

15KLD FSTP AT CAMP 18 (BANGLADESH)

TREATMENT TECHNOLOGY

A decentralised wastewater (DEWATS) treatment system.

TREATMENT OBJECTIVE

COD¹ reduction (below 100 mg/l) and pathogen elimination.

QUALITY (INLET AND OUTLET)

SI No.	Parameter	unit	standard	influent	effluent
1	pH	[-]	6 - 9	8.0	6 - 9
2	BOD	mg/L	30	7,687	< 20
3	Total Nitrogen	mg/L	15	1,475	
4	Nitrate	mg/L	250	0	
5	Phosphate	mg/L	35	88	< 35
6	Suspended solids	mg/L	100	10,585	< 20
7	temperature	Degree centigrade	30	< 30	< 30
8	Coliform	CFU/100 mL	1000	4,100,000	400
9	Oil & grease	mg/L	10	< 10	Nil
10	COD	mg/L	200	23,060	< 50

TREATMENT PROCESS WITH STABILIZATION REACTOR

SI No.	Unit	Capacity	Area
1	Screen Chamber (SDB)	2.4 m ³ /hr. (Emptying of one 40 L barrel takes 1 min)	2 m ²
2	Stabilization Reactor	15 m ³ /day	80 m ² (appx.)
3	Sludge Drying Bed (6+20 beds)	15 m ³ /day	600m ²
4	Settler + Anaerobic filter	9 m ³ /day (60 % percolate quantity from SDB)	6.8 m ²
5	Horizontal Planted Gravel Filter (2 PGF of 7mx5m each)	9 m ³ /day	240 m ²
6	Collection tank	9 m ³ /day	12 m ²
7	Sand and carbon filter	3 m ³ /hr (3 hrs of daily operation)	
8	Incinerator	3 m ³ /hr (3 hrs of daily operation)	

DESIGN ASSUMPTIONS

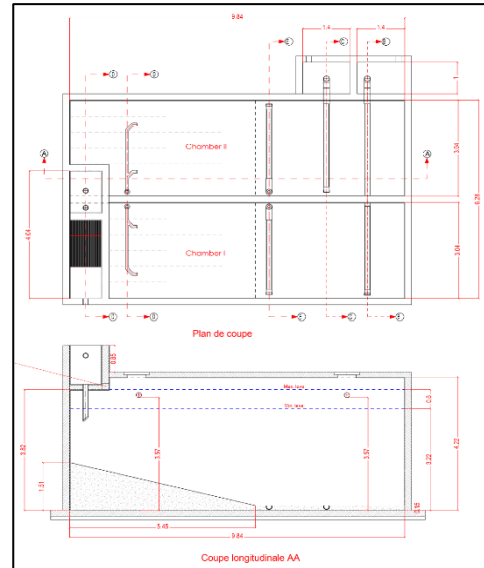
1. Current disposing: One barrel (40 L) gets emptied manually within 1 min of time

¹ Chemical Oxygen Demand

2. Sludge loading rate in Sludge Drying Bed = 100-200 Kg/m²/year²
3. Suspended solids concentration of FS = 10,585 mg/L³ (Total solid assumed 2%)
4. COD reduction in percolate from SDB = 77 to 99%⁴
5. BOD & COD concentration of percolate from SDB is 50-150 & 300-550 mg/L respectively⁵

ANAEROBIC STABILIZATION REACTOR

Sr. No.	Component	Unit	Value
1	Treatment capacity	m ³ /day	15
2	Number of chambers	Nos	-
3	Sludge Retention time	Days	-
4	Dimensions (Area)	m ²	Appx. 40
5	Treatment efficiency COD reduction VSS reduction	%	-



SLUDGE DRYING BED

Sr. No.	Component	Unit	Value
1	FSTP capacity	m ³ /day	15
Total Solids Calculations			
2	TS concentration	mg/L	20,000
		Kg/m ³	20
3	Total FS load	m ³ /year	4,680
4	Total TS load (a)	Kg/year	93,600
Area calculations			
5	TS loading rate (b)	Kg/m ² .year	200

² IWA publishing, 2014. Faecal Sludge Management. London, UK

³ Provided by client

⁴ Case Study on Loading rate experiments in Cameroon (Adapted from Kengne et al., 2011), FSM, IWA.

⁵ CDD's internal research

Sr. No.	Component	Unit	Value
6	Total area required (c) = a/b	m ²	468
7	Feeding Frequency	Days	14
8	Beds required (d) (two streams)	nos.	12 + 12
9	Area required for single bed (e) = c/d	m ²	19.5
10	Length	M	5
11	Width	M	4
12	Area of single bed (finalized)	m ²	20
13	Area of total bed (finalized)	m ²	480

ANAEROBIC FILTER (AF) & HORIZONTAL PLANTED GRAVEL FILTER (PGF)

Settler Design

Depth of water at outlet: d(w,s)	1.9	m
Inner length of chamber 1: L1(s)	0	m
Inner length of chamber 2: L2(s)	1	m
Inner width: W(s)	2.0	m
Reactor volume: V(s)	3.8	m ³
Hydraulic retention time: HRT(s)	5.6	h

Anaerobic Filter Design

Water depth at outlet: d(w)	1.90	m
Depth of filter: d(f)	1.00	m
Length of chambers: L(c,AF)	1.20	m
Total width of chambers: W(AF)	2.00	m
Specific surface area	120	m ² /m ³
Void space	45%	%
Upflow velocity: v(up)	0.5	m/h
Number of chambers	2	-
Reactor volume (AF filter void space)	2.2	m ³
Hydraulic retention time (HRT)	6	h

Horizontal Planted Gravel Filter Design

Depth of filter at inlet (d,f)	0.6	m
Total filter height	0.7	m
Width	10.0	m
Length	7.0	m
Surface area	70.0	m ²
Filter volume	45.5	m ³
HRT	1.5	d

Treatment Performance			
Module	COD (mg/L)	BOD (mg/L)	COD treatment efficiency (%)
Influent	350	100	-
Settler	204	56	42%
Anaerobic Filter (AF)	122	32	40%
Horizontal Planted Gravel Filter (HPGF)	65	16	46%
Final effluent concentration	65	16	
Overall treatment efficiency	81%	84%	

COLLECTION TANK

Sr. No.	Component	Unit	Value
1	Treatment capacity	m ³ /day	9
2	Number of chambers	Nos	1
3	Retention time	Days	2 days
4	Dimensions	m	4 × 3 × 1.5

SAND AND CARBON FILTER

Sr. No.	Component	Unit	Value
1	Treatment capacity	m ³ /day m ³ /hr	9 3 (3hrs. of operation)
2	Filter feed pump		2 nos. (1 working + 1 standby) Capacity: 3 m ³ /hr @ 3 bar
3	Number of FRP vessels	Nos	2 (one for each sand and carbon filter)
4	Dimensions	inches	18 × 65

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