REPORT

ON

Sustainable Water Consumption and Sanitation

Daffodil International University

August 2020

Sustainable Water Consumption and Sanitation


SUSTAINABLE
DEVELOPMENT
GOALS


1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
THE GLOBAL GOALS
For Sustainable Development

Contents

1. INTRODUCTION

According to the United Nations (UN), 17 Sustainable Development Goals (SDGs) were adopted by its member states to end poverty, protect the planet and ensure that all the people enjoy peace and prosperity by the year 2030. The proper integration of policy interventions in all the 17 areas of SDGs. Taking action in one area will affect outcomes in others and eventually development must balance social, economic and environmental sustainability. As a higher education institution, Daffodil International University (DIU) is committed to respond to this universal call for SDGs and take actions to comply with the United Nation's endeavor and to support the Government of Bangladesh for achievement of desired outcomes. In this regard, DIU is working closely with the Government, private sector, NGOs, civil society and citizens jointly for implementation of SDGs and to make sure that a better and sustainable planet can be created for the future generations.

In the past few years, Daffodil International University has been striving to make a footprint in this arena through its contributions towards sustainable development initiatives. In order to promote achievement of certain SDGs through research and academic excellence, DIU has established separate academic departments namely: Department of Environmental Science and Disaster Management (ESDM). DIU develops its graduates with sustainability skills and environmental awareness. The university adopts sustainable practices in all its development activities and initiatives. DIU arranges a lot of events in collaboration with other partners in the areas of sustainability and environmental wellbeing round the year.

With this report, DIU would like to share its initiatives, thoughts, outcomes, research findings, students' activities, achievements, and lessons learned from different projects implemented at DIU with the national and international communities and partners.

2. CLEAN WATER AND SANITATION (GOAL 6)

The United Nations Development Programme (UNDP) says

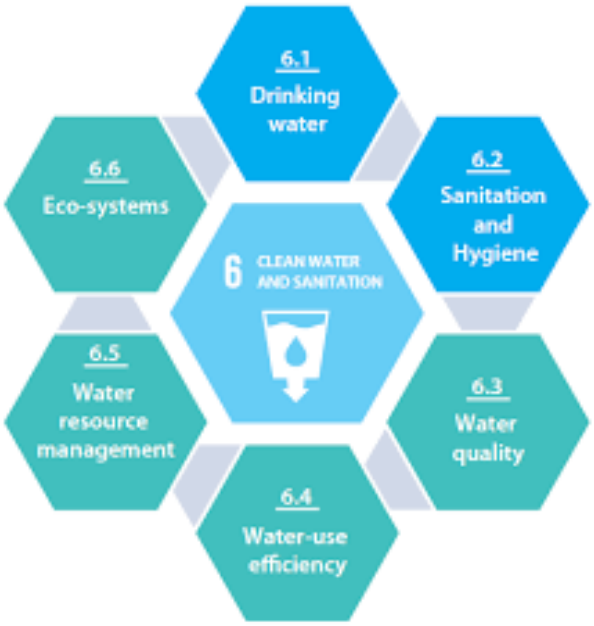
"Water scarcity affects more than 40 percent of people, an alarming figure that is projected to rise as temperatures do. Although 2.1 billion people have improved water sanitation since 1990, dwindling drinking water supplies are affecting every continent.

More and more countries are experiencing water stress, and increasing drought and desertification is already worsening these trends. By 2050, it is projected that at least one in four people will suffer recurring water shortages.

Safe and affordable drinking water for all by 2030 requires we invest in adequate infrastructure, provide sanitation facilities, and encourage hygiene. Protecting and restoring water-related ecosystems is essential.

Ensuring universal safe and affordable drinking water involves reaching over 800 million people who lack basic services and improving accessibility and safety of services for over two billion.

In 2015, 4.5 billion people lacked safely managed sanitation services (with adequately disposed or treated excreta) and 2.3 billion lacked even basic sanitation."



3. DAFFODIL INTERNATIONAL UNIVERSITY

Daffodil International University (DIU) is one of the leading private universities in Bangladesh and was established back on 24th January, 2002. The university aims to become a global leader in providing tertiary level education that produces graduates with high self-esteem who are able to accept challenges in a fast-changing environment. DIU provides higher education in the areas of Science and Technology, Engineering, Business and Entrepreneurship, Humanities & Social Sciences and Allied Health sciences aligning with the adoption of contemporary technological advancement. The mission of the University are to:

- Supporting research, design, develop and implement educational methods that nurture creativity and independent learning by students and faculty members.
- To build a research culture at the department level and the university as a whole and consequently, establish DIU as a Research University in international arena
- Promoting research, aligned with the national development agenda, the vision of digital Bangladesh, and Sustainable Development Goals (SDGs).
- Promoting entrepreneurial education and develop entrepreneurial mindset in the students to encourage them in becoming self-employed
- Providing underprivileged and rural populace access to higher education.
- Providing adequate skills training in areas that are in demand by local and global employers.

The University is serving the citizens of the country through its quality education for lifelong learning, research, entrepreneurship, outreach programs, skills development, internationalization and preparing its graduates to respond positively to the challenges of glocalization. The University has proved that it provides students broad access to the institution's educational resources. As per the recent report of the University Grants Commission of Bangladesh, Daffodil International University could attract the highest number of international students for studying here both at bachelor and masters programs.

As a young university, Daffodil International University (DIU) took a lot of initiatives in higher education domains and took part in international mobility programs for its internationalization. DIU is one of the partner institutes of Erasmus+ and many students are studying in Turkey, Poland, Portugal, Italy, UK, Lithuania, and Finland through Erasmus+ scholarship. DIU has a strong network, built through partnership with about four hundred academic institutions both in and outside of the country, in order to have inbound and outbound exchange program of students and faculty members, research collaboration, internationalization, ensuring quality of teaching-learning etc. DIU emphasizes on integrating information technology (IT) and entrepreneurial education in the country. DIU leads the Daffodil Education Network (DEN) comprising other 13 educational institutions of the Daffodil Family.

4. Department of Environmental Science and Disaster Management

Growing populations and higher standards of living put increasing pressure on our environment. Environmental problems are just as real, just as controversial, and just as in need of intelligent solutions. Environmental problems and their associated solutions typically involve social, political and economic aspects which all the human beings must be aware of it. To address all these issues and for contribution towards achievement of SDGs in Bangladesh, the Daffodil International University established the Department of Environmental Science and Disaster Management in 2010.

The department makes collaboration with some government and non-government organizations in teaching and research. Frequently, it arranges some practical oriented learnings like environment and its problem related seminar and workshop. This development in the country is especially important as Bangladesh is one of the most vulnerable countries to natural disaster and environmental pollution because of its geographic location and population expansion. The demand for environmental scientists and those trained in disaster management and pollution control are, therefore, acute and DIU feels strongly that the University must be a part of the solution to environmental degradation and ensure sustainable development.

DIU has responded to this by planning a permanent new green campus in Asulia, Dhaka. DIU also wishes to take on the challenge of restoring the degraded ecosystems caused already to our environment by training skilled and committed experts who can work with governmental and non-government agencies, by undertaking research to provide accurate data to help to survey the extent of the damage and assess different strategies to overcome it, and to champion projects that aim at low-cost, sustainable remedies.

5. INITIATIVES OF THE UNIVERSITY TOWARDS CLEAN WATER AND SANITATION

5.1 Treated water consumed

Daffodil International University consumed self-treated water in campus. The Department of Nutrition and Food Engineering of DIU develops bottled drinking water which is used in campus drinking purpose and it is also sold out in market. It follows the following steps:

i) Firstly, the impure water enters the Ion Exchange Resin Column
ii) Then, it goes to filtration column for filtering the water
iii) The filtered water then goes to the UV Retreated Reserved Tank
iv) Then the filtered water is bottled through the water bottle shrinking machine
v) The final output is found as drinkable bottled water

Fig: Water Treatment Plant to use the water for drinking in campus

5.2 Water Conservation Programs

The university has different modes of water conservation in campus. It uses the updated technology and system for water conservation.

1. Conserves water through the rain water harvesting program in campus. The program is set up at the Academic building 4 of the largest green campus.
2. DIU also uses its ponds for water conservation
3. Lake water conservation is also in practice at DIU
4. Water conservation in Tanks at roof top

Water conservation in DIU Lake

Water conservation in DIU pond and artificial Lake

5.3 Water Recycling Program Implementation

The water preserved from rain water harvesting is used for the following tasks with the help of different piping system:

- garden sprinkler system
- car washing
- watering the plants and vegetation
- use in the DIU swimming pool
- use in water fountain and fish cultivation

DIU has also been implementing a project on 'Water Spinach Utilization as a Phytoremediation Technique for detoxing the Waste water'. The hand and mouth washed used water is preserved in a different preserving tank which is used for toilet flushing and saves a huge amount of fresh water wastage.

Recycled Water is Used in DIU water fountain

Used water recycled and re-use for watering the plants

Water Spinach Utilization as a Phytoremediation Technique for detoxing the Waste water

Preserved Rain water is used for water fountain

Preserved Rain water is used for fish cultivation

Harvested Rain water is used to water the plants and vegetation in the campus

6. RELEVANT PROJECTS IMPLEMENTATION

6.1. DIU Lake Project (Wastewater treatment and place refurbishment)

Background

The campus of the Daffodil International University (DIU) is a phenomenal natural beauty and an art of perfect green entity. There is a water body adjacent to the campus which somehow restricts the flourishing visuals and environmental aspects. The place is posing impediments to study in a healthy environment, to the current as well as future students who will be belonging to the under construction female halls nearby. It is therefore a crying need to work on the problem. The Department of Environmental Science and Disaster Management of DIU has been implementing a DIU Lake Project (Wastewater treatment and place refurbishment) to solve the problem and revive the water lake with sound environmental effects.

Objectives

- To treat the wastewater.
- To make the study environment better.
- To stop waste disposal
- To change the place with lakes and residential halls.

Methodology

The following methodology is being followed

Wastewater treatment – Waste Management – Construction

The wastewater is being treated. Some aquatic plants have been removed. Waste disposal has also been reduced. Construction works, such as roads and halls have been greatly developed.

Outcomes

- The project is changing the degraded quality of the place.
- The place is now getting better aesthetic values.
- Odour and Toxic chemicals is being reduced.
- Students are now getting better and pollution free environment.

6.2. Existing Water Body Restoration and Quality Development at the Ashulia Campus, Dafffodil International University

Background

The campus of Daffodil International University (DIU) at Ashulia is a phenomenal natural beauty and an art of perfect green entity. There is a water body adjacent to the campus which somehow restricts the flourishing visuals and environmental aspects. The place is posing impediments to study in a healthy environment, to the current as well as future students who will be belonging to the under construction female halls nearby. It is therefore a crying need to work on the problem. Following is the description of the present state as well as an improvement plan for the place.

Pre-Condition

The water body is located at the permanent campus of DIU at North to the 'Shadhinota Shommelon Kendro', DIU. The approximate position is 23°87' N and 90°32' E. The concerned area is approximately 7.961 Acres, as estimated by the Civil Engineering Department of DIU. Aerial image has been captured to delineate the location and the shape of the concerned place.

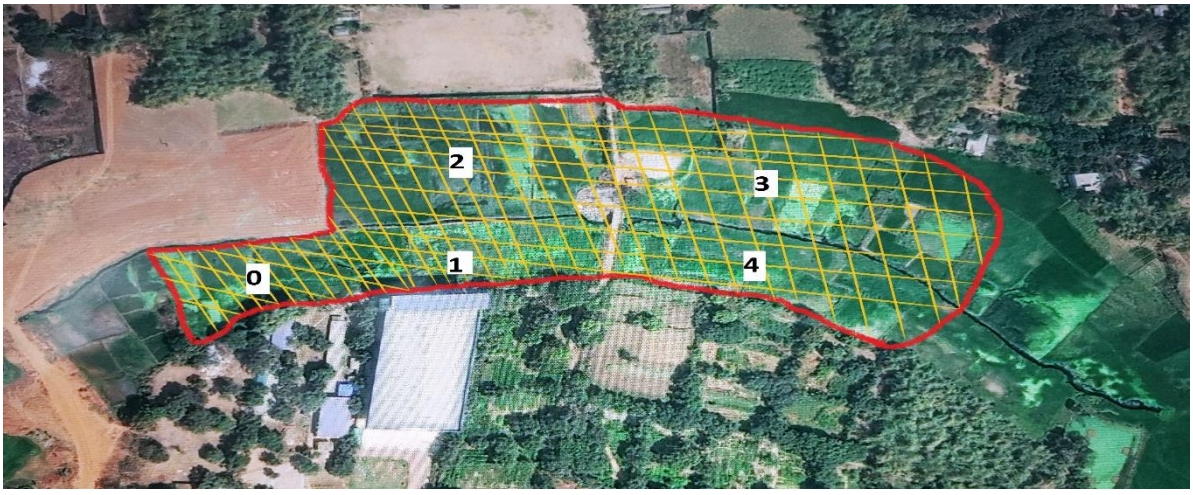


Fig: The proposed Area for Existing Water Body Restoration.

The targeted area has been marked with Red and Yellow color. Numbering has been done to link with the following pictures in order to understand the place better. Some glimpses of the place is shown below:

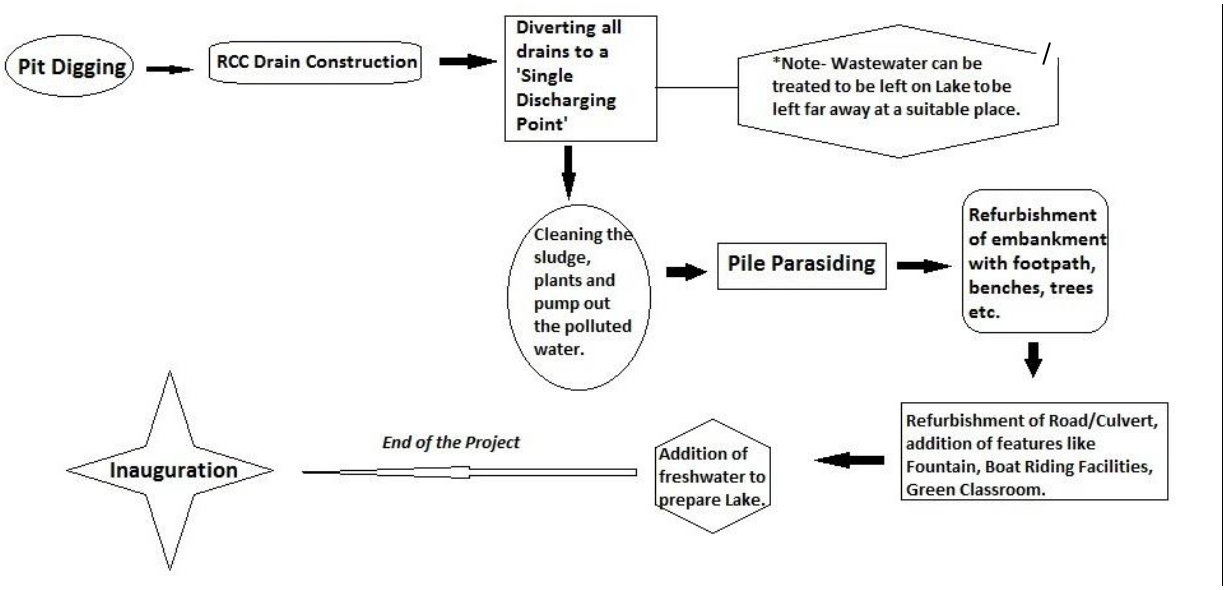
Fig: Pre-Condition at Targeted Area

Improvement Plan

The improvement plan has been designed through a drawing. According to the design, plans have been set part by part. A secondary management plan has been proposed. Firstly, the main focus is to take care of the effluents that are being discharged from nearby industries and local villagers. For that, **Pit** will be dug below the discharging points of the pipes. Then following the pit, **Reinforced Cement Concrete (RCC) drain** would be built as shown with Cross-Section in the design. All the drains around would meet at a single point as shown in the design. After the construction of RCC drain, the pipes would be cut short so that the effluents can fall in pit and be directed towards the **Single Discharging Point.** That point can be extended to leave the wastewater at a suitable place or a treatment plant can be established to treat the wastewater and leave back as treated water to the lake.

After taking care of the effluent by diverting them, the next focus would be on the existing water body. So, the hyacinths and aquatic plants should be removed. Then the existing polluted water should be pumped out. Lime can be used to clean the water. Afterwards, the attention would be on the stability of the Lake's embankment. And for that, the proposal is for **Pile Parasiding,** almost 5 feet away from the existing embankment. Piled structure would shape the Lake. Then the embankment can be made ready by sand and clay filling. Later on, footpath can be added, a cross section of that has been added in the design. Some features like Fountain, Boat Riding Facilities, and Green Classroom have been added as well. Green classroom has been proposed to be under the Environmental Science and Disaster Management (ESDM) department, it

will be powered by 'Green Energies' like Solar/Bio, and would be used as recreational and counselling purposes besides studies. In case of the road, it can be refurbished and the culvert can be extended as well as beautified. Lastly, Freshwater would be added to the Lake. The place can then be inaugurated as an amusement park or other suitable title. A work flowchart has been added:



The budget of the project can be precise after necessary surveys and measurements by the engineers. The proposal has been made to offer the feasibility with the least possible amount. For example, an alternative of pile parasiding would be 'RCC Retention Wall Construction'. But that would greatly increase the costing.

Fig: Post-Condition at the targeted area

Conclusion

To reiterate, the water body is not conducive to the studious as well as healthy environment. The operation of the university with a purpose to serve the students with good quality environment, is being interrupted due to the polluted water. If immediate

measures aren't taken now, the place might have more negative impacts in the long run, in terms of human health and environment. So, an improvement is urgent for now.

6.3. Natural Water Conservation and Restoration Using Aquatic Macrophytes

Background

Due to the industrialization, our water bodies such as rivers, lakes, ponds and wetlands of Dhaka are being polluted by the discharge of toxic chemicals and harmful substances which degrades the water quality and it creates back to back harmful impacts on humans and also the aquatic ecosystem. To improve water quality in a natural we need to think any possible solution related with biological method. In this regard a submerged macrophyte was used to reduce the level of pollutants and contaminants from the natural fresh water. The project has been implemented by the Department of Environmental Science and Disaster Management of DIU.

Objective

- To find the concentration level of heavy metals
- To improve the water quality by our native aquatic plants
- To observe the efficiency of our native aquatic plants on the wastewater.
- To detoxify the water in a naturally occurred manner through aquatic plants
- To implement this cost effective way for the treatment of our polluted water body.

Methodology

This research has systematic procedures to follow. The overall process is being illustrated below-

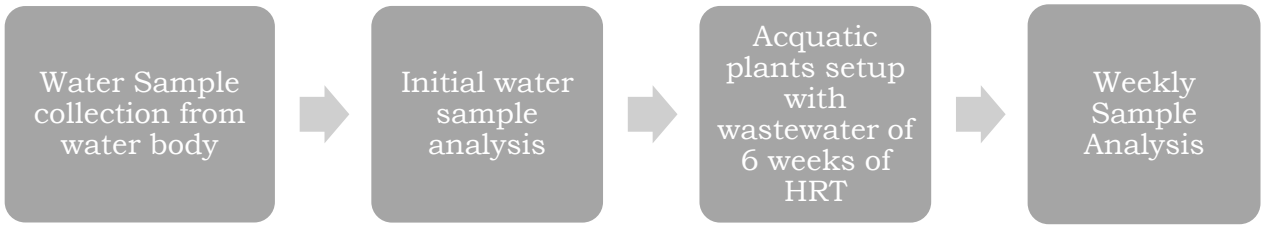


Fig. 1. Natural water quality improvement via aquatic plants in laboratory.

Research Outcome:

- The treatment has successfully changed the water quality

- It's a plant based treatment, so the oxygen is increased and creates a healthy environment for aquatic organisms
- Huge changes have been identified in water color and its odor.
- A huge percentage of reduction of heavy metals and other toxic chemicals.
- This research will assure the plausible sound life for aquatic organisms.

6.4. Municipal solid waste management at different location of Dhaka city

Background

Basically the scenario or system of Municipal Solid Waste Management is weak and full of vulnerability. Due to improper management we are suffering the most for the huge amount of waste and tens of hazardous bacteria. So, to develop a management system of Municipal solid waste this research has been done by the Department of Environmental Science and Disaster Management.

Objective

- To manage the municipal solid waste in a sustainable way
- To find out which bacteria plays a great role to consume municipal organic & inorganic solid waste.
- To find out the hazardous bacteria found in Municipal solid waste which affects the Human health & environment as well.
- To identify proper Antibiotics to eliminate the harmful bacteria.

Methodology

This research has systematic procedures to follow. The overall process is being illustrated below-

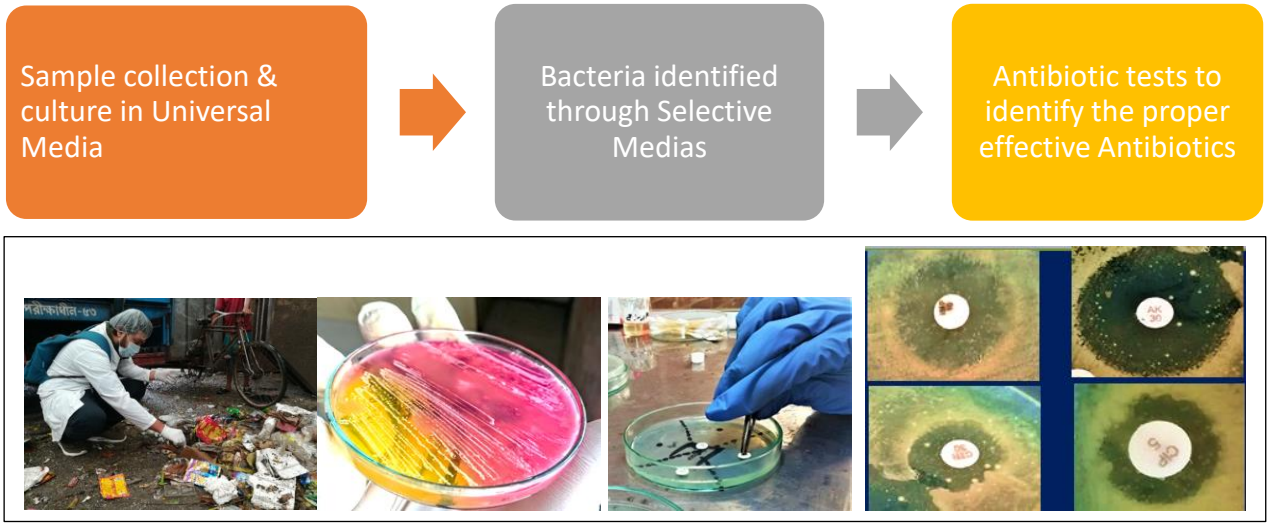


Fig: Sample collection from the sampling sites and work in research lab.

Research Outcome:

- Successfully identified the huge availability of Harmful bacteria such as *Bacillus.*
- The potential and direct threat to human health due to these bacteria has been identified to the waste workers and the surrounding dwellers.
- A huge percentage of the most commonly used antibiotics ain't able to kill the harmful bacteria.
- Effective antibiotics have been identified to kill the harmful bacteria.

6.5. Waste to Resource (Plastic Reuse)

Background

As the students and faculties of Environmental Science and Disaster Management (ESDM), we always had a passion to protect the environment. From this passion, we want to know how we can protect our environment from pollution. After knowing this term we thought about a plan by which we can clean our whole surroundings, can reduce environmental pollution and also can run a small business from which we get some money. This business is a recycling or reusing business with a mid-term plan of going into full-scale recycling or reusing of some recyclable or reusable items, mainly plastics, and other (e.g. paper, metal, rubber, glass, etc.), and a long term plan of converting waste to reusable products.

Plastic waste is arguably one of the most common forms of waste on this planet. Waste plastic such as plastic bottles, used plastic tins and containers, and shopping bags can be reused and formed into an amazing range of new and reusable products. According to the ESDO, 73,000 tons of plastic wastes end up in the Bay of Bengal every day through the GBM Basin of Bangladesh. A study report has done by the Ministry of Environment, Forest and Climate Change under the Department of Environment, Bangladesh, stated that plastic waste is 60% of the total waste found in the coastline, and most of the plastic waste is plastic bottles.

Fig: Reuse of Plastic Bottle and Jar for Plantation

Objective

- To reuse and recycle plastic wastes and other waste that are harmful to nature
- To aware people on the creative use of plastic and other wastes
- To create a business model for the community which is eco-friendly and sustainable

Methodology

Anyone who's environmentally conscious will know how important it is to reuse or recycle as much of our trash as we can. It is very important not to just throw it away when the plastic drinking bottle is empty. It can be reused through recycling and making something new out of the old bottles is much more fun, plus it could save some money by crafting something required instead of having to go out and buy it.

Instead of buying a can, glass, or ceramic pencil holder, simply recycle the old plastic bottles that are sitting idle at home. Using a rubber lining on top to make it as plain or as colorfully designed as anyone would like it to be. An easier way to create an organizer using plastic bottles is to cut the bottom part and place them alongside each other on the desk. You can use the containers to store pens, clips, wires, pins, stapler wires, and other office supplies.

Fig: Reuse of Plastic Jar and Bottle for Plantation

Benefits or Outcome

- Starting up a recycling plant also contributes to the economy, concerning taxes, conservation of power consumption, local content creation, small and medium scale development, job creation, and wealth distribution. 1-20% of salt can be collected as a byproduct of the plant.
- For instance, the money saved through the consumption of less energy means more competitive price of goods. The production cycle can be greatly decreased. Taking paper as an instance, the whole wood growth time lag is removed from the producing process

- As a green entrepreneur or owner of an eco-conscious company, one can also contributing the quota in the movement for environmental protection because that A little company young people established will help to curtail many problems.

6.6. Water Spinach Utilization as a Phytoremediation Technique for Toxic Waste Management

Background

The present state of toxic waste management system in Bangladesh is not in a good condition. There is lack of proper management of toxic waste in different industries such as leather, textile, chemical and others industries which contain heavy metals. It has harmful effects on environment and human health. Waste water treatment cost is very high and it's a long time process. The waste water which have heavy metals that modify the cells of living organic substances, soil, water bodies and human body too. So, untreated waste water is a great problem for us and for the environment. If it remains untreated then it will become a great threat for the human race. The waste water can be treated with phytoremediation which is a process where plants are used to treat water and it is also very cost effective way to manage toxic waste.

Objective:

- To manage the toxic waste coming from the industries.
- To find out feasibility of water spinach in toxic waste water.
- To find out the level of toxic content removed by the plants.

Methodology: This research has systematic procedures to follow. The overall process is being illustrated below-

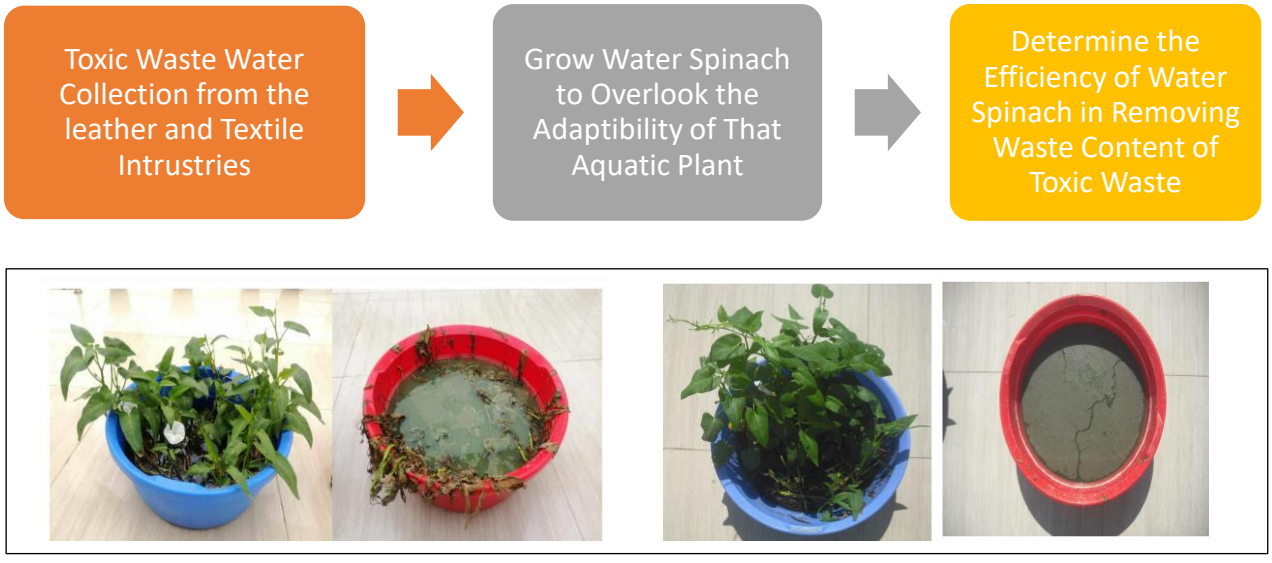


Fig: Adaptability Measures of Water Spinach in Textile and Leather Waste Water

Research Outcome:

- Water Spinach successfully survived in the textile toxic waste water for one month.
- Water Spinach could not survive in high leather toxic effluent for 2 days.
- A huge amount of contaminant and pollutant removed by phytoremediation.

6.7. Home Scale Desalination Plant Design and Development for Treating Saline Water of Coastal Area

Background

The present condition of drinking water for the people of coastal area is very much weak and unavailable at most of the coastal area. This research can bring a very handy solution for the people of coastal area who are suffering from premature miscarriage, malnutrition, skin diseases & so on. This research can be used to develop a home scale desalination plant to treat the saline water through sublimation process.

Objective

- To create a device or home scale plant to treat saline water
- To get salt from the saline water as a byproduct.
- To provide a handy and effective solution for the coastal people about fresh drinking water in a very low cost

Methodology

This research has systematic procedures to follow. The overall process is being illustrated below-

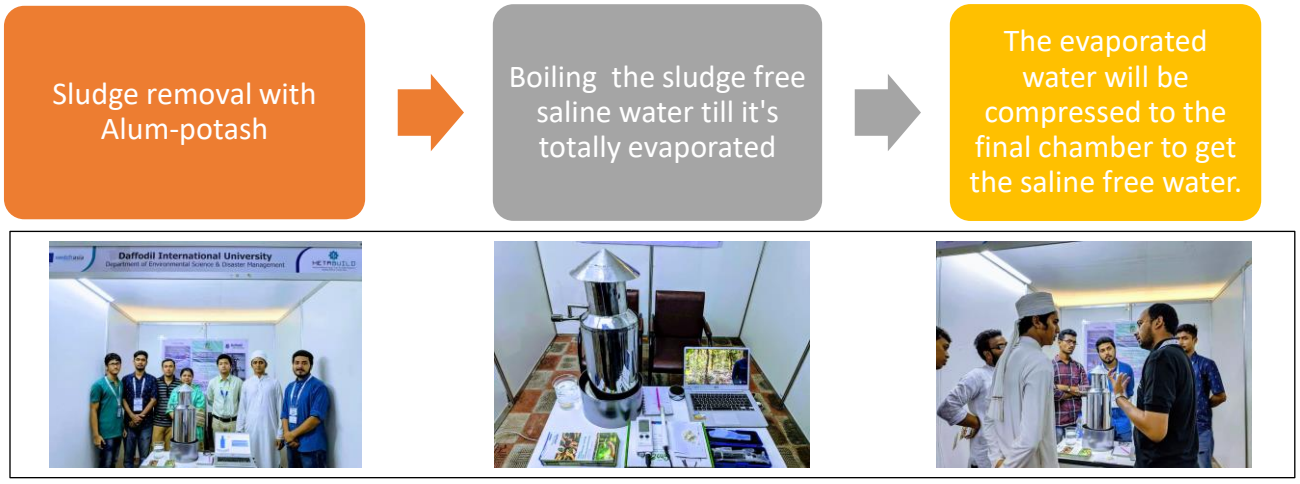


Fig: Project demonstrated in competitive project exhibition

Research Outcome:

- About 70-80% fresh water can be produced from the total amount of saline water.

- 1-20% of salt can be collected as a byproduct from the plant.
- Handy and affordable.

7. UNIVERSITY SANITATION AND WASTE MANAGEMENT PROGRAMS

Daffodil International University follows various programs for campus waste management for ensuring sustainable use and consumption.

7.1. Organic Waste Management Process:

Daffodil International University (DIU) has been using organic waste management program where the organic waste of the university is used to produce gas, power and composting through its biogas plant which reduces the consumption of national electricity and gas along with chemical pesticides use in green plantation and vegetation in the campus.

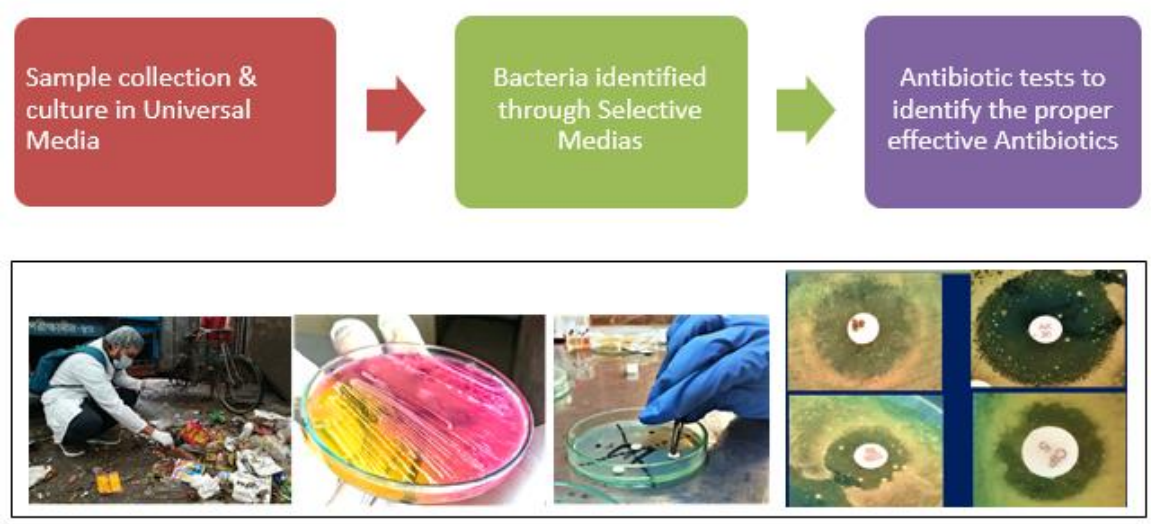
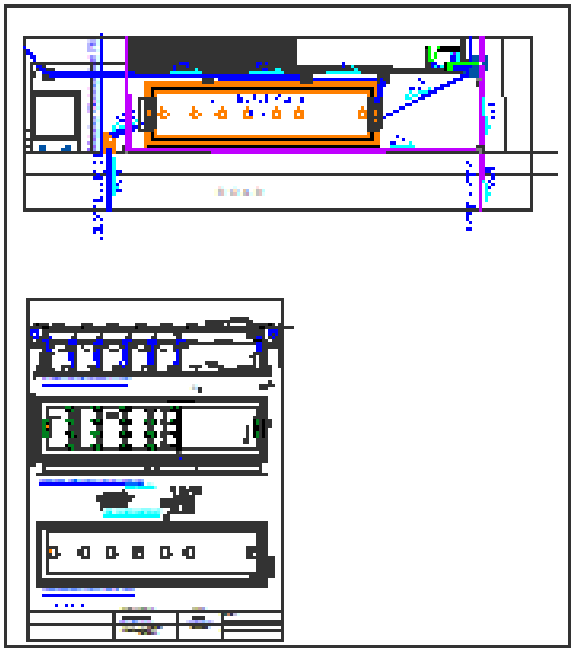


Fig: Project on Municipal Organic waste management at different locations of Dhaka city

Fig: Organic waste management and reusing program, Daffodil International University

7.2. Sewerage Disposal System at DIU:



The diagram is an Architectural Design of the Sewage Treatment Plant (STP) of a multistoried building of the permanent campus of Daffodil International University. The 3D image of the AutoCAD system was converted to a 2D image to fit with the online data submission portal of UI Green Metric system. The plant is established to facilitate

filtering of the harmful substances of the waste received from the domestic uses of the buildings and discharging into the water bodies of the campus for possible reuses.

Daffodil International University has been striving to do Sewerage Disposal with appropriate treatment so that it does not harm the environment. It has been using this Sewerage Disposal system/model which is helpful for the environment and sustainability concern.

7.3. Inorganic Waste Management

DIU has also been using inorganic waste management program where reusable wastes are being reused at the campus through transformation & innovations. It has a planning to utilize the other non-reusable waste materials to produce fuel oil, carbon black and combustible gas.

The Department of Environmental Science and Disaster Management of DIU is implementing the Web Application-based Inorganic Waste Management Project through the web-based application 'Save the Environment'

The Biomass powered Eco Sustainability Village Model is ready for operation at the green campus of DIU (Ashulia campus)

Fig: Inorganic waste management, recycling and re-use Program for Daffodil International University

Website link for the activity is given below:
https://safeenvironment.github.io/

Web Application-based Inorganic Waste Management Project

The Biomass powered Eco Sustainability Village Model is ready for operation at the campus

Plastic Bin (Reusing Plastic Bottle)

Plastic Sitting Tool (Reusing Plastic Bottle)

7.4. Toxic Waste Handled

Example of Toxic Waste Handled (Daffodil International University, Bangladesh)

8. CONCLUSION

As a higher education institution, Daffodil International University (DIU) is committed to respond to this universal call for SDGs and take actions to comply with the United Nation's endeavor and to support the Government of Bangladesh for achievement of desired outcomes. In this regard, DIU is working closely with the Government, private sector, NGOs, civil society and citizens jointly for implementation of SDGs and to make sure that a better and sustainable planet can be created for the future generations.

Daffodil International University has been striving to make a footprint in this arena through its contributions towards sustainable development initiatives. The report highlighted the initiatives, activities, achievements and implemented projects related to clean water and sanitation.