

Reducing Waste, Renewing Sustainability, Manipal University Jaipur Measures and Maximizes Recycling Across Campus

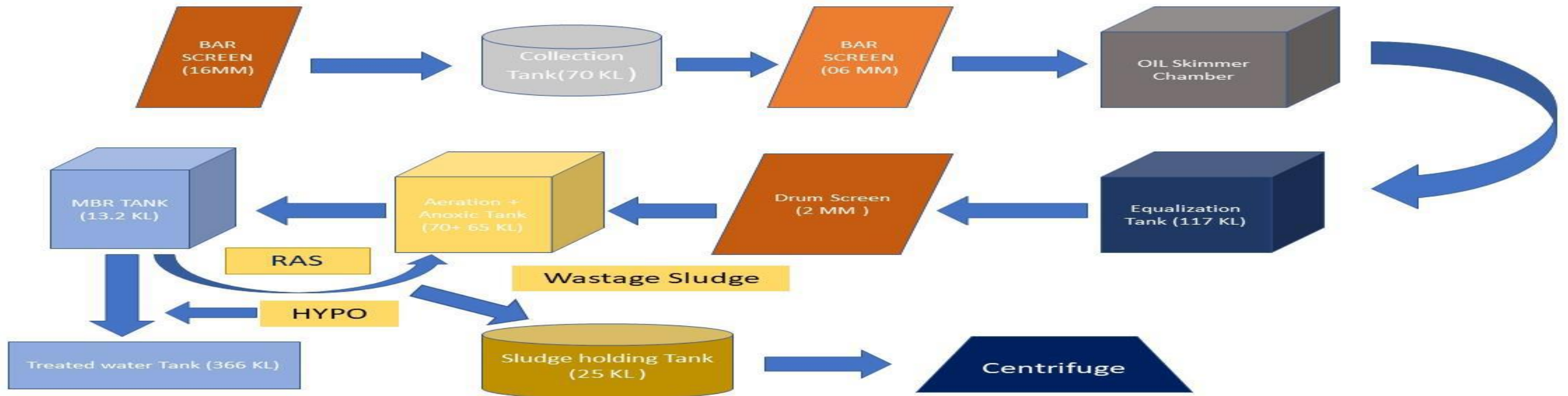
Manipal University Jaipur's commitment to sustainability goes beyond the classroom, extending to every aspect of campus life. The measures put in place to monitor and reduce waste generated while maximizing recycling efforts are a testament to the university's dedication to environmental stewardship. By setting ambitious targets, promoting waste reduction at the source, enhancing recycling infrastructure, collaborating with local partners, and fostering innovation, Manipal University Jaipur is paving the way for a greener, more sustainable future.

To effectively address waste reduction and recycling, Manipal University Jaipur began with a thorough waste audit and assessment. This process involved analyzing the types and quantities of waste generated across campus. This step served as a baseline, providing essential data to identify areas where improvements could be made. Manipal University Jaipur understands that to make a real impact, concrete goals must be set. Therefore, the university established ambitious targets for waste reduction and recycling. These targets are specific, measurable, and aligned with the broader sustainability goals of the institution. A fundamental principle of Manipal University Jaipur's approach is to reduce waste at its source. This involves raising awareness and encouraging the campus community to adopt sustainable practices. The university has launched awareness campaigns, educated students and staff on the benefits of waste reduction, and promoted the use of reusable items, reducing the demand for disposable ones. To maximize recycling efforts, Manipal University Jaipur has upgraded its recycling infrastructure across campus. This includes strategically placed recycling bins, improved signage, and ensuring that recycling facilities are easily accessible to all members of the university community. These improvements have significantly increased recycling rates. Manipal University Jaipur recognizes that effective recycling extends beyond campus boundaries. The university collaborates with local recycling partners to ensure that materials are processed efficiently and sustainably. This collaboration fosters a sense of community and supports local environmental initiatives.

Innovation is at the heart of Manipal University Jaipur's sustainability efforts. The university has explored innovative recycling technologies and practices. Manipal University Jaipur has implemented composting programs, converting organic waste into valuable compost that enriches campus green spaces. To track progress and maintain accountability, Manipal University Jaipur regularly measures and reports on waste generation and recycling rates. Transparency is key in driving continuous improvement and ensuring that the university stays on track to meet its sustainability targets. Engaging the campus community is essential for the success of Manipal University Jaipur's waste reduction and recycling initiatives. Students and staff actively participate in recycling programs, and student-led sustainability organizations play a vital role in raising awareness and promoting eco-friendly practices.



PROCESS FLOW CHART –STP (350 KLD)



Process description of STP plant

1	Coarse Screen: -	Provided to remove screen particles greater than 16 mm.
2	Fine Screen : -	To remove any screen particles greater than 6 mm.
3	Collection Tank: -	To transfer raw sewage to Oil and Grease Skimmer.
4	Oil & Grease skimmer: -	To separate coarse particles and oil & grease respectively.
5	Equalization tank: -	Homogenization of the effluent and feed the flow uniformly in secondary process.
6	Drum Screen / Mini Screen: -	To separate particles greater than 2mm size before entering to Bioreactor.
7	Bioreactor tank: -	Aeration tank is provided with bacterial culture to reduce organic pollutants in presence of oxygen.
8	MBR tanks: -	Provided with Cassettes of membranes to separate water from mix liquid suspended solids.
9	Sludge holding tank: -	Wastage sludge stored in to this tank.
10	Centrifuge: -	Solid liquid separation of sludge.
11	Disinfection: -	HYPO dosing in to treated water discharge line.
12	Permeate tank: -	Treated water stored in this tank to supply for Horticulture & Flushing.



Water Reuse from WTP and STP

	Year 2021-22			
	WTP		STP	
	Domestic water in KL		Flush water in KL	
Month	200 KLD (MUJ)	80 KLD (Housing)	150KLD	350KLD
April	5570	1405	180	3464
May	4400	1273	444	3922
June	4366	1226	241	4118
July	3395	1145	152	4736
August	2278	1002	0	4502
September	2746	1216	167	4655
October	2765	1258	139	4040
November	2623	1216	52	4198
December	2974	1212	45	3905
January	3824	1132	15	3765
February	3267	1116	0	3661
March	3073	1184	0	3757
Total	34941	12085	1435	41305
Per month Avg.	3494.1	1208.5	143.5	4130.5



Measuring Food Waste Generation in Manipal University Jaipur

Food waste is a pressing global issue, and universities, with their large dining facilities and diverse student populations, are not exempt from contributing to this problem. Measuring the extent of food waste generated in universities is a crucial step in addressing this issue and promoting sustainability on campus. Manipal University Jaipur quantifies food waste in the institutions.

Manipal University Jaipur has a social responsibility to ensure that food resources are distributed equitably. Reducing waste can free up resources to support food security initiatives and reduce hunger on campus. The significance of measuring food waste in the university has environmental impact, Food waste in university has environmental consequences. Manipal University Jaipur spends significant budgets on purchasing, preparing, and serving food. (Picture1)

Manipal University Jaipur measures food waste, conducting regular waste audits involves collecting and sorting food waste to determine its composition and volume. (Picture 2) This hands-on approach provides detailed insights into what, when, and why food is being wasted. Manipal University Jaipur weighs the food waste generated at various points in the food service process, such as kitchen prep, serving lines, and dining areas. (Picture 3) This data is tracked over time to identify trends and areas for improvement. Manipal University Jaipur employs surveys and innovative technologies like smart bins equipped with sensors to gather real-time data on food waste. (Picture 4) These methods provide a more comprehensive understanding of consumer behavior.

Accurate data on food waste allows Manipal University Jaipur to identify specific areas where waste occurs most frequently. This enables them to implement targeted strategies for waste reduction(Picture 5, 6, 7). By reducing food waste, Manipal University Jaipur can work efficiently on purchasing and disposal costs, making dining operations more financially sustainable. Measuring food waste aligns with the university's commitment to sustainability, helps in reducing Manipal University Jaipur's environmental footprint and meet sustainability goals. The process of measuring and reducing food waste provides educational opportunities for students. It fosters awareness and encourages responsible consumption habits that students can carry forward.



Measuring food waste generated in the university is an essential step towards promoting sustainability, reducing costs, and fulfilling social responsibilities. By employing methods such as waste audits, weighing, tracking, surveys, and technology, Manipal University Jaipur gains valuable insights into their food waste patterns. With this data in hand, Manipal University Jaipur develops targeted strategies to minimize waste, become economically efficient, and contribute to a more sustainable future. Manipal University Jaipur leads by example and inspires the next generation to adopt responsible food consumption practices, and measuring food waste is a key part of that endeavor.

SOLID KITCHEN WASTE MANAGEMENT

Sl.No.	Department	Waste Type	Quantity (kg)	Frequency	Clearance	Remarks
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30

Collection frequency & clearance: Twice a day
Time: 9:00 AM & 4:00 PM

DISPOSAL OF SOLID WASTE - INHOUSE

Solid Waste Management

1. Organic waste from kitchen and horticulture used in **Biogas Plant** which supplies fuel to Food Court.
2. Recyclable solid waste collected separately
3. Pilot project with BEIL (Bharuch Enviro Infrastructure Ltd) for converting MSW to Fuel / Energy.
4. Bio Medical waste is collected separately and Disposed
5. Papers printed on one side are not discarded but reused.

➤ [Agreement for external agency for partial waste management \(click here\)](#)

Bio-Gas generation system
30kg of Gas per day with 500 kg of Kitchen waste



Picture 1: Cold Room for food storage



Picture 2: Garbage Segregation in Garbage Segregation Area



Picture 3: Garbage Segregation done at MUJ



Picture 4: Installation of Smart Bins and waste oil tins for scrap and Recycling

PLATE WASTAGE FOOD RECORD	
SECTION	IN KG
BREAKFAST →	75 kg
LUNCH →	280 kg
DINNER →	408 kg
TOTAL ⇒	763 kg

763 KG PLATE WASTAGE COULD HAVE FED 1271 PEOPLE
PLEASE DON'T WASTE FOOD



Picture 5: Daily food waste measurement in the mess and displayed



Picture 6: Food Waste reduction awareness messages in the MUJ Premises



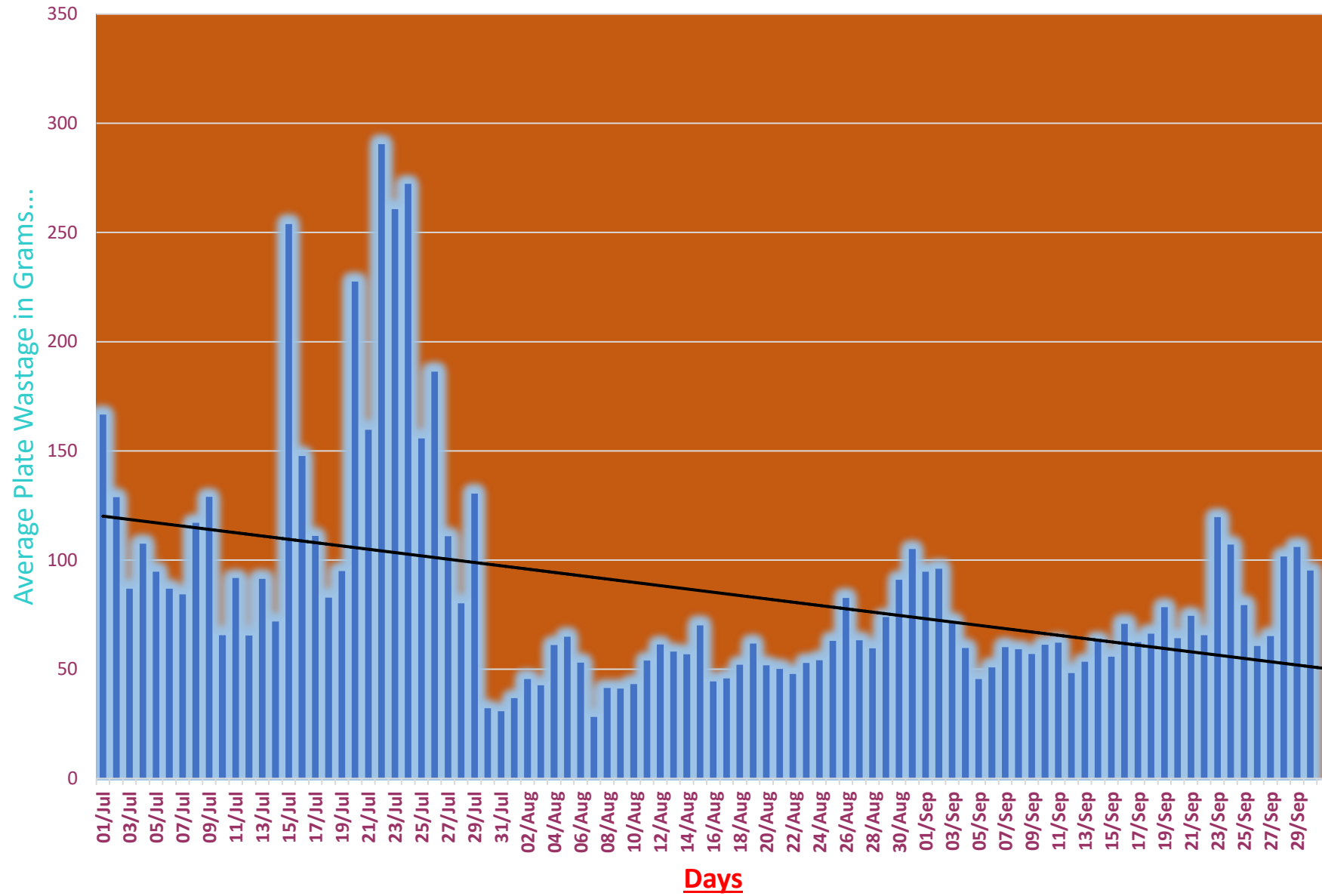
Picture 7: Food Waste reduction awareness messages in the MUJ Premises



Date	Student count	Total Weight	wastage average	Date	Student count	Total Weight	wastage average	Date	Student count	Total Weight	wastage average
1-Jul	6500.00	27	0.00	1-Aug	6500.00	266	0.04	1-Sep	6500.00	520	0.08
2-Jul	6500.00	21	0.00	2-Aug	6500.00	364	0.06	2-Sep	6500.00	470	0.07
3-Jul	6500.00	24	0.00	3-Aug	6500.00	310	0.05	3-Sep	6500.00	498	0.08
4-Jul	6500.00	30	0.00	4-Aug	6500.00	456	0.07	4-Sep	6500.00	567	0.09
5-Jul	6500.00	27	0.00	5-Aug	6500.00	371	0.06	5-Sep	6500.00	460	0.07
6-Jul	6500.00	24	0.00	6-Aug	6500.00	379	0.06	6-Sep	6500.00	489	0.08
7-Jul	6500.00	23	0.00	7-Aug	6500.00	238	0.04	7-Sep	6500.00	455	0.07
8-Jul	6500.00	24	0.00	8-Aug	6500.00	342	0.05	8-Sep	6500.00	586	0.09
9-Jul	6500.00	29	0.00	9-Aug	6500.00	346	0.05	9-Sep	6500.00	491	0.08
10-Jul	6500.00	21	0.00	10-Aug	6500.00	378	0.06	10-Sep	6500.00	519	0.08
11-Jul	6500.00	27	0.00	11-Aug	6500.00	386	0.06	11-Sep	6500.00	627	0.10
12-Jul	6500.00	21	0.00	12-Aug	6500.00	410	0.06	12-Sep	6500.00	476	0.07
13-Jul	6500.00	30	0.00	13-Aug	6500.00	343	0.05	13-Sep	6500.00	567	0.09
14-Jul	6500.00	22	0.00	14-Aug	6500.00	379	0.06	14-Sep	6500.00	581	0.09
15-Jul	6500.00	66	0.01	15-Aug	6500.00	466	0.07	15-Sep	6500.00	480	0.07
16-Jul	6500.00	35	0.01	16-Aug	6500.00	421	0.06	16-Sep	6500.00	542	0.08
17-Jul	6500.00	34	0.01	17-Aug	6500.00	445	0.07	17-Sep	6500.00	505	0.08
18-Jul	6500.00	28	0.00	18-Aug	6500.00	471	0.07	18-Sep	6500.00	568	0.09
19-Jul	6500.00	36	0.01	19-Aug	6500.00	574	0.09	19-Sep	6500.00	604	0.09
20-Jul	6500.00	76	0.01	20-Aug	6500.00	494	0.08	20-Sep	6500.00	611	0.09
21-Jul	6500.00	61	0.01	21-Aug	6500.00	588	0.09	21-Sep	6500.00	671	0.10
22-Jul	6500.00	79	0.01	22-Aug	6500.00	497	0.08	22-Sep	6500.00	689	0.11
23-Jul	6500.00	79	0.01	23-Aug	6500.00	577	0.09	23-Sep	6500.00	924	0.14
24-Jul	6500.00	107	0.02	24-Aug	6500.00	551	0.08	24-Sep	6500.00	906	0.14
25-Jul	6500.00	76	0.01	25-Aug	6500.00	614	0.09	25-Sep	6500.00	716	0.11
26-Jul	6500.00	98	0.02	26-Aug	6500.00	600	0.09	26-Sep	6500.00	601	0.09
27-Jul	6500.00	106	0.02	27-Aug	6500.00	551	0.08	27-Sep	6500.00	630	0.10
28-Jul	6500.00	125	0.02	28-Aug	6500.00	563	0.09	28-Sep	6500.00	929	0.14
29-Jul	6500.00	295	0.05	29-Aug	6500.00	562	0.09	29-Sep	6500.00	963	0.15
30-Jul	6500.00	155	0.02	30-Aug	6500.00	533	0.08	30-Sep	6500.00	771	0.12
31-Jul	6500.00	211	0.03	31-Aug	6500.00	500	0.08			0	
Grand Total	201,500.00	2,017.00	0.31	Grand Total	201,500.00	13,975.00	2.15	Grand Total	195,000.00	18,416.00	2.83



Daily Wise Average per Plate Wastage



SOP –KST

PURPOSE: To establish a procedure for housekeeping (KST) activities.

SCOPE: The scope of KST activities is as follows:

- a) KST Manpower
- b) Handling of KST consumables
- c) Premises Cleaning
- d) Garbage Management

RELEVANT STAKE HOLDERS:

S.No.	Process Step	Responsibility	Authorized by
1	Preparation of Duty Roaster	KST Head	Unit Head/ Unit Chef
2	Preparation of Cleaning Schedule	KST Supervisor	Unit Chef
3	Maintenance of Chemical stock and Equipment	KST Supervisor	KST Head
4	Chemical Dilution	KST Supervisor	FSMS Head
5	Segregation of waste	KST Supervisor	Unit chef

PROCEDURE

a) KST Manpower

- The duty roaster is made by the KST supervisor by considering the intensity of operation in each area.
- Shift supervisor shall take a small briefing for all of his team members in the beginning of the shift and explain the roles, do’s & don’t to be followed on the day.
- KST supervisor checks the personal hygiene of all the employees before beginning of the shift and the same is recorded in the personal hygiene checklist.
- The supervisors shall provide the necessary PPEs like aprons, gloves, hair nets, face masks (if required) to each staff.

b) Handling of KST consumables:

- As per the requirements, the KST supervisor shall fill the store requisition slip (SRS) with the details of items required for a day.
- The indent shall be signed by the KST head/unit head/unit chef and is sent to the store department for issuing of the material.
- A KST personnel shall receive the items from store and acknowledge the same.
- All the chemicals & KST items issued shall be kept in segregated area, separate from the production area, under lock and key to prevent misuse and mishandling.

- Supervisor is responsible for maintaining stock and controlling the receiving and issuing of the items which shall be recorded.
- Material Safety Data Sheet (MSDS) for all chemical being used in the premises needs to be displayed in a designated area of the unit.
- Awareness of MSDS shall be taken care in the chemical usage training.

c) Premises Cleaning

- Dilution of the chemicals are done and monitored by the shift KST supervisor and the consumption is recorded.
- The chemicals are diluted and kept separately away from the food.
- A cleaning schedule shall be developed at site and the same is been followed & recorded.
- The deep cleaning of the kitchen is done at least once in a week and recorded in the kitchen cleaning schedule record.
- The team shall monitor the rood-box and gum traps daily and replace if needed and any pest spotted is recorded in the pest sighting checklist.
- KST supervisor shall monitor the pest control activity and ensures the activities are happening as scheduled.
- Post pest control activity the premises is thoroughly washed within recommended time to remove the used chemicals.

Garbage disposal:

- Specific areas shall be assigned for placing dustbins. The dustbins to be always kept in closed condition with its lids.
- Garbage shall be removed from each dustbin frequently when its 3/4th filled and placed in the assigned garbage room until it's lifted by the garbage vendors.
- Wet and dry garbage shall be stored separately so that there is no cross contamination between both.
- Wet garbage clearance depends on the local municipal guidelines
- After it is cleared the garbage room has to be cleaned daily using suitable chemicals and air dried before use.
- The contact details of local municipal garbage clearance team to be made available. Supervisors /Unit heads to ensure that the wet wastes are cleared within 24-36 hours.
- If there is any deviation/delay in collecting the garbage's from the garbage collector same to be recorded with proper reason.

Scrap waste handling

Si no	Common types of Scrap items generated usually includes
1	Carton boxes part of bulk packing, recyclable plastic like milk packets etc
2	Empty oil tins
3	Glass items/Bottles
4	Scrap metal utensils/Equipment

- Specific areas to be assigned for placing scrap waste generated and should be away from production premises.
- These scraps should not be placed within the production premises.
- A vendor to collect these scrap items to be identified and assigned considering the geographical limitation and non-availability of scrap vendor operation team shall initiate and assign the scrap vendor locally who would visit as per the requirement needed i.e. or call service. It shall be documented in a book/register with suitable approval from management.
- The unit chef/unit head to decide the frequency of scrap clearance based on the volume of production/purchase scrap accumulated across the individual QFS units.
- In general scrap shall be cleared at least twice a month.
- If there is delay in collecting the scrap from vendor, the supervisor shall do a follow up on the same.
- Cleanliness of assigned scrap area to be well maintained and cleaned regularly to ensure that the area doesn't become a breeding place for pests and rodents.
- Asset management approval to be taken if any equipment /asset of QFS to be moved out as scrap when the machine/equipment can no longer be repaired/rectified.

Records

Format/ Record name	Format number	Responsible
Cleaning of chiller	QFS/HC/KST/01	KST Supervisor
Cleaning of Freezer	QFS/HC/KST/02	KST Supervisor
General cleaning – Floor/Ceiling	QFS/HC/KST/03	KST Supervisor
Deep cleaning - Kitchen/Production	QFS/HC/KST/04	KST Supervisor
Deep cleaning - Pot wash	QFS/HC/KST/05	KST Supervisor
Grooming Checklist	QFS/HC/KST/06	KST Supervisor
Garbage clearance	QFS/HC/KST/07	KST Supervisor
Chemical Usage Record	QFS/HC/KST/08	KST Supervisor



Details of E-Waste management at MUJ

Electronics waste, commonly known as e-scrap or e-waste, is the trash we generate from surplus, broken, and obsolete electronic devices. Electronics contains various toxic and hazardous chemicals and materials that are released into the environment if we do not dispose of them properly. E-waste or electronics recycling is the process of recovering material from old devices to use in new products.

According to **MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE GOVT. OF INDIA** Gazette G.S.R. 472(E), dated the 10th June, 2015 Notification MUJ has been classified as bulk consumer. MUJ has implemented process and framework to identify all end of life/obsolete products. A committee is constituted by management to scrutinize the final product list marked as e-waste and approve the recycling. For recycling MUJ has given contract to Adinath Recyclotronix Pvt. Ltd. (ARTRONIX) Panipat, Haryana. As per schedule 1 of notification e-waste at MUJ comes in category **Information Technology and Telecommunication Equipment**. Following items are applicable to e-waste at MUJ Campus:

Sr. No.	Categories of electrical and electronic equipment	Electrical and electronic equipment code
i	Information technology and telecommunication equipment:	
	Centralized data processing: Mainframes, Minicomputers	ITEW1
	Personal Computing: Personal Computers (Central Processing Unit with input and output devices)	ITEW2
	Personal Computing: Laptop Computers(Central Processing Unit with input and output devices)	ITEW3
	Personal Computing: Notebook Computers	ITEW4
	Personal Computing: Notepad Computers	ITEW5
	Printers including cartridges	ITEW6
	Copying equipment	ITEW7
	Electrical and electronic typewriters	ITEW8
	User terminals and systems	ITEW9
	Facsimile	ITEW10
	Telex	ITEW11
	Telephones	ITEW12
	Pay telephones	ITEW13
	Cordless telephones	ITEW14
	Cellular telephones	ITEW15
Answering systems	ITEW16	

Annexure:

1. Copy of partner's/collector's registration certificate with govt.
2. E-waste Inventory Copy
3. E-waste Tax Invoice
4. E-Waste Refund
5. E-waste Policy

Adinath RecycloTRONIX Pvt.Ltd.

A Technical Approach Towards Ecological Balance



- Plot # 361, Industrial Estate, HSIIDC, Panipat (132103), Haryana
- E-mail: info@artronix.in
- Website: www.artronix.in
- Contact #: +91-98969-92399

CIN: - U37100HR2016PTC064367

Haryana State Pollution Control Board Authorization No.HSPCB/2020/7469817EWREF00

DATA DESTRUCTION AND DISPOSAL CERTIFICATE

Date : 15/12/2020

Certificate Number: ART/101002

Supplier Name: MANIPAL UNIVERSITY, JAIPUR

Supplier Address: VPO Dehmi Kalan, Off Jaipur- Ajmer Expressway


This is to certify that all the Waste Electrical & Electronic Equipment (WEEE) collected from your premises as on below mentioned date has been completely dismantled and recycled in our recycling facility.

Please refer below details of the scrap lifted from your premises:

Scrap details (Ref. attached excel document no.)	Dated	Quantity (Kgs)
<u>e-waste disposal UV-6</u>	<u>19/11/2020</u>	<u>APPROX 550 KGS</u>

We certify that all the above listed equipment has been recycled in an environmentally friendly manner and are in accordance with our organization's safe and secure data destruction policies.

NOTE: All the recycling techniques and measures are in accordance with Central/State Pollution Control Board norms.


Authorised Signatory
For Adinath Recyclotronix Pvt. Ltd.
Panipat

E-WASTE DISPOSAL UV-6

S. NO.	DEVICE TYPE	ITEM DESCRIPTION	(MAKE/ MODEL)	QUANTITY	SERIAL NO(S). OF THE UNIT	CONDITION	YEAR OF PURCHASE
1	UPS	Computer UPS		4		Scrap	
2	TV	LED TV 42 inch		4		Scrap	
3	SWITCH	Super Stack 24 Port Switch		4		Scrap	2011
4	PROJETOR	NEC M420XG		1	2740185UG	Scrap	2012
5	PROJETOR	NEC M420XG		1	2840147UG	Scrap	2012
6	PROJETOR	NEC M420XG		1	2940183UG	Scrap	2012
7	PROJETOR	NEC M420XG		1	2940156UG	Scrap	2012
8	PROJETOR	NEC M420XG		1	2740165UG	Scrap	2012
9	PROJETOR	NEC M420XG		1	3740045UH	Scrap	2012
10	PROJETOR	NEC M420XG		1	2840135UG	Scrap	2012
11	PROJETOR	NEC M420XG		1	2840142UG	Scrap	2012
12	PROJETOR	NEC M420XG		1	3740071UH	Scrap	2012
13	PROJETOR	NEC NP-V260G		1	1440129EA	Scrap	2012
14	PRINTER	Toshiba Studia 212		1	CJF266632	Scrap	2012
15	PRINTER	Toshiba Studia 225		1	C3J270501	Scrap	2012
16	PRINTER	Toshiba Studia 212		1	C6A223695	Scrap	2012
17	PRINTER	RISO KS 800		1	NO	Scrap	2012
18	PRINTER	Ricoh SP 111		1	T984M440337	Scrap	2015
19	PRINTER	Ricoh SP 111		1	T984M340027	Scrap	2015
20	PRINTER	Ricoh SP 111		1	T984MB42336	Scrap	2015
21	PRINTER	Ricoh SP 111		1	T984M440130	Scrap	2015
22	PRINTER	Ricoh SP 200s		1	T794M201305	Scrap	2015
23	PRINTER	HP 1536 DNF		1	CNB9B8JC83	Scrap	2013
24	PRINTER	HP M1213		1	CNG9C2T932	Scrap	2011
25	PRINTER	Ricoh SP 111		1	T984MB42639	Scrap	2015
26	PRINTER	Ricoh SP 111SU		1	T944M740320	Scrap	2015
27	PRINTER	Ricoh SP 111		1	T984M742006	Scrap	2015
28	PRINTER	Ricoh SP 111		1	T984BB42311	Scrap	2015
29	PRINTER	Ricoh SP 111		1	T984M640922	Scrap	2015
30	PRINTER	Ricoh SP 111		1	T984MB42335	Scrap	2015
31	PHONE	Phone		4		Scrap	2011
32	Accessories	Printer Cartridge		50+		Scrap	
33	Accessories	Laptop Battery		50+		Scrap	
34	Accessories	Computer UPS Battery		3		Scrap	
35	Accessories	Mouse		20		Scrap	
36	Accessories	Mother Board		2		Scrap	
37	Accessories	Cartridge DRUM @Roller		2		Scrap	
38	Accessories	SMPS		4		Scrap	
39	Accessories	Laptop Bags		100+		Scrap	

recycled & disposed.

15/12/2021



BIO-Urja System Processflow Description

Introduction

This document defines the standard operation procedure for the Bio-Urja system, a bio-methanation system installed by GPS Renewables Pvt Ltd.

The bio-methanation system is a high throughput digestion system operating on the food waste feed stock. The gas produced is used daily for the cooking needs in kitchen where GPS burners have been installed.

Digestion Process

Input of the system consists mainly of food waste and vegetables. This input is fed into the shredder and is mixed uniformly with the slurry (from the reactor/digester) and is pumped into the reactor/digester by using a pump.

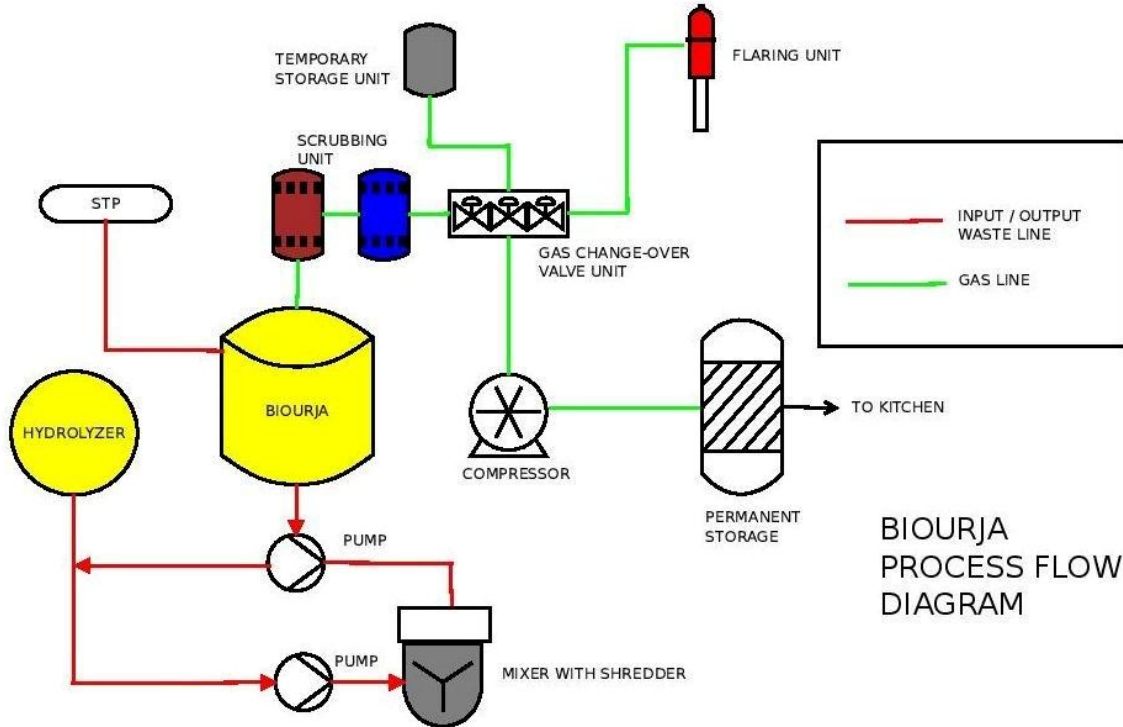
A temperature of 39 degree Celsius is maintained by using temperature controller, geyser, little pump and coil (coil is fixed inside the reactor). Once the food waste is fed into the reactor, the anaerobic digestion takes place and it gets bio-methanised as a result of which biogas is formed.

This biogas contains water content, H₂S, CO₂ and methane. To separate the impurities (Water, H₂S and CO₂) this gas is passed through a water scrubber, H₂S scrubber and air filter. From here the biogas is stored in a temporary storage balloon and when the balloon is full; this biogas is compressed and stored in a pressure vessel by using a compressor. Biogas is piped from the pressure vessel to the kitchen. Through specialized burners biogas is used for cooking.

Components

- 1) Shredder and Mixing Unit
- 2) Transfer Pump
- 3) Hydrolyser Tank with Screw Pump
- 4) Digester
- 5) Scrubbers
- 6) Valve Box
- 7) Balloon Cage
- 8) Compressor
- 9) Gas Pressure Vessel
- 10) Flaring Post

Process Flow Diagram



Shredder & Mixing Unit:

This unit comprises of a shredder and a mixing tank.

The function of the shredder is to chop the food waste up to size digestible by the Digestion unit.

Pump:

This unit is generally used to transfer the shredded waste into the Digestion unit and hydrolyser unit. The pump is a submersible pump with cutter arrangement for ease flow of shredded food waste and also screws pump to pump the waste from hydrolyser to digester.

Hydrolysis Tank with Screw Pump:

The first stage of the Bio-Methanization process called the 'Hydrolysis' happens in this tank, the daily loading to this tank need not be maintained constant and the nature of slurry is acidic in this tank.

Digester:

This unit is the processing unit for the remaining 3 stages of Bio-methanization namely acidogenesis, gametogenesis and methanogenesis, following parameters of the slurry in the digester are monitored

- 1) pH: This is done with an equipment called the “Auto Titrator”, which automatically titrates the slurry sample and the results of the titration determines the pH, acidity and alkalinity of the slurry.
- 2) Temperature: The Methanogenic bacteria are thermophilic and the slurry temperature is maintained between 39 – 42 deg Celsius, this is maintained with the help of an Heating system which comprises of the following component
 - a) Geyser
 - b) Heating Coil
 - c) Circulating Pump
 - d) Temperature Sensors

Scrubbers:

Biogas produced generally comprises of Methane, Water vapour, Hydrogen Sulphide and Carbon Dioxide, following scrubbers are used in our system:

- 1) **H₂O Scrubber:** This scrub is used to scrub the water vapour present in the gas, it generally consists of an empty sealed tank, the scrubbing happens due to Temperature difference.
- 2) **H₂S Scrubber:** This unit is used to scrub hydrogen sulphide, the unit is filled with iron filings which has the capability to adsorb sulphide present in hydrogen sulphide.

Valve Box:

This unit controls the flow of gas from the scrubber to the final storage that is pressure vessel, it comprises of the following:

- 1) Change Over Valve : This valve is used to control the temporary storage(Balloons) and compression
- 2) Flaring Valve: This valve is used to automatically flare the excess gas produced, the flaring valve is actuated when the gas pressure vessel is completely filled or during the event of a power failure.

Balloon cage:

This is a temporary storage for gas which consist of one balloon of 1cum capacity, the balloons is the input for the compressor, the quantity of gas produced and flow rates can be determined by the number of balloons compressed.

Compressor:

The gas filled in the balloons are compressed to the required pressure and stored in the Gas pressure vessel. The compressor is automatically triggered as and when the balloon reaches the required pressure with help of a pre-set programming.

Gas pressure Vessel:

This is the final storage unit for the gas and the reservoir for distribution to the required utility, it consist of a pressure sensor which senses the pressure in the pressure vessel which in turn decides the operation of compressor and the flaring unit.

Flaring Unit:

The excess gas is burnt/flared through this unit, it generally consist of ignition rods which is automatically actuated as and when the flaring valve is open, it generally acts as an exhaust for he system.