration and maintenance
- Bioaerosol Sampling and Analysis
- Noise Pollution Monitoring, Mapping, Modelling, and Control
- Monitoring of Meteorological Parameters
- Air Toxics Health Risk Assessments
- Dispersion Modelling
- Source Apportionment Modelling
- Air Quality Program Management
- Air Pollution and Air Quality Mapping
- GIS maps for measured pollutants
- Source and stack emission monitoring
- Ambient air quality studies
- Mobile lab services
- Environmental management plan (EMP)
- Environmental impact assessment studies (EIA)
- Life cycle assessment studies (LCA)
- Pollutants dispersion modelling (AREMOD)
- Risk assessment and dose calculation
- Auditing and inspection
- Energy efficiency
- Carbon footprint
- Global warming and greenhouse gases
- Ambient/Indoor Sampling, Monitoring, Analysis of Air Pollutants

Mobile Air Quality Monitoring Station

https://www.iau.edu.sa/sites/default/files/resources/general_introduction-compressed.pdf

15. Water extraction technologies on associated university grounds

Snapshot of Saudi Building Code National Committee's website

Example of Green Building Implementation – efforts in IAU, The cultivation of Nano Plants

Description:

All buildings of the IAU Campus fulfil the requirements of the Saudi Building Code National Standard for construction of buildings, whereby many of our building follow the international building standard code, which is of much higher standard.

As stated in Saudi Building Code that “all facilities in general require availability of building code that determines safety and security terms as well as comfort in all building stages and the issue increases in its significance in the Kingdom of Saudi Arabia due to its geographical nature and difference in climates of its regions. The desert climate is dry on the interior parts and of high humidity on the areas near the sea as well as it is distinguished by high temperature in most the year seasons and its soil that contains high percentage of detrimental salts in addition to presence of earthquake phenomena in some coastal areas- all these factors and others affect clearly safety of facilities and their sustainment and protection of citizens.”

As far as Green Building implementation is concern, one of the steps IAU had started implemented that is the cultivation of invented nano - plants in IAU as a tool for removal of air pollutants.

Additional evidence link:

https://www.sbc.gov.sa/En/BuildingCode/