



Karunya INSTITUTE OF TECHNOLOGY AND SCIENCES

(Declared as Deemed to be University under Sec.3 of the UGC Act, 1956)

MoE, UGC & AICTE Approved

NAAC A++ Accredited

6.3.1 Process for Grey water and Black Water Treatment



Greywater Treatment Units



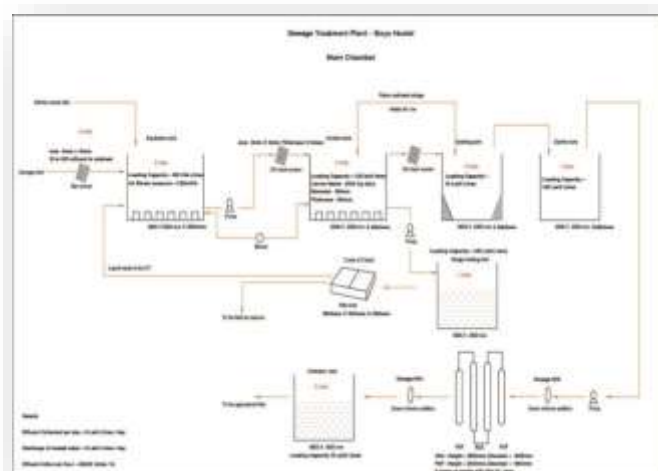
Karunya Institute of Technology and Sciences (KITS) is a fully residential campus with a total of 8087 faculty and staff members. The campus comprises 17 departments, 15 hostels for both boys and girls, and 17 apartment complexes housing approximately 500 faculty and staff. Additionally, the School of Agriculture and Biosciences utilizes 329 acres of agricultural land for academic, research, and community development purposes. The campus has 5 open wells and 23 bore wells that supply water to 177 storage tanks meeting the water demand of students, faculty, and staff.

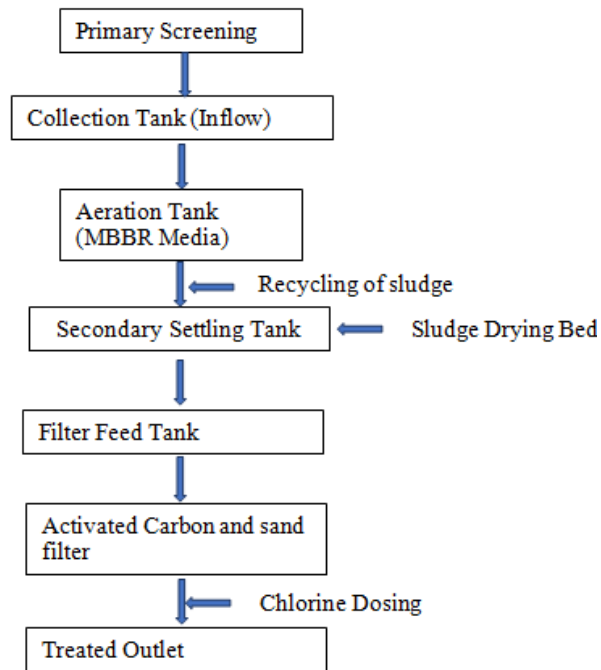
GREY WATER TREATMENT

STP Unit	Installed Capacity (KLD)	Annual Output (m ³ /year)	End-Use Application
JMR Hostel	1000	132,525	Irrigation, lawns etc.
FDR Hostel	400	79,729	Hostel & garden irrigation
Ladies Hostel STP	450	61,778	Mess cleaning
PR GARG Campus STP	600	111,171	Farm Irrigation (329 acres)
Total	2,450 KLD	385,204 m ³ /year	100% Recycled and Reused

To ensure sustainable water reuse, five Sewage Treatment Plants (STPs) have been established across student hostels. These treat greywater generated from bathrooms, kitchens, and laundry facilities. Additionally, four biogas plants are used to process blackwater from hostels, producing biogas for cooking and reducing the load on sewage treatment units. The treated wastewater is reused for gardening and irrigation, with 113 outlets supplying treated water across the campus.

General Process and Functions of Treatment Plant:





Steps involved in treatment process

The treatment process is a multi-stage system comprising physical, biological, and chemical processes to remove solids, organic matter, and pathogens.

Steps Involved:

1. **Primary Screening:**
Removes large non-biodegradable materials like plastics, rags, and paper through coarse screens.
2. **Fluidized Bed Bioreactor (FBBR):**
Wastewater undergoes biological degradation in an aeration basin by bacteria. The process continues for ~24 hours, after which mixed liquor is sent to a clarifier for sedimentation. The effluent is collected, and biomass is recycled back into the system.
3. **Settling Tank:**
Sludge settles and is partially returned to the aeration tank to maintain microbial concentration.
4. **Filtration System:**
Water passes through pressure sand filters and activated carbon filters, which remove fine particulates, algae, and microorganisms.
5. **Sludge Drying Beds:**

The collected sludge is dried through natural evaporation. The duration varies with climate conditions.

6. Reuse:

The treated water is reused for gardening, irrigation, and cleaning activities in the campus and agricultural areas.



Primary Screening Unit



Fluidized Bed Reactors



Aeration System



Filtration System



Sludge Drying Bed

Reuse of Treated Water: The treated water is reused for gardening and irrigation in the agricultural farm.

JMR – STP



JMR Collection Tank, Settling Tank (after filtration)



FDR Collection Tank, Settling Tank (after filtration)



LH Collection Tank (After Filtration)



PRG Collection Tank, Settling Tank



JMR and LH STP – Aeration Tanks



Storage Tanks for Treated Water (Before Reuse in the Garden)



Outlet for the recycled wastewater from STP

BIO-GAS PLANTS FOR TREATING BLACK WATER

Blackwater contains human waste and is treated through biogas plants that enable anaerobic digestion of organic matter.

i) Biogas Overview

- Biogas is produced through anaerobic fermentation of organic matter, generating methane (CH_4) and carbon dioxide (CO_2).
- Methane, a combustible gas, is used as a renewable fuel for cooking and lighting.
- The leftover digested slurry serves as organic manure for agriculture.

ii) Bio-gas plants in Karunya Campus

Since being a residential campus, blackwater in the hostel zones (both ladies and gents) of Karunya Campus are treated by biogas plant installed in the following locations:

S.No.	Location	Capacity of the Bio-gas Plant	Year of Installation	Savings in terms of LPG Cylinders (19Kg) /Day
1	FDR Campus	100m ³	2017	2 Nos.
2	JMR Campus	80m ³ (Multifeed)	2010	2 Nos.
3	Ladies Hostel (PRG Campus)	100m ³	2017	2 Nos.
4	Ladies Hostel (EVR Campus)	80m ³	2017	1.5 Nos.

- The treated effluent from biogas plant is diverted to the STP for storage and utilized for irrigation/gardening. This will reduce the organic load coming to two STPs of capacity 6 and 4.5 lakh litres of sewage and their operational & maintenance cost.

- The biogas produced from the plant can be utilized for cooking, and the residual dung or the digested slurry left after generating biogas can be used as manure for agricultural purposes



Biogas Plant for Blackwater



Utilization of Biogas for Cooking