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(Research Article)

Feacal Sludge treatment plant (FSTP) - Koratla: Analytical study to assess its Efficiency

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Abstract

The government of India GoI has launched the Swachh Bharath Mission (SBM) to maintain hygiene and sanitation all over the nation The main goal to reach the Country is to Free from Open Defecation ODF. As part of this increased the number of toilets countrywide and also Government is establishing theFeacal Sludge treatment plants FSTPs s in concerned locations. In the present study, an attempt is made to assess the efficiency of FSTP located in Koratla District Jagtial Telangana State. Various chemical parameters and other characteristics were assessed by Standard methods. After this complete analytical study, it is concluded that the residue as manure and other treated materials including water will be used for various purposes, mainly for agriculture.

Keywords: FSTP; ODF; Biochar; Septage and Sanitation

1 Introduction

Swachh Bharat Mission (SBM), Swachh Bharat Abhiyan, or Clean India Mission is a country-wide campaign initiated by the Government of India in 2014 to eliminate open defecation and improve solid waste management. It is a restructured version of the Nirmal Bharat Abhiyan launched in 2009 carried through by successor Manmohan Singh that failed to achieve its intended targets.[2][3]

- Phase 1 of the Swachh Bharat Mission lasted till October 2019.
- Phase 2 is being implemented between 2020–21 and 2024–25 to help cement the work of Phase 1.[4]

One of the major goal of SBM is to construction of Sewage Treatment Plants (STPs)/ STP cum Fecal Sludge Treatment plants (FSTPs) for used water treatment.

The state government has started the development of Faecal Sludge Treatment Plants (FSTPs) at 71 ULBs (urban local bodies), thereby giving a boost to waste management in Telangana

Sewage is treated in STP and faecal sludge can be treated either at STP or STP-cum-FSTP or standalone FSTP. Further, the treatment may be centralized or decentralized treatment

Faecal Septage Treatment Plants (FSTPs) are used for treatment of faecal septage being periodically removed from septic tanks of domestic, commercial, institutional establishments etc. to maintain their efficiency.

Pathogen inactivation: A key objective of fecal sludge treatment is often pathogen reduction to protect public health.

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First Feacal sludge TP was built in Jhansi.

One of the major goals of SBM is to construction of Sewage Treatment Plants (STPs)/ STP cum Fecal Sludge Treatment plants (FSTPs) for used water treatment.

Objectives of the study

This study is carried out to explore FSTP Technology including concept, process operational procedure and major advantages

This technology plays a major role in controlling the disease outbreak due to effective control on disease vectors

- The primary objective

To assess the efficiency of FSTP Koratla for treating the faecal sludge, and along with water.

- The Secondary objective

To test suitability of the biochar manufactured from the treated sludge for manure purpose.

2 Literature Review

Since the wider recognition of the importance of sanitation, marked by the UN declaring 2008 as the 'Year of Sanitation', there has been a steady increase in commitment, uptake, implementation, and knowledge generation in non-sewered sanitation.

R&D Department of the defence Organization of Govt of India Technology for the effective decomposition of Human feacal matter under changed geo climatic conditions applying the principles of anaerobic climatic Conditions biodegradation and biodigester technologies, which makes to an eco-friendly treatment plant in developing Countries. Eco Friendly treatment

Commissioner and Director of N. Satyanarayana Municipal Administration stated that the government had already built over 8,900 public toilets across the nation, and now the focus is on handling and processing the waste scientifically as septage is much more polluting than domestic waste.

3 Material and methods

Faecal Sludge Treatment Plant (FSTP) is a vermifiltration based comprehensive and sustainable technological solution developed by us to manage faecal sludge effectively.

There are four main treatment objectives:

- Pathogen inactivation,
- Dewatering,
- Stabilization, and
- Nutrient management.

3.1 Study Area

Koratla FSTP is of Capacity 25 KLD and Location at Lat: 18.82° Long: 78-689°. Water samples from the inlet and outlet of each process were collected in the morning hour (7-10am) for three months (Jan to March 22) in the prewashed plastic containers of 2 liters

The parameters such as pH, BOD, COD and TSS were analyzed following the standard methods of APHA (2012)

After dewatering and drying, the faecal sludge was analyzed for calorific value, rash, fixed carbon, volatile matter, Carbon H, N and S. After that the faecal sludge was Pyrolysed to produce the energy and biochar and then the blocker analyzed for pH, color, moisture, bulk density, K,N, an,Cd, Cu, N, Cr and Hg.

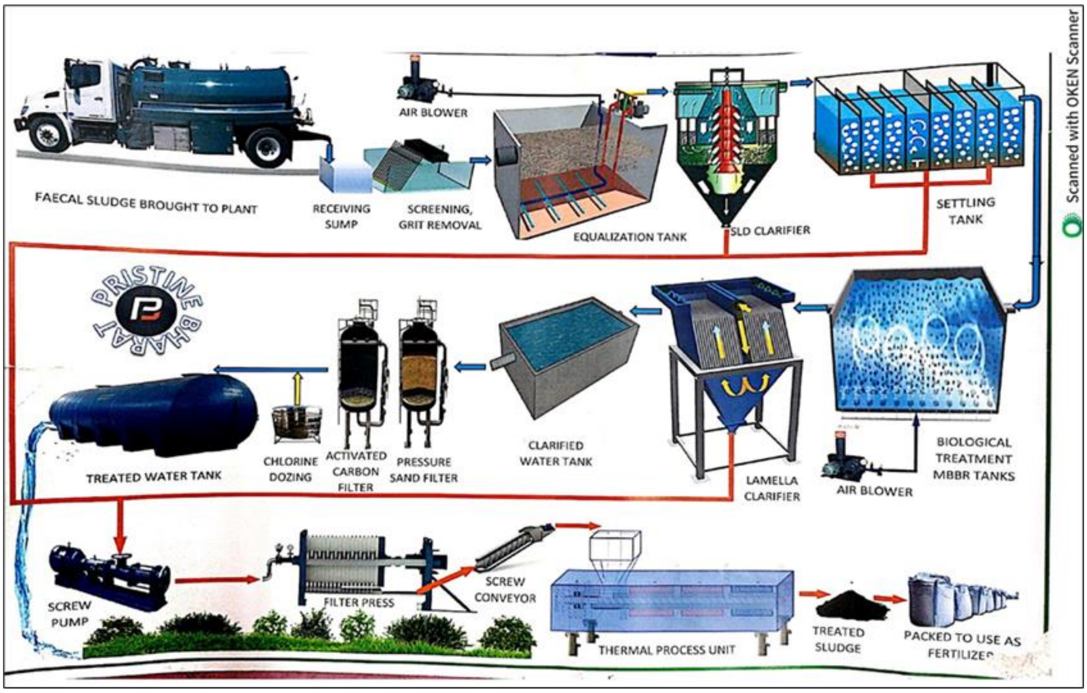

Figure 1 Work flow Diagram of Faecal Sludge Treatment Plant at Koratla

4 Results and Discussion

The Outlet released after the treatment from this technology is free from Pathogens and Can be used in different purposes The technology developed can be used in any area throughout the India.

All the results of the inlet and out let water released from various purposes are presented In the Tables. Characteristics of faecal sludge and biochar are given in Tables

The efficiency of the FSTP for BOD, COD and TSS removal is figured.

Table 1 The parameters before after the treatment with different processes and % removal of each process January

Parameter/Process	BOD				COD				TSS				PH
	Inlet	Outlet	Diff	% Removal	Inlet	Outlet	Diff	% Removal	Inlet	Outlet	Diff	% Removal	
Screening grit chamber	6230	4730	1500	24.08	32120	21245	10875	33.86	12650	7985	4665	36.88	1.5-11.9
Biological chamber	4230	735.5	3494.5	82.61	24325	6420	17905	73.61	8595	3125.2	5469.8	63.64	6.6-8.4
Lamella Clarifier	715.4	420.3	295.1	41.25	3954	2856.5	1097.5	27.76	3235.7	2185.7	1050	32.45	6.6-8.4
Pressure sand filter	20.8	14.2	6.6	31.73	76.5	45.4	31.1	40.65	342.5	285.2	57.3	16.73	6.6-8.4
Activated carbon filter	9.1	7.9	1.2	13.19	28.5	21.5	7	24.56	47.3	19.5	27.8	58.77	6.6-8.4
Final treated Water		7.9(99.87%)				21.5(99.93)				19.5(99.84)			6.6-8.4

Table 2 The parameters before after the treatment with different processes and % removal of each process February

Parameter/Process	BOD				COD				TSS				PH
	Inlet	Outlet	Diff	% Removal	Inlet	Outlet	Diff	% Removal	Inlet	Outlet	Diff	% Removal	
Screening grit chamber	6120	4560	1560	25.49	32080	20950	11130	34.69	12050	8560	3490	28.96	1.5-11.9
Biological chamber	4180	725.8	3454.2	82.64	24150	8520	15630	64.72	8750	4520	4230	48.34	6.6-8.4
Lamella Clarifier	705	416.8	288.2	40.88	3850	2940	910	23.64	3850	2256	1594	41.40	6.6-8.4
Pressure sand filter	20.6	13.8	6.8	33.01	79.5	51.2	28.3	35.60	352.5	297.5	55	15.60	6.6-8.4
Activated carbon filter	8.9	8.1	0.8	8.99	29.6	22.5	7.1	23.99	48.5	20.5	28	57.73	6.6-8.4
Final treated Water		8.1(99.86)				22.5(99.92)				20.5(99.82)			6.6-8.4

Table 3 The parameters before after the treatment with different processes and % removal of each process March

Parameter/Process	BOD				COD				TSS				PH
	Inlet	Outlet	Diff	% Removal	Inlet	Outlet	Diff	% Removal	Inlet	Outlet	Diff	% Removal	
Screening grit chamber	6450	4815	1635	25.35	33220	21315	11905	35.84	12580	7978	4602	36.58	1.5-11.9
Biological chamber	4325	732.5	3592.5	83.06	23825	6350	17475	73.35	8592	3215.2	5376.8	62.58	6.6-8.4
Lamella Clarifier	732.5	432.5	300	40.96	3948	2863.5	1084.5	27.47	3236.5	2179.7	1056.8	32.65	6.6-8.4
Pressure sand filter	21.2	15.3	5.9	27.83	77.2	46.2	31	40.16	3395	285.2	3109.8	91.60	6.6-8.4
Activated carbon filter	9.5	7.6	1.9	20.00	29.65	21.5	8.15	27.49	46.5	18.9	27.6	59.35	6.6-8.4
Final treated Water		7.6(99.88)				21.5(99.89)				18.9(99.84)			6.6-8.4

Table 4 Theaverage parameters before after the treatment with different processes and % removal of each process

Parameter/Process	BOD % Removal				COD% Removal				TSS% Removal				PH
	January	February	March	Average	January	February	March	Average	January	February	March	Average	
Screening grit chamber	24.08	25.49	25.35	24.97	33.86	34.69	35.84	34.80	36.88	28.96	36.58	34.14	1.5-11.9
Biological chamber	82.61	82.64	83.06	82.77	73.61	64.72	73.35	70.56	63.64	48.34	62.58	58.19	6.6-8.4
Lamella Clarifier	41.25	40.88	40.96	41.03	27.76	23.64	27.47	26.29	32.45	41.40	32.65	35.50	6.6-8.4
Pressure sand filter	31.73	33.01	27.83	30.86	40.65	35.60	40.16	38.80	16.73	15.60	91.60	41.31	6.6-8.4
Activated carbon filter	13.19	8.99	20.00	14.06	24.56	23.99	27.49	25.35	58.77	57.73	59.35	58.62	6.6-8.4
Final treated Water	99.87	99.93	99.84	99.88	99.86	99.92	99.82	99.86	99.88	99.89	99.84	99.87	6.6-8.4

Table 5 Characteristics of Feacal sludge during the study period Jan 2022 to March 2022

Parameter	January	Febraury	March	Average	Minimum	Maximum
Calorific value (Kcal Kg-1)	3525	3340	3396	3420.33	3340	3396
Ash (%)	31.75	31.45	31.6	31.60	31.45	31.75
Fixed Carbon(%)	5.75	5.46	5.5	5.57	5.46	5.75
Volatile Matter (%)	73.4	72.6	72.8	72.93	72.6	73.4
Carbon (%)	34.67	32.79	33.6	33.69	32.79	34.67
Hydrogen(%)	5.46	5.82	5.62	5.63	5.46	5.82
Nitrogen (%)	2.65	2.69	2.96	2.77	2.69	2.96
Sulphur (%)	2.15	2.76	1.98	2.30	1.98	2.76

Table 6 Characteristics of Biochar and their comparison with SWM rules 2016 (India) Organic compound standards

Parameter	January	Febraury	March	Average	Min	Max	SWM Rules , 2016
PH	7.2	7.3	7.3	7.27	7.2		6.5-7.5
Color	Black	Black	Black				Dark brown to Black
Moisture	8.6	8.4	9.2	8.73	8.4	9.2	15-25
Bulk Density	1.95	2.2	2.15	2.10	2.15	2.2	<1
Potassium K (%)	0.95	1.2	0.86	1.00	0.86	1.00	Minimum 0.4
Nitrogen N (%)	2.46	3.25	3.12	2.94	2.46	3.25	Minimum 0.8
Posphorus P (%)	0.25	0.52	0.24	0.34	0.24	0.52	Minimum 0.4

5 Conclusion

On the basis of present study we can conclude that more than 90% BOD, COD and TSS has removed after the treatment all the studied parameters were compaired with standards set by SWM Rules 2016 for FSTP discharge.

FSTP Technology is eco-friendly, suitable and sustainable.

FSTP Technology is eco-friendly, suitable and sustainable.

Implementation of this technique

- Reduces chances of soil and groundwater pollution.
- Reduces the potential for human contact with faecal borne pathogens by improving the functioning of onsite sanitation systems.
- Minimise odors and nuisances and the uncontrolled discharge of organic matter from overflowing tanks or pits.
- Reduces the indiscriminate disposal of collected feacal sludge

Compliance with ethical standards

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Disclosure of conflicts of interest

The authors have no conflicts of interest to declare.

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