MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

(Formerly WEST BENGAL UNIVERSITY OF TECHNOLOGY)

Main Campus: NH 12, Haringhata, Post Office - Simhat, Police Station – Haringhata, Pin - 741249 City Campus: BF-142, Sector -I, Salt Lake, Kolkata -700 064

GREEN AUDIT

2022

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Certificate of Green Audit

This is to certify that the green audit was conducted by Department of Environmental Science, Maulana Abul Kalam Azad University of Technology in accordance with the applicable standards prescribed by the Central Pollution Control Board and Ministry of Environment, Forests and Climate Change, Government of India. The audit has assessed the quality of water and soil in the campus along with fuel consumption, carbon footprint, water management, waste management, green cover, renewable energy resources, sewage water treatment facility, rain water harvesting and ground water recharge facilities in the campus. The audit gives an 'Environment Management Plan' which the university can follow to reduce fuel and water consumption, also follow environment friendly waste disposal methods and improve on other environmental indicators. The complication of data on environmental indicators was made on the basis of best of information given to us amid Covid-19 pandemic conditions. This green audit gives a true and fair view in conformity with environmental auditing principles accepted in India.

Dr. Chabita Saha
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Executive Summary

The university campus at Haringhata has been planned and designed to meet sustainable environmental standards. With growing awareness of environmental pollution and its hazards it has become necessary to take measures to make the university campus an Eco campus. In day to day operation of the university there is utilization of mass resources and waste discharge into the environment, which is a concern and to neutralize this certain steps are taken by the university. The green auditing of university campus at Haringhata enables to assess if measures taken by university are sufficient to make the campus environment friendly. This is the first attempt to conduct green auditing of the university campus at Haringhata. This audit is mainly focused on greening indicators like fossil fuel, quality of soil and water, vegetation, waste management practices and carbon foot print of the campus etc. To start with a questionnaire survey was conducted via Google sheets to know about the means of transport of the faculty and staff, kilometers travelled and fuel consumed. Google sheets were also used to know about laboratory waste etc. In order to assess the quality of water and soil, water and soil samples were collected from different locations of the university campus and analysed for its parameters. Collected data was grouped, tabulated and analyzed. Finally a report pertaining environmental management plan with strength, weakness and suggestion on the environmental issue of campus are documented.

Introduction

Maulana Abul Kalam Azad University of Technology (MAKAUT), West Bengal is the nodal University which provides affiliation to more than 200 Colleges spread throughout the state. It is offering courses in Engineering & Technology, Pharmacy, Architecture, Management, Applied & Social Sciences. The courses offered by the University are approved by the All India Council for Technical Education (AICTE) and UGC. The University started functioning from the State Archive Building at Shakespeare Sarani and later migrated to its Salt Lake campus at BF 142, Sector I, Salt Lake, Kolkata. It is now carrying out its academic and administrative activities from its sprawling new academic campus of 40 acres located at Haringhata, Nadia. This main campus was inaugurated by the Hon'ble Chief Minister of West Bengal in 2018. This new campus has a lush green campus ideal for carrying out varied academic activities.

Vision of the University

To achieve the status of a globally ranked premier University in the field of Science, Technology, Pharmacy, Architecture, Management and interdisciplinary areas for the creation of high-calibre professionals with environmental consciousness, social, moral and ethical values along with the competency to face the new challenges of rapid technological advancements.

Mission of the University

- To impart quality and value based teaching & learning of international standard for solving the real life problems
- To create and disseminate knowledge both nationally & internationally towards the transformations of the civilization into a knowledge based society
- To institutionalize the extension and field outreach activities with a view to transform the university system into an active instrument for social change
- To develop liaison and collaboration with the globally recognised academic institutions in order to inject new and fresh thinking in teaching, learning and research

To generate intellectually capable and imaginatively gifted professionals and successful entrepreneurs having environmental consciousness and ethics who can work as individual or in group in multi-cultural global environments for continuing significantly towards the betterment of quality of human life

Green Audit is a process of systematic identification, quantification, recording, reporting and analysis of components of environmental diversity of various establishments. It aims to analyze environmental practices within and outside of the concerned sites, which will have an impact on the eco-friendly ambiance. The main objective of Green Audit at Maulana Abul Kalam Azad University of Technology is to make a complete assessment of the environmental indicators in the campus and make recommendations for implementation in the campus for better environmental management.

Objectives in brief:

1. To ensure that the university does all environmental activities in compliance with existing laws and regulations
2. To assess the quality of the water and soil in the university campus
3. To calculate the fuel used for conveyance to the university and other needs
4. Estimation of the carbon foot print of the university on a full attendance day
5. Evaluation of the measures implemented by university in reducing the Carbon Footprint
6. To monitor the liquid and solid waste generation and their disposal methods in the campus
7. To assess whether day to day activities in the university support collection, recovery, reuse and recycling of solid and liquid waste.
8. To identify the gap areas and suggest recommendations to improve the Green Campus status of the university.
9. Providing a database for corrective actions and future plans.

1. *General steps involved in Green Audit*

a. Systematic and exhaustive data collection for carbon foot print and other environmental indicators

b. On site visit for assessing the status of the green cover of the university, waste management practices and energy conservation strategies etc. The sample collection (water, soil) will be carried out during the visits

c. Evidence based documentation of green activities like rain water harvesting, ground water recharge pits , sewage treatment plant and renewable energy measures

d. Regular monitoring of air, water and soil quality, carbon foot print etc.

e. Provide standards and methods for improvement by establishing cost effective green action plan.

Figure 1.1 Process of green auditing

Figure 1.2 Scope of the green audit for 2022

2. Auditing for Green Campus Management

It is essential to audit the fuel use in campus in form of LPG, Generators and also amount used in conveyance as one litre of fuel emits 2.3 Kg of CO_2. This will give estimate of carbon foot print of all members of the university. To make campus carbon neutral measures have been taken by the university.

Trees play an important ecological role within the urban environment, as well as support improved public health and provide aesthetic benefits to campuses. In one year, a single mature tree will absorb up to 48 pounds of carbon dioxide from the atmosphere, and release it as oxygen. The amount of oxygen released by the trees of the campus is good for the students and staff in the campus. We need to realize the importance of trees in and around the campus as they significantly contribute towards making the air cleaner for us. The Haringhata campus sustains a luxuriant plant diversity ranging from trees, grasses, herbs, shrubs, creepers ornamental plants, palm and seasonal flowers. Some of the plants are massively destroyed by the recent cyclonic events

2.1 Auditing for Carbon Footprint

Fossil fuels (such as petrol, diesel) contribute significantly to environmental pollution through emission of greenhouse gases into the atmosphere mainly as carbon dioxide. Vehicular emission is the main source of carbon emission in the campus, hence to document the various means of transportation that is practiced by the university members is important.

Carbon foot print analysis

1 Total number of Students – 1813

2 Total number of Faculty – 131

3 Number of staff – 185

4 Total number of vehicles used by the stakeholders of the university -- 16/day

5 No of cycles used in the campus - 10

6 No of two wheelers used (average distance travelled and quantity of fuel and amount used per day)- 2 Faculty and 10 staff (8.0 L/day)

7 No of cars used (average distance travelled and quantity of fuel and amount used per day)- 9 by faculty (57 L/day) , 1 staff (2 L/day)

8 No of persons using public transportation- 36 faculty and 60 staff

9 No of persons using university conveyance- 31 faculty and 98 staff. For three buses total fuel used is 58 L/day

10 No of generators used per day- 2, fuel used 6.66 L/day. CO_2 emission 15.33 Kg/day

11 Amount of fuel used- 125 L/day. Average per user 0.55 L/day for transport

12 Number of LPG cylinders used in canteen/labs- 64 cylinders consumed/month or 17L/day. Total CO_2 emission is 1.5 Kg x 17 = 25. 5 Kg/day

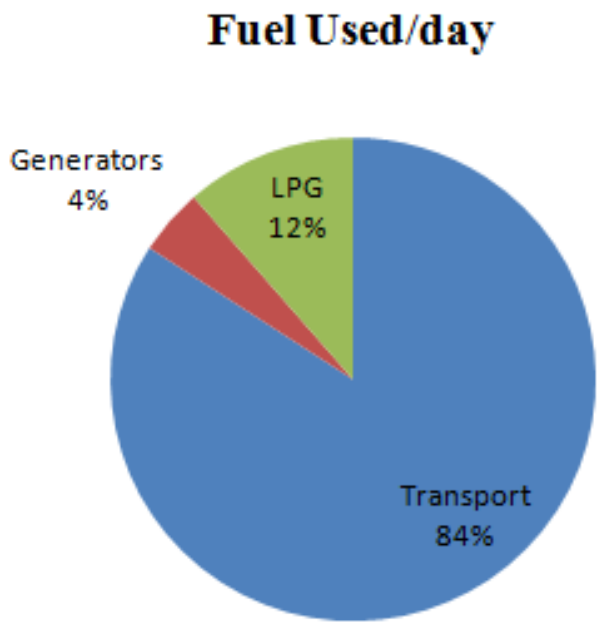

Figure 2.1 Fuel use/day in %

Recommendations to reduce the use of fuel

Average fuel used 0.55 L/day by faculty and staff which is healthy indicator for contribution towards carbon dioxide emission. As known 1 L of fuel emits 2.3 Kg of CO_2, so on average carbon foot print for each faculty and staff is 1,26 Kg of CO_2 in travel, which can be further reduced if more of us use the university conveyance or public transport. However, the audit reflects most of them use public transport. Total CO_2 released by adding transport, generators and LPG is 328.33 Kg/day. However, in the campus released CO_2 is 40.83 Kg from LPG and generators. This measurement is excluding the natural emission of CO2 by human by breathing (i.e. 1.140 Kg/day). To neutralize this carbon emission we need more green cover and put curbs on entry of outside vehicles.

3. Assessment of the green cover of the university campus

3.1 Total number of plant species 15

3.2 Total number of plants in the campus 3000

Table 3.1 List of major tree species planted in the university campus

Sl. No.	Plants' Variety	Common Name	Scientific Name	NOs	Benefits
1.	Bael	Indian Bael	*Aegle marmelos*	400	Bael is loaded with a myriad of nutrients which include vitamins A, B1, B2, C and minerals calcium, potassium and iron. It is also beneficial in treating tuberculosis, hepatitis, ulcer and digestive problems. Furthermore, it is also a good source of tannins which aid in treating cholera.
2	Neem	Margosa	*Azadirachta indica*	200	Neem leaf is used for leprosy, eye disorders, bloody nose, intestinal worms, stomach upset, loss of appetite, skin ulcers, diseases of the heart and blood vessels (cardiovascular disease), fever, diabetes, gum disease (gingivitis), and liver problems. The leaf is also used for birth control and to cause abortions.
3	Chattim	Devil tree	*Alstonia scholaris*	500	The bark is known as ditabark, used as traditional medicine to treat diarrhea, dysentery, asthma, and a few types of fevers.
4	Chalta	Elephant Apple	*Dillenia indica*	300	Treats hypertension symptoms, rejuvenates ageing skin, boosts vitality and vigour, remedies kidney disorders, alleviates anxiety and depression, enhances eyesight, remedies diarrhea, soothes sore throat.
5	Jam (desi)	Berry	*Syzygium cumini*	300	Improves hemoglobin count, loaded with vitamin C and iron, jamun

					increases hemoglobin level, improves health of skin and eyes, keeps heart healthy, strengthens gums and teeth, treats diabetes.
6	Jam (grafting)			100	-do-
7	Kanthal	jack fruit	*Artocarpus heterophyllus*	200	Help to prevent diseases like cancer and heart disease, as well as eye problems like cataracts and macular degeneration. Jackfruit also contains many other antioxidants that can help delay or prevent cell damage in human body.
8	Aam (grafting)	Mango	*Mangifera indica*	400	The tender leaves of the mango tree contain tannins called anthocyanidins, which help in treating early diabetes. Mangoes are a good source of fiber and antioxidants, including vitamin C, which means they support a healthy immune system and may fight chronic and inflammatory diseases.
9	Kadam	Kadamba	*Neolamarckia cadamba*	200	Kadamba is used as anti-hepatotoxic, antimalarial, antimicrobial, wound healing, antioxidant, anthelmintic, analgesic, anti-inflammatory, antipyretic, diuretic and laxative.
10	Bakul	Bakul	*Mimusops elengi*	100	The tender leaves of Bakul or the unripe fruit of the plant is chewed to treat bleeding from the gums and gingivitis. The cold infusion or decoction prepared from the bark of the stem is given to treat diarrhea and intestinal worms.
11	Kul	Chinese date	*Ziziphus mauritiana*	200	High in antioxidants. rich source of flavonoids, polysaccharides, and triterpenic acids, regulate the blood flow in the body and maintain a

					good heart health. Iron helps in improving the hemoglobin count which in turn prevents anemia, help in digestion and constipation.
12	Campus beautification plants (fox tail palm and others)----------100	foxtail palm	*Wodyetia bifurcata*	100	Beside beauty benefits and aesthetic uses it has been used in herbal purposes.
13		Rose	*Rosa indica*		Reduces inflammation of the eyes and skin, soothes sore throats and coughs, promotes restful and peaceful sleep, cools the gastrointestinal tract, soothes nervous, angry and sad emotions. Rose petals may reduce wrinkles and slow down skin aging.
14		Chamomile	*Matricaria chamomilla*		Chamomile is a wonderful herb for relaxation and sleep, which is why it's so popular as an evening tea. As a nervine herb, it also helps to relieve stress and anxiety. Beyond tea, it also has powerful aromatherapy benefits for relaxation and stress.

Analysis and Recommendations

Total trees in the campus are 3000, which can absorb 3000 x 0.0000019 Kg/day CO_2 which is =0.0057 kg/day. However, in the campus released CO_2 is 40.83 Kg from LPG and generators**.** So we need more carbon sinks in the campus. We have water body in the campus; also some small plants are there which along with good quality soil can serve to partially sequester the excess CO_2 in campus and contribute towards carbon neutralisation. A carbon positive environment suggests, plantation of more trees and small plants in the campus. Use of LPG and generators can be minimized by using alternative energy sources.

4. Soil Quality Assessment

Soil analysis is a very valuable tool in nutrient management. Most importantly, it enables us to determine the proper amount of nutrients that should be added to a given soil according to its fertility needs. This can help in improving crop production; protect the environment from contamination by runoff and leaching of excess fertilizers. Soil is a key compartment for climate regulation as a source of greenhouse gases (GHGs) emissions and as a sink of carbon. Thus, soil carbon sequestration strategies should be considered alongside reduction strategies for other greenhouse gas emissions. In India, about 28 to 30 Mt of nutrients (N, P, K) are removed from the soil whereas, 18 to 20 Mt are added through all sources, leaving a deficit of about 10 Mt yearly. Therefore, management of organic and mineral fertilizers is, advocated to meet the nutrient needs, improve soil quality, and to obtain sustainable and higher yields.

Table 4.1 Soil Quality assessment with samples near Biotech Building and Guest House

Customer Name	: MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB (Formerly West Bengal University of Technology)			**Report No.**	: SS/22(02)/01
				Report Date	: 14-02-2022
Address	: NH -12, Haringhata, P.O. - Simhat, P.S. - Haringhata Pin - 741249			**Sampling Date**	: 07-02-2022
				Sample Received Date	: 07-02-2022
				Sample Id No.	: SS/22(02)/01
Type of Sample	: **Soil**			**Test Start Date**	: 10-02-2022
Sampling Location	: **Biotech (MAKAUT)**			**Test End Date**	: 13-02-2022
SL No.	**PARAMETER TEST**	**UNIT**	**STANDARD AGAINST WHICH TEST ARE PERFORMED**		**RESULT**
1	pH at 25°C	--	IS 2720 (Part 26) : 1987 (RA 2016)		8.49
2	Total Kjeldahl Nitrogen (TKN)	mg/kg	IS 14684 : 1999 (RA 2014)		1636.8
3	Total Organic Carbon (TOC)	% (w/w)	IS 2720 (Part 22) : 1972 (RA 2015)		0.73
4	Phosphate ($PO_4^{\equiv}$ P)	mg/kg	In-House Method SOP No SOP/03/24 Issue No. 02 Dated 01/01/2018		2062.0

Customer Name	: MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB (Formerly West Bengal University of Technology)			**Report No.**	: SS/22(02)/02
				Report Date	: 14-02-2022
Address	: NH -12, Haringhata, P.O. - Simhat, P.S. - Haringhata Pin - 741249			**Sampling Date**	: 07-02-2022
				Sample Received Date	: 07-02-2022
				Sample Id No.	: SS/22(02)/02
Type of Sample	: **Soil**			**Test Start Date**	: 10-02-2022
Sampling Location	: **Guest House (MAKAUT)**			**Test End Date**	: 13-02-2022
SL No.	**PARAMETER TEST**	**UNIT**	**STANDARD AGAINST WHICH TEST ARE PERFORMED**		**RESULT**
1	pH at 25°C	--	IS 2720 (Part 26) : 1987 (RA 2016)		8.47
2	Total Kjeldahl Nitrogen (TKN)	mg/kg	IS 14684 : 1999 (RA 2014)		1403.1
3	Total Organic Carbon (TOC)	% (w/w)	IS 2720 (Part 22) : 1972 (RA 2015)		0.34
4	Phosphate ($PO_4^{\equiv}$ P)	mg/kg	In-House Method SOP No SOP/03/24 Issue No. 02 Dated 01/01/2018		1554.0

Analysis and recommendations

The carbon content in the top soil is less than 0.5 % which is not a good indicator. Measures need to be taken to increase it at least to 3.0 %. 500-800 mg/Kg is standard soil phosphate and the samples of campus have between 1000-2000 mg/kg which will hinder plant growth and uptake of micro nutrients by plants. The nitrogen content is also high against standard requirement of 5.0 to 10.0 mg/kg. High nitrogen could come from sewage contamination etc. The nitrogen content also needs to be balanced. It can be suggested here to measure the nitrogen content in STP water which is being used for gardening purposes. Measures to increase the soil fertility should be immediately taken for healthy plant growth and sustainability of plant life.

5. Auditing of Water Management

Water is a natural resource; all living organisms depend on water. While freely available in many natural environments, in many human settlements potable (drinkable) water is less readily available. Groundwater depletion and water contamination is a serious concern in recent times. Hence it is essential to examine the quality and usage of water in the university. A water audit is a qualitative and quantitative review of water consumption to find opportunities for water conservation, reuse, and recycling. It also identifies water conservation opportunities by identifying inefficiencies in the water distribution system. Water losses due to various uses in the system or any utility must be measured in order to adopt water conservation measures in such a facility.

To make the University a Zero discharge campus, a STP plant having capacity of 120 MLD has been installed and the treated water is being used in gardening, washing of the campus and also for cleaning vehicles, resulting savings of huge quantity of underground water. Moreover, the solid wastes of the plant after filter press are used as manure. Hence, no waste is discharged on the surface

Table 5.1 Water Management Details

SL NO	PARAMETERS	Response
1	Source of water	P.H.E
2	No of Wells	2
3	No of motors used	2
4	Horse power – Motor	5 HP
5	Depth of well –Total	150.00 m
6	Water level	10 feet
7	Number of water tanks	79
8	Capacity of tank	39500 L
9	Quantity of water pumped every day	30,000 L
10	Any water wastage	No
11	Water usage for gardening	Yes
12	Waste water sources	STP
13	Use of waste water	gardening
14	Faith of waste water from labs	No
15	Whether waste water from labs mixed with groundwater	No
16	Any treatment for lab water	No
17	Whether any green chemistry method practiced inlabs	No
18	No of water coolers	15
19	Rain water harvest available?	Yes, in recharge pit
20	No of units and amount of water harvested	Nil
21	Any leaky taps	No
22	Amount of water lost per day	
23	Any water management plan used?	STP
24	Are there any signs reminding peoples to turn off the water?	Yes

Table 5.2 Details of water analysis in the university on a working day

	Average use per activity in liters	Number of Activity/day	Water Use/person/day	Number of persons using water	Total Water consumption/day (L)
Toilet flush	5322.5	2	5.0	2129	10,645
Leaking/dripping	NA				
Garden use	15,000	1			15,000
Cooking (average)	5000	2	5000/canteens	2 canteens	10,000
CleaningFloor	500	1	167/building	3 buildings	500
Cleaning university bus	120	1	40/bus	3	120
Lab uses	1000	1	2	500	1000
Washing hands andface	2129	2	1	2129	4258
Washingclothes	12,750	1	15	850	12,750
Bath	8500	1	10	850	8500

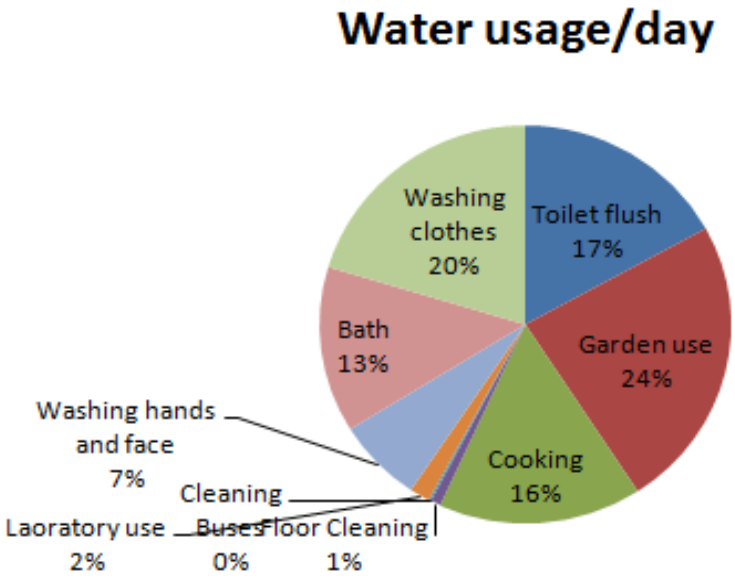

Fig 5.1 Water Usage Chart in %

5.1 *Water quality assessment of STP out put*

Table 5.3 STP water analysis report

Customer Name : MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB (Formerly West Bengal University of Technology) **Address** : NH -12, Haringhata, P.O. - Simhat, P.S. - Haringhata Pin - 741249 Type of Sample : **Effluent Water** Sampling Location : **STP Outlet (MAKAUT)**					**Report No.** : W/22(02)/04 **Report Date** : 14-02-2022 **Sampling Date** : 07-02-2022 **Sample Received** : 07-02-2022 **Sample Id No.** : E/22(02)/04 **Test Start Date** : 08-02-2022 **Test End Date** : 13-02-2022
Sl. No.	**Chemical Test Parameter**	**Unit**	**Results**	**Genl.Std.for Discharge of Env.Pollutants in Inland Surface water Limit as per CPCB Norms**	**Methods of Test (Reference)**
1	pH	--	7.95	5.5 -9.0	APHA (23rd Edition) 2017 : 4500 H+B
2	Total Suspended Solid (TSS)	mg/l	6.5	100.0	APHA (23rd Edition) 2017 : 2540 D
3	Chemical Oxygen Demand (COD)	mg/l	70.0	250.0	APHA (23rd Edition) 2017 : 5220 B
4	Bio-Chemical Oxygen Demand (BOD)	mg/l	12.0	30.0	IS 3025 (Part 44) : 1993 (RA 2014)
5	Oil & Grease	mg/l	<5.0	10.0	APHA (23rd Edition) 2017 : 5520 B

5.2 *Water quality assessment of campus water supply*

Table 5.4 Aqua Guard water of Academic and Biotech buildings

Customer Name : MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB		**Report No.**	: W/22(02)/02
(Formerly West Bengal University of Technology)		**Report Date**	: 14-02-2022
Address : NH -12, Haringhata, P.O. - Simhat, P.S. - Haringhata		**Sampling Date**	: 07-02-2022
Pin - 741249		**Sample Received Date**	: 07-02-2022
		Sample Id No.	: DW/22(02)/02
Type of Sample : **Potable Water**		**Test Start Date**	: 08-02-2022
Sampling Location : **Academic Building Aqua Guard (MAKAUT)**		**Test End Date**	: 13-02-2022

Sl. No.	**Parameters Tested**	**Unit**	**Results**	**LIMIT as per IS:10500:2012**		**Methods of Test (Reference)**
				Requirement (Acceptable Limit)	**Permissible Limit in the Absence of Alternate Source**	
1	pH	--	7.83	6.5-8.5	No	APHA (23rd Edition) 2017 : 4500 H+B
2	Acidity	mg/l	NIL	--	--	APHA (23rd Edition) 2017 : 2310 B
3	Salinity	ppt	0.029	--	--	APHA (23rd Edition) 2017 : 2520 B
4	Dissolved Oxygen (DO)	mg/l	5.58	--	--	APHA (23rd Edition) 2017 : 4500-O C
5	Total Dissolved Solids (TDS)	mg/l	460.0	500.0	2000.0	APHA (23rd Edition) 2017 : 2540 C
6	Conductivity at 25°C	µS/cm	740.0	--	--	APHA (23rd Edition) 2017 : 2510 B
7	Total Alkalinity (as $CaCO_3$) (as $CaCO_3$)	mg/l	356.2	200.0	600.0	APHA (23rd Edition) 2017 : 2320 B
8	Total Hardness (as $CaCO_3$)	mg/l	276.6	200.0	600.0	IS : 3025 (Part-21) 2009 (RA 2014)
9	Chloride (as Cl)	mg/l	16.1	250.0	1000.0	APHA (23rd Edition) 2017 : 4500 Cl B
10	Total Coliform	MPN/100ml	<1.1*	Shall not be detectable in any 100 ml sample		APHA (23rd Edition) 2017 : 9221 B & C

Customer Name : MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB		**Report No.**	: W/22(02)/03
(Formerly West Bengal University of Technology)		**Report Date**	: 14-02-2022
Address : NH -12, Haringhata, P.O. - Simhat, P.S. - Haringhata		**Sampling Date**	: 07-02-2022
Pin - 741249		**Sample Received Date**	: 07-02-2022
		Sample Id No.	: DW/22(02)/03
Type of Sample : **Potable Water**		**Test Start Date**	: 08-02-2022
Sampling Location : **Biotech Building Aqua Guard (MAKAUT)**		**Test End Date**	: 13-02-2022

Sl. No.	**Parameters Tested**	**Unit**	**Results**	**LIMIT as per IS:10500:2012**		**Methods of Test (Reference)**
				Requirement (Acceptable Limit)	**Permissible Limit in the Absence of Alternate Source**	
1	pH	--	8.14	6.5-8.5	No	APHA (23rd Edition) 2017 : 4500 H+B
2	Acidity	mg/l	NIL	--	--	APHA (23rd Edition) 2017 : 2310 B
3	Salinity	ppt	0.035	--	--	APHA (23rd Edition) 2017 : 2520 B
4	Dissolved Oxygen (DO)	mg/l	5.42	--	--	APHA (23rd Edition) 2017 : 4500-O C
5	Total Dissolved Solids (TDS)	mg/l	285.0	500.0	2000.0	APHA (23rd Edition) 2017 : 2540 C
6	Conductivity at 25°C	µS/cm	460.0	--	--	APHA (23rd Edition) 2017 : 2510 B
7	Total Alkalinity (as $CaCO_3$) (as $CaCO_3$)	mg/l	195.8	200.0	600.0	APHA (23rd Edition) 2017 : 2320 B
8	Total Hardness (as $CaCO_3$)	mg/l	150.5	200.0	600.0	IS : 3025 (Part-21) 2009 (RA 2014)
9	Chloride (as Cl)	mg/l	19.1	250.0	1000.0	APHA (23rd Edition) 2017 : 4500 Cl B
10	Total Coliform	MPN/100ml	<1.1*	Shall not be detectable in any 100 ml sample		APHA (23rd Edition) 2017 : 9221 B & C

Table 5.5 Tap water from Academic building

Customer Name : MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB (Formerly West Bengal University of Technology)		**Report No.**	: W/22(02)/01
		Report Date	: 14-02-2022
Address : NH -12, Haringhata, P.O. - Simhat, P.S. - Haringhata Pin - 741249		**Sampling Date**	: 07-02-2022
		Sample Received Date	: 07-02-2022
		Sample Id No.	: DW/22(02)/01
Type of Sample : **Potable Water**		**Test Start Date**	: 08-02-2022
Sampling Location : **Academic Building Supply Tap (MAKAUT)**		**Test End Date**	: 13-02-2022

Sl. No.	Parameters Tested	Unit	Results	LIMIT as per IS:10500:2012		Methods of Test (Reference)
				Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	
1	pH	--	7.59	6.5-8.5	No	APHA (23rd Edition) 2017 : 4500 H+B
2	Acidity	mg/l	NIL	--	--	APHA (23rd Edition) 2017 : 2310 B
3	Salinity	ppt	0.031	--	--	APHA (23rd Edition) 2017 : 2520 B
4	Dissolved Oxygen (DO)	mg/l	5.50	--	--	APHA (23rd Edition) 2017 : 4500-O C
5	Total Dissolved Solids (TDS)	mg/l	468.0	500.0	2000.0	APHA (23rd Edition) 2017 : 2540 C
6	Conductivity at 25°C	µS/cm	750.0	--	--	APHA (23rd Edition) 2017 : 2510 B
7	Total Alkalinity (as $CaCO_3$) (as $CaCO_3$)	mg/l	359.3	200.0	600.0	APHA (23rd Edition) 2017 : 2320 B
8	Total Hardness (as $CaCO_3$)	mg/l	281.3	200.0	600.0	IS : 3025 (Part-21) 2009 (RA 2014)
9	Chloride (as Cl)	mg/l	17.2	250.0	1000.0	APHA (23rd Edition) 2017 : 4500 Cl B
10	Total Coliform	MPN/100 ml	<1.1*	Shall not be detectable in any 100 ml sample		APHA (23rd Edition) 2017 : 9221 B & C

Analysis and Recommendations

From The water usage pie chart in figure 4.1, it is evident that maximum water is used in gardening and this water comes from our installed Sewage Treatment Plant (STP) in the campus. In this way we save lots of water by recycle of sewage water. Next is consumption of fresh water in flushing, which can be saved if the STP water is used for flushing toilets also. In the hostel washing machines can be used to wash clothes to save water and water again can be purified for reuse. The water analysis report of STP suggests the STP is functioning at its best efficiency as all the parameters listed in table 4.1 are within the permissible limits. It can be used for gardening car washing and in future for flushing in toilets.

The Tap water and the aqua guard water samples in the campus are very safe for drinking as the parameters listed in tables 4.2 and 4.3 are within permissible limits.

Rainwater harvesting measures are taken in the campus. There is water body created to replenish ground water and also there is water pit of 8 inches diameter and depth of 12 meters to direct the water to the aquifer layer in the ground.

6. *Solid Waste Management Audit*

Importance of solid waste management

- Unavailability of proper waste management practices may lead to environmental pollution
- A waste management audit helps educational institutes to efficiently and responsibly dispose of the waste that is generated every day
- By designing a more efficient waste disposal program through a waste audit, we can enhance recycling practices
- On-going cost savings by recycle and reuse of some waste
- Identification of new sources of revenue
- Improved resource efficiency
- Improved environmental performance

Different kinds of wastes are generated from the different sources in the university. The quality and quantity of the wastes are primarily controlled by the source of their generation. Waste generated in the university with huge number of students along with significant number of teaching and non-teaching staff requires to be managed with proper strategies.

6.1 Waste Management Details

Table 6.1 Approximate quantity of solid waste generated per day (in kg)

Offices			
Approx in kg/day	Biodegradable	Non - biodegradable	Others
	1	3	0.5

Laboratories				
Approx in kg/day	Biodegradable	Non - biodegradable	Hazardous	Others
	2	10 (glass and plastic) average in 10 labs	1	1

Canteen/kitchen				
Approx in kg/day	Biodegradable	Non - biodegradable	Hazardous	Others
	22.0 When hostels are fully occupied	1.0	None	No food waste recorded

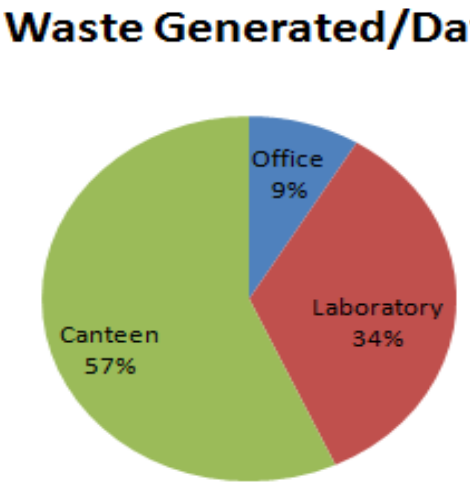

Fig 6.1 Waste generated/day chart in %

Table 6.2 How the solid waste generated in the university is managed?

Composting/ Vermi composting	Yes/ No	Remark
Recycling	Yes	Vermi composting in consideration
Reusing	Yes	Many lab ware are reused

Table 6.3 Waste generated in the university and their disposal

Types of waste	Particulars	Disposal method
E-Waste	Computers, electrical and electronic parts	Direct selling
Plastic waste	Pen, Refill, Plastic water bottles and other plastic containers, wrappers etc	Direct selling
Solid wastes	Damaged furniture, paper waste,paper plates, food wastes	Reuse after maintenance Or diposal
Chemical wastes	Laboratory waste	Neutralise with water and allowed to flow into drain
Waste water	Washing, urinals, bathrooms	Soak pits
Glass waste	Broken glass wares from the labs	Direct selling
Waste from kitchen and Sanitary Napkin	-	Collected by Haringhata Municipal corporation

Do you use recycled paper in university?	Yes
Any waste management methods used?	No

Analysis and Recommendations

From the pie chart in figure 5.1, it is evident that kitchen waste is the maximum/day and it could be easily very composted and used as manure in the university garden. In this way we can avoid disposing to the municipal waste.

The amount of E-waste, Plastic waste and chemical waste was found to be generated approximately within 1 kg limit per day. The chemical waste generated on the campus through science laboratories is in both solid form and liquid form. Usually, there is a practice in the laboratories to store these hazardous chemicals in containers and cans for safe disposal. E-waste generated in the university is handled, treated, and disposed of scientifically. Generation of solid waste per day was comparatively with a range between 1 to 20 kg, of which kitchen waste is the maximum. Here the recommendations are to have a vermicompost

pit to convert the kitchen and garden waste to useful manure for the garden. Hazardous waste generated is disposed according to environmental regulations. Plastic waste, biomedical waste and chemical wastes are collected by the municipality and finally disposed of at the municipal waste disposal site. Solid wastes are stored in the septic tank and are collected by the municipality at regular intervals. Wastewater from the master pit is released directly to the municipal drainage canal. E-waste is directly sold for recycling and reuse. The recommendations here are to make the campus plastic free and not to dispose plastic into municipality waste. Also different coloured dustbins should be installed at various points in the campus to segregate paper, biodegradable and plastic and other non-biodegradable waste.

7. Renewable Energy

The university took some serious initiatives for moving towards the renewable energy sources considering the pollution due to huge carbon emission and subsequent climate change. Solar Power Plant installation of capacity 50 KW is complete and target is 135 KW costing Rs 60 to 70 lakhs and once commissioned 20%-25% energy will be saved from present consumption and will significantly contribute towards reduced carbon foot print.

8. Routine Green Practices

Every year university celebrates World Environment Day and World Water Day in the campus. Many plants are planted on this day every year, in this way we are exceeding the plant count every year. The main focus of these programs is to provide awareness to the students about the importance of the environment, its conservation and sustainable use of environmental resources. The programs are conducted through seminars, poster presentations; debates etc. organized by the college connect of MAKAUT and Department of Environmental Science. Already we have STP installed in the campus, also measures are taken for rain water harvesting. Installation of vermicompost and bio gas plant is under consideration for reuse of kitchen and other biodegradable waste.

Rainwater harvesting measures are taken in the campus. There is water body created to replenish ground water and also there is water pit of 8 inches diameter and depth of 12 meters to direct the water to the aquifer layer in the ground


Solar Power Plant installation of capacity 135 Kwp is under process costing Rs 60 to 70lakhs and once commissioned 20%-25% energy will be saved from present consumption

To make the University a Zero discharge campus, a STP plant having capacity of 120 MLD has been installed and the treated water is being used in gardening, washing of the campus and also for cleaning vehicles, resulting savings of huge quantity of underground water. Moreover, the solid wastes of the plant after filter press are used as manure. Hence, no waste is discharged on the surface.

Every year university celebrates World Environment Day and World Water Day in the campus. Many plants are planted on this day every year, in this way we are exceeding the plant count every year

Acknowledgements

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