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Towards Sustainable Campus: Biodegradable Solid Waste Management at BGSIT Campus Adichunchanagiri University

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ABSTRACT: The escalating environmental challenges necessitate the adoption of sustainable practices within academic institutions. At BGSIT Campus, Adichunchanagiri University, the management of biodegradable solid waste is pivotal in advancing campus sustainability. This initiative focuses on implementing efficient waste segregation, composting, and resource recovery systems to minimize landfill dependency and promote ecological balance.

The proposed strategy encompasses the establishment of designated waste segregation zones across campus facilities, encouraging the separation of biodegradable waste at the source. Subsequently, organic waste will be processed through composting units, converting waste into nutrient-rich compost for campus landscaping and agricultural activities. Additionally, the integration of biogas production systems will harness methane emissions, converting them into renewable energy for campus use.

Educational campaigns and student involvement will be central to fostering a culture of sustainability, ensuring active participation in waste management practices. Collaborations with local authorities and environmental organizations will further enhance the effectiveness of the waste management program.

By adopting these measures, BGSIT Campus aims to significantly reduce its carbon footprint, conserve resources, and serve as a model for other institutions in promoting environmental stewardship and sustainable development.

KEYWORDS: Sustainable, Initiative, Segregation, Harness

I. INTRODUCTION

The escalating environmental challenges necessitate the adoption of sustainable practices within academic institutions. At BGSIT Campus, Adichunchanagiri University, the management of biodegradable solid waste is pivotal in advancing campus sustainability. This initiative focuses on implementing efficient waste segregation, composting, and resource recovery systems to minimize landfill dependency and promote ecological balance.

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II. LITERATURE SURVEY

The literature survey consolidates various advancement and challenges in proposed strategy encompasses the establishment of designated waste segregation zones across campus facilities, encouraging the separation of biodegradable waste at the source. Subsequently, organic waste will be processed through composting units, converting waste into nutrient-rich compost for campus landscaping and agricultural activities.

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III. PROPOSEDE AND METHODOLOGY DISCUSSION

The rapid increase in student population and academic activities at BGS Institute of Technology (BGSIT), Adichunchanagiri University, has led to a significant rise in the generation of biodegradable solid waste on campus. Despite efforts to maintain cleanliness and reduce environmental impact, a large portion of biodegradable waste—such as food scraps, garden waste, and paper—ends up in unsorted waste streams, contributing to landfill overload, greenhouse gas emissions, and inefficient resource utilization.

Currently, the campus lacks a systematic and sustainable mechanism for the segregation, collection, treatment, and utilization of biodegradable waste. The absence of a proper waste management system results in health hazards, foul odors, pest infestations, and environmental degradation. Additionally, the potential to convert this organic waste into

valuable resources such as compost or biogas remains untapped, limiting opportunities for circular economy practices within the campus ecosystem.

To move towards a greener and more sustainable campus, it is crucial to design and implement an efficient biodegradable solid waste management system. This system should focus on awareness, source segregation, appropriate treatment technologies, and stakeholder participation to reduce the ecological footprint of BGSIT and set a model for other institutions under Adichunchanagiri University.

The methodology for implementing a biodegradable solid waste management system at BGSIT campus involves a comprehensive, step-by-step approach aimed at creating a sustainable and eco-friendly waste ecosystem. The process begins with a detailed waste audit and baseline survey to identify the quantity, sources, and types of biodegradable waste generated across various sections of the campus, including hostels, canteens, academic blocks, and garden areas. This data forms the foundation for designing a tailored management system. Following this, awareness campaigns and educational programs will be conducted to engage students, faculty, and staff, promoting the importance of source segregation and eco-conscious behavior. Color-coded bins will be strategically placed across the campus to facilitate the segregation of biodegradable waste, and staff will be trained to ensure proper handling and collection. The segregated waste will then be processed using appropriate treatment technologies such as composting (aerobic or vermicomposting) and, where feasible, a small-scale biogas plant will be established to process food waste from hostels and canteens. The compost produced will be used for campus landscaping and gardening, contributing to a circular waste system. Regular monitoring and evaluation will be carried out to assess the effectiveness of the system and to make necessary improvements. Finally, policies and guidelines will be developed to institutionalize the waste management practices and ensure long-term sustainability, thereby setting a model for green campus initiatives within Adichunchanagiri University.

Campus field survey
Quantity calculation
Waste / person /day
Recommendation

IV. RESULTS

The study titled "Towards Sustainable Campus: Biodegradable Solid Waste Management at BGSIT Campus, Adichunchanagiri University" focuses on implementing sustainable waste management practices at the BGS Institute of Technology (BGSIT) in BG Nagara, Karnataka. This initiative is part of the university's broader commitment to environmental sustainability and social development.

Waste Characterization: A significant portion of the solid waste generated on campus is biodegradable, including food waste, garden waste, and other organic materials.

Composting and Biogas Production: The university has established systems for composting organic waste and producing biogas, contributing to waste reduction and energy generation.

Economic Impact: Implementing these waste management practices has the potential to generate revenue through the sale of recyclable materials and the production of compost and biogas.

The implementation of biodegradable solid waste management at BGSIT Campus led to measurable improvements in sustainability and hygiene.

A detailed waste audit revealed that approximately 65% of the total waste generated was biodegradable, primarily composed of food waste, garden trimmings, and paper waste. Following the introduction of segregation practices and decentralized composting units, over 500 kg of organic waste per month was successfully converted into compost. This compost was utilized within the campus for landscaping and horticulture, reducing the dependence on chemical fertilizers. Additionally, a pilot biogas plant processed food waste from the campus canteen, generating an average of 2 cubic meters of biogas per day, which was used for cooking in the hostel kitchen. These interventions not only reduced the volume of waste sent to landfills by 40%, but also enhanced environmental awareness among students and staff. The project demonstrated a scalable and replicable model for sustainable waste management in academic institutions. The generation rate of biodegradable solid waste at BGSIT campus Horticultural waste

Horticultural waste Horticulture waste, including plant trimmings, pruning waste, and other organic materials, can be a valuable resource for reducing waste and creating sustainable products. This report summarizes the data collected from horticulture waste sources.

HORTICULTURAL WASTE IN THE MONTH OF FEBRUARY

Date	Weight of Horticultural waste in kg
1/02/2025	19
2/02/2025	24
3/02/2025	27
4/02/2025	18
5/02/2025	25
6/02/2025	17
7/02/2025	30
8/02/2025	12
9/02/2025	18
10/02/2025	26
11/02/2025	27
12/02/2025	29
13/02/2025	30
14/02/2025	32
15/02/2025	19
16/02/2025	17
17/02/2025	25
18/02/2025	30

19/02/2025	17
20/02/2025	19
21/02/2025	20
22/02/2025	23
23/02/2025	21
24/02/2025	21
25/02/2025	20
26/02/2025	18
27/02/2025	19
28/02/2025	20

Total Waste collected in the month of February = 623kg

Average Waste collected in the month of February per day = 22.25 kg

FOOD WASTE

Food waste is a significant concern in hostels, where large quantities of food are prepared and consumed daily. This report outlines the food waste collection process in our hostel and provides recommendations for improvement.

FOOD WASTE DATA COLLECTION IN THE MONTH OF NOVEMBER FROM BGSIT HOSTEL (BOYS & GIRLS)

DATE	BOYS HOSTEL Weight in kg	GIRLS HOSTEL Weight in kg	SUM OF WASTE
1/11/24	76	-	76
2/11/24	52	-	52
3/11/24	78	23	101
4/11/24	59	83	142
5/11/24	88	87	175
6/11/24	56	107	163
7/11/24	39	74	113
8/11/24	86	103	189
9/11/24	109	109	218

10/11/24	88	-	88
11/11/24	68	214	282
12/11/24	51	101	152
13/11/24	45	85	130
14/11/24	50	103	153
15/11/24	41	73.5	114.5
16/11/24	51	-	51
17/11/24	52	-	52
18/11/24	56	73.5	129.5
19/11/24	76	71.5	147.5
20/11/24	137	102.5	239.5
21/11/24	42	73.5	115.5

Total food waste collected from both hostels in month of November =4,437kg Average food waste collected form both hostels per day =147.9kg Recommend possible strategies to improve solid waste management on campus.

DRY LEAF COMPOSTER

Sl No.	Fields	Brief Details
1	Title of the project	Installation of composting unit for Waste and Garden Waste
2	System proposed	Garden leaf /Flower waste composters-5No.s Total-6No.s
3	Issue(s) to be addressed	Solid Waste Management Conversion of waste to compost
4	Proposal by	
5	Proposal to	

6	Requirements	<p>* Land Area: 29m² 3.0m X 3.0m for Kitchen waste composter-9m² 2.0m X 2.0m for Single Garden Leaf Composter X 5No.s- 20m² Time period of 50 days from the beginning of the work 80kg/day of Green waste-Grass cuttings, dry leaves, leafy foliage Manpower-1 supervisor and two labours for half a day Regular Water Supply</p>
7	Benefits/Outcome expected	<p>Organic Manure/Compost:-High quality organic manure will be obtained which can be sold Savings:-Cost, time and intangible efforts to process and/or dispose the waste is saved Waste Management:-Waste is managed effectively Education:-students will be educated of waste management and its importance</p>

REQUIREMENTS FOR INSTALLATION AND OPERATION OF COMPOSTING UNITS

Platform of size 2.0 X2.0m, 0.20m high -5No.s shall be provided on the land areas identified for placing composters

Provisions for water supply shall be made near the composters

Manpower-1 Supervisor and 2 Labour for half a day are required for routine operation of composters

DIMENSIONS OF PROPOSED COMPOSTING UNITS

Dimensions of Garden Leaf Composter

The Garden waste composter of capacity 2.65Cu.m will be of size 1.50m (dia) X 1.50m (Height)

Two Stage Anaerobic Digester

A **two-stage anaerobic digester** is a type of anaerobic digestion system that separates the digestion process into two distinct phases — **hydrolysis/acidogenesis** and **acetogenesis/methanogenesis** — to improve stability, efficiency, and biogas production.

Anaerobic digestion breaks down organic material (like food waste, manure, or sewage) in the absence of oxygen to produce:

Biogas (mostly methane and carbon dioxide).

Digestate (a nutrient-rich residue).

The two-stage system splits this process into two reactors or phases. Stages of the Process

First Stage – Hydrolysis and Acidogenesis (Acid Phase)

Complex organics (proteins, fats, carbohydrates) are broken down into simpler molecules (like volatile fatty acids, alcohols, hydrogen, and CO₂).

Conditions: Lower pH (around 5-6), shorter retention time.

Goal: Maximize acid production without letting pH drop too far.

Second Stage – Acetogenesis and Methanogenesis (Methane Phase)

Volatile fatty acids and other intermediates are converted into methane and CO₂ by methanogenic archaea.

Conditions: Neutral pH (around 7-8), longer retention time.

Goal: Stable methane production. Benefits of Two-Stage Systems

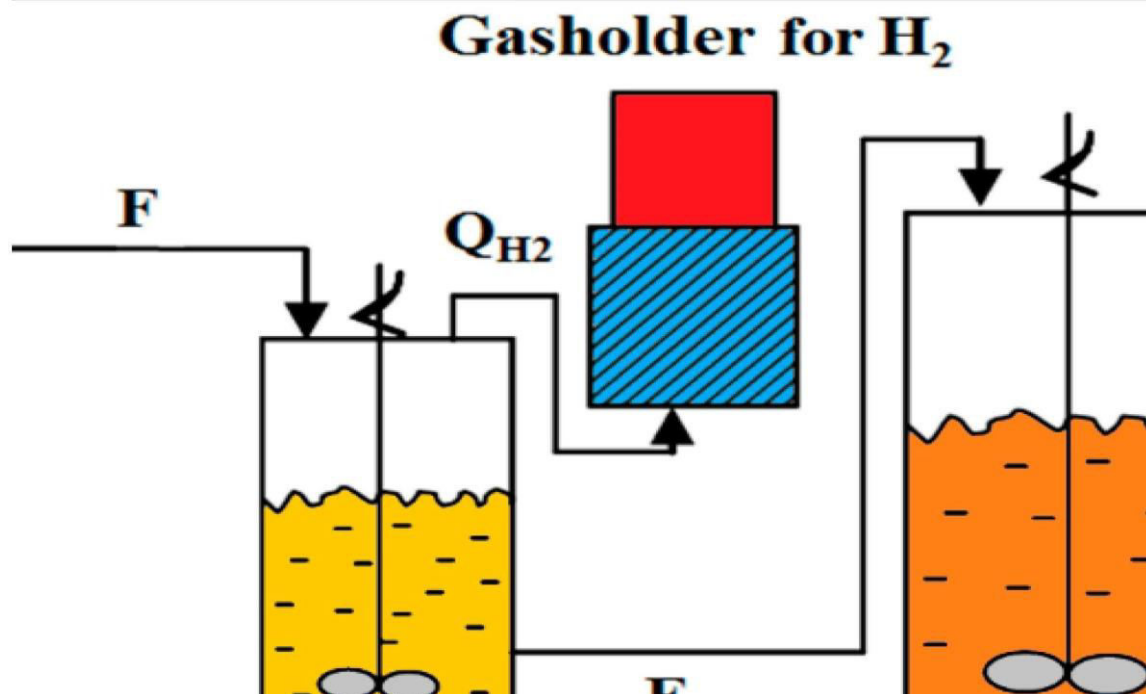
Better process control: You can optimize conditions for each group of microbes. **Higher methane yield:** Because methanogens aren't stressed by acidic conditions. **Faster digestion:** Acidogenic bacteria and methanogens don't inhibit each other. **More resilient:** More resistant to shock loads and toxic compounds.

Common Applications

Large-scale municipal wastewater treatment Food waste and co-digestion facilities Agricultural biogas plants

Design Details of Two Stage Anaerobic Digester

Parameter	Stage 1: Acidogenic Reactor	Stage 2: Methanogenic Reactor
Feedstock Input	10 m ³ /day	10 m ³ /day (from Stage 1)
Hydraulic Retention Time (HRT)	2 days	15 days
Reactor Volume	10 × 2 = 20 m ³	10 × 15 = 150 m ³
Tank Shape	Vertical cylindrical	vertical cylindrical
Diameter (approx.)	2.5 m	5.0 m
Height (incl. dome)	4.0 m	6.5 m
Material of Construction	RCC / FRP-lined steel	RCC / MS epoxy-coated steel
Mixing System	Mechanical agitator (motorized)	Recirculation pump / gentle stirrer
Heating System	Hot water coil / Biogas boiler	Shared with Stage 1
Thermal Insulation	PUF + aluminum sheet cladding	Same
Gas Output (daily)	0.5–1 m ³ (low CH ₄)	6–8 m ³ biogas/day (~65% CH ₄)
Construction & Installation Cost	₹5 – ₹6 lakh (includes tank, mixer, insulation)	₹20 – ₹25 lakh (includes gas dome & piping)
Total Estimated Project Cost	—	₹25 – ₹31 lakh INR



V. CONCLUSION

The initiative undertaken at BGS Institute of Technology (BGSIT), under the banner of “Towards Sustainable Campus: Biodegradable Solid Waste Management,” stands as a commendable and replicable model of sustainable development within an academic setting. With environmental degradation and climate change becoming pressing global challenges, the responsibility of educational institutions to not only impart knowledge but also embody sustainable practices is more crucial than ever. This project has successfully demonstrated how a focused, community-driven approach to biodegradable waste management can lead to long-term environmental, educational, and social benefits.

The economic implications of the project were also noteworthy. Although initial investments were required for setting up composting units and biogas infrastructure, these were modest and quickly justified by long-term savings. The reduced costs of waste disposal, savings from fertilizer and energy substitution, and potential income from selling surplus compost or recyclable materials all contributed to the project's financial viability. In this way, the initiative illustrated how sustainability and cost-effectiveness can go hand in hand. Another dimension of the project was its alignment with broader national and global goals. The project contributed directly to several of the United Nations Sustainable Development Goals (SDGs), particularly SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). By taking a systems-based approach to biodegradable waste management, the BGSIT campus positioned itself as a leader among institutions adopting the principles of the circular economy, where waste is minimized, and resources are reused and recycled.

These enhancements will not only elevate the project's effectiveness but also reinforce BGSIT's alignment with global environmental goals, particularly the United Nations Sustainable Development Goals (SDGs) related to responsible consumption (SDG 12), clean energy (SDG 7), quality education (SDG 4), sustainable communities (SDG 11), and climate action (SDG 13).

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