Septage Management in India

Decentralized treatment strategies

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Outline

- Problems
- Sustainable solution
- Lessons learned

Septage management in India

Disposal practices and problems

- Total sanitation coverage in India - 50%
- Dependence on Septic tanks -22.2%
- Poor maintenance and disposal practices
- No treatment strategy for effective management

Untreated septage disposal

Septage overflowing

Targets in Septage management

- Pathogens
- Micropollutants (ECs)
- Green house gas emissions

Sustainable treatment option

Objective

Sustainable management of septage by co-composting and understanding the process dynamics during composting

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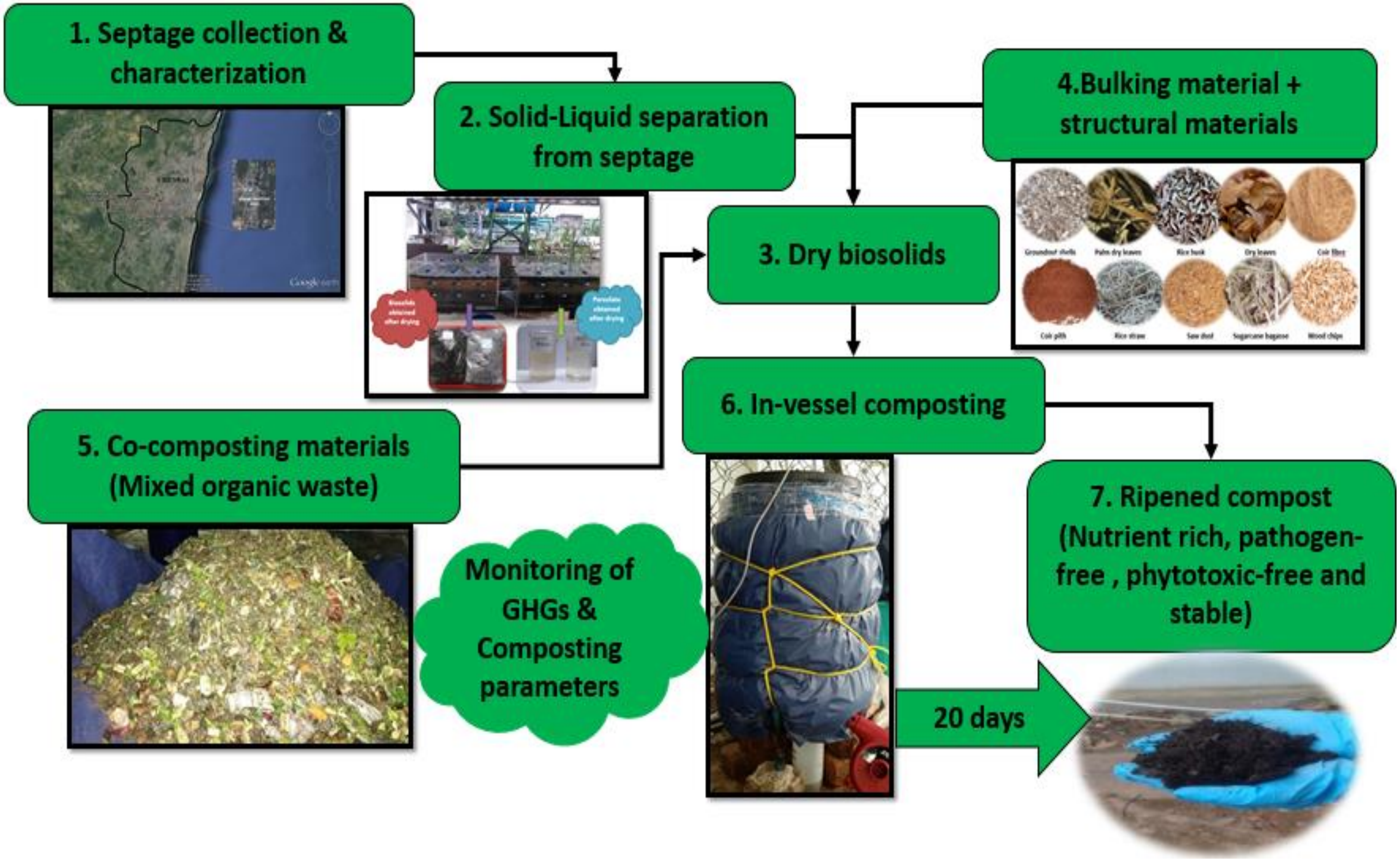
Approach for septage treatment



Septage collection from Chennai city

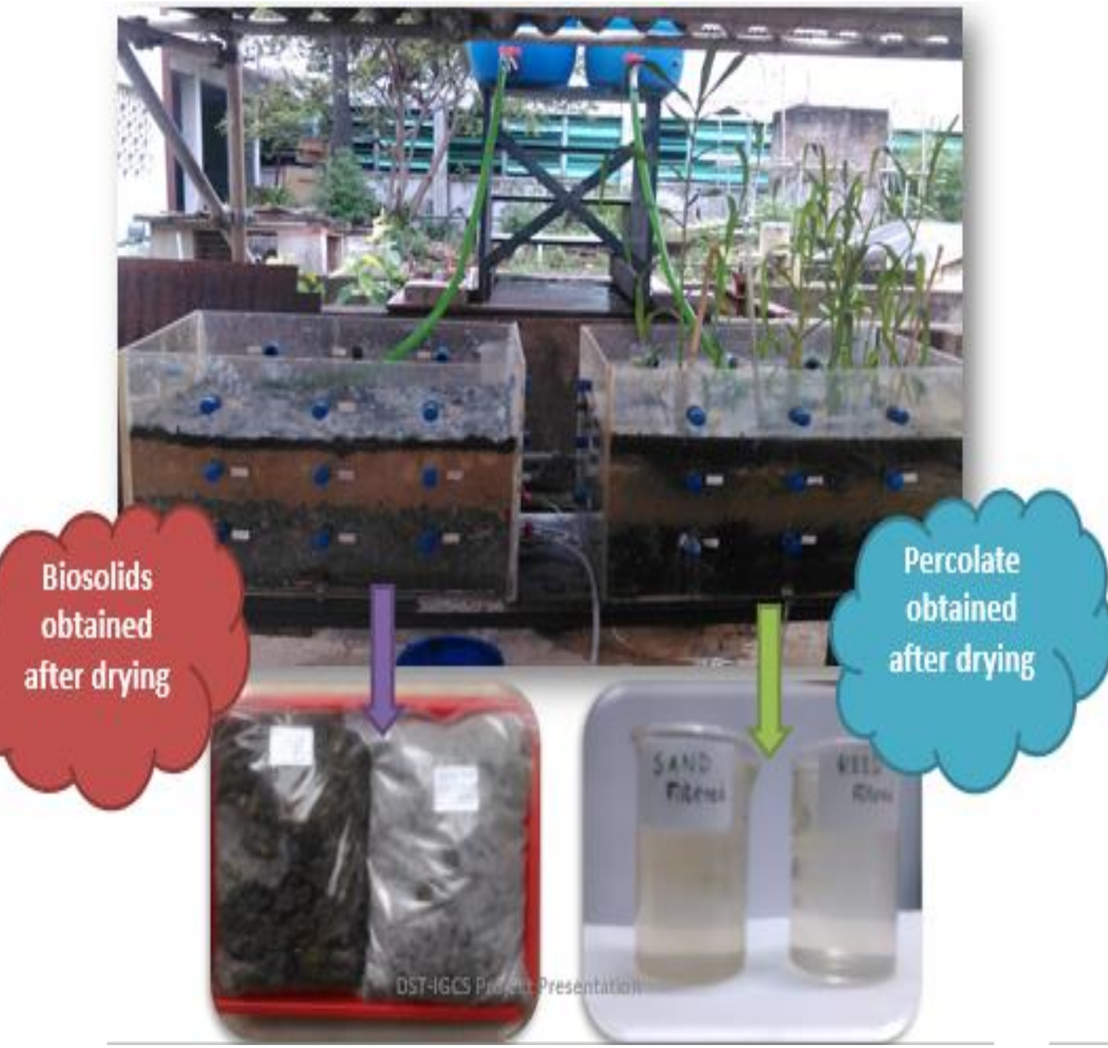
Characterization of Septage in Chennai city

Parameters	No: of Samples	Concentration (mg/L)							
		Pre Monsoon				Post Monsoon			
		Maximum	Minimum	Average	SD	Maximum	Minimum	Average	SD
TS	120	6940	1000	2185	1070	17467	1010	3555	2935
VS	120	4753	307	1414	657	14400	10	1541	2157
TSS	120	4010	105	712	602	11200	27	1103	1908
VSS	120	2337	57	463	382	9760	10	842	1566
SS	120	850	50	288	170	850	0	94	116
sBOD	120	240	30	117	54	1896	40	211	220
COD	120	2400	80	905	603	6656	160	1460	1295
sCOD	120	1064	16	336	272	4296	64	427	485
Ammonia	120	84	3	16	13	129	2	32	24
TN	120	313	19	94	65	500	4	58	65
TP	120	236	7	77	43	182	5	54	36
Sulphate	120	209	16	76	41	612	2	99	118
Sulphide	120	28	0	10	6	61	0	10	12

Krithika et al., 2017

Septage Dewatering

using Sand drying bed and Reed drying bed



Filtrate Quality			
Parameters	Concentration in mg/L		
	Raw septage quality	Reed bed percolate quality	Sand bed percolate quality
Total solids	12733	1716	2003
Volatile solids	7013	1770	1397
Total Suspended Solids	10787	133	267
Volatile Suspended Solids	5313	123	213
BOD	1150	510	540
Soluble BOD	990	300	330
COD	9920	3520	4800
Soluble COD	5440	2280	960

Available bulking agents in Tamil Nadu

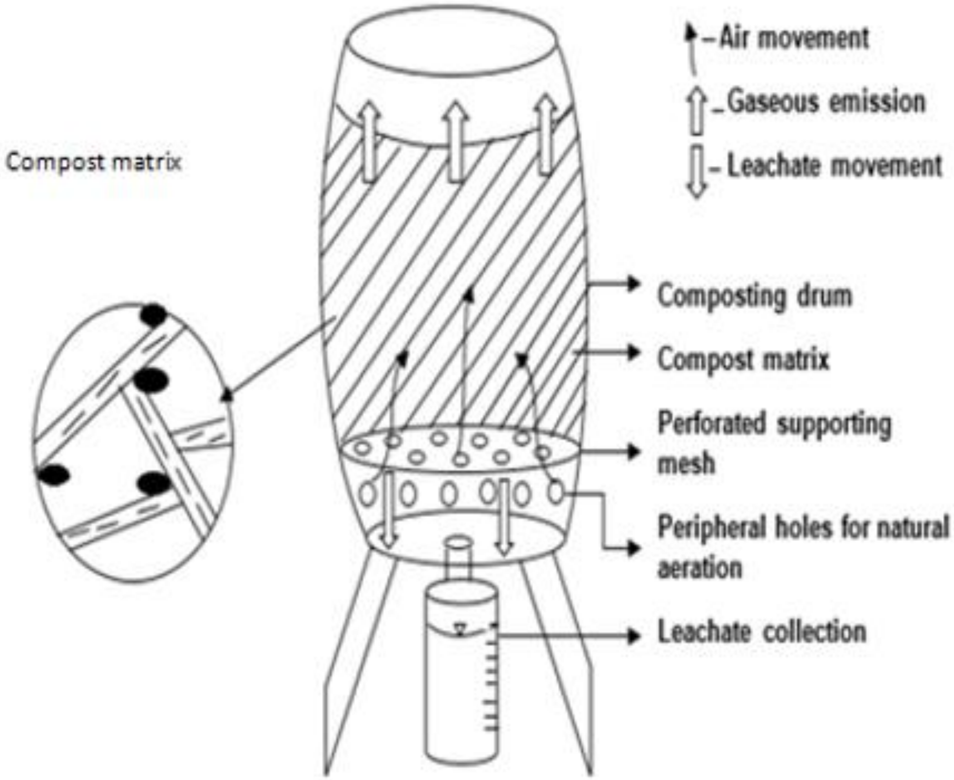
Composting materials	Moisture content (%)	Organic matter (%)	C/N ratio	Water holding capacity (g of water/ g of material)	Bulk density (kg/m^3)	Air filled Porosity (%)
Bulking agent for composting						
Bagasse	5.14	81.18	62	6.79	200	85.03
Straw	6.83	65.50	54	4.30	220	82.37
Wood chips	7.17	70.20	500	2.03	120	89.41
Saw dust	11.04	75.20	779	4.35	95	90.95
Dry leaves	5.29	62.96	60	2.15	70	93.96
Coir fibre	8.06	64.29	26	3.38	84	92.88
Coir pith	19.66	64.08	53	5.07	70	93.78
Rice husk	8.02	48.20	47	1.82	75	93.11
Groundnut shells	8.88	49.37	24	1.97	130	88.17
Palm dry leaves	7.34	45.12	20	1.42	92.8	91.48
Substrate for composting						
Dewatered septage solids	5.14	81.18	10	0.72	300	85.03

- Order of suitable bulking agent (mainly based on water holding capacity & air filled porosity):

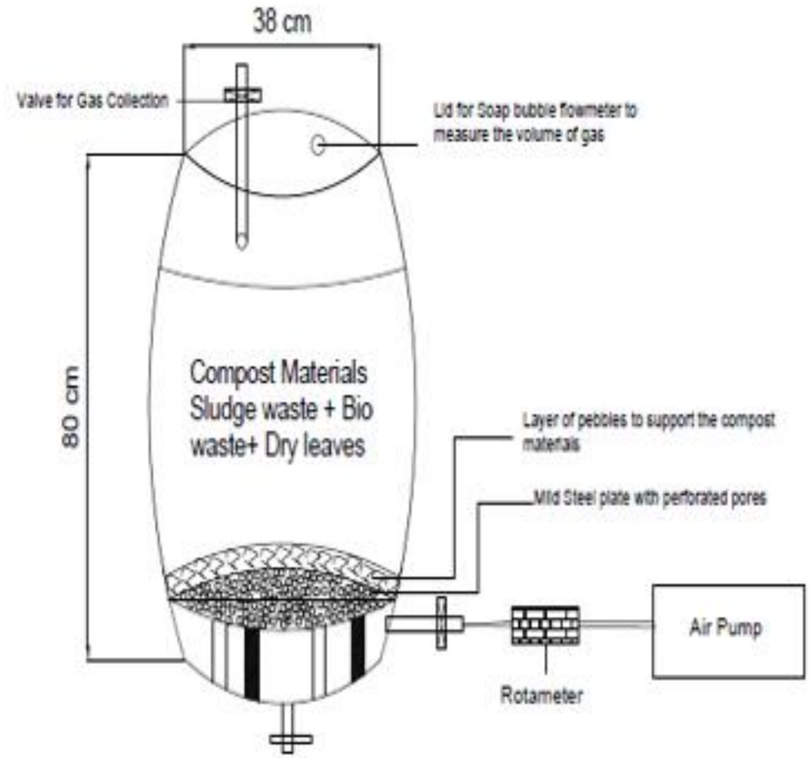
  Coir pith >Bagasse> Saw dust>Dry leaves

- Coir pith as bulking material for septage co-composting
- Wood chips- rigid structure and recalcitrant nature – used as structural material

Laboratory scale in-vessel composter



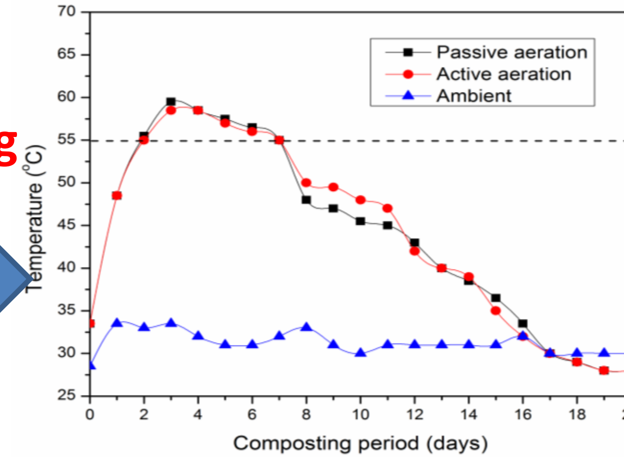
Passive (natural) aeration



Active (forced) aeration

Selection of Feedstock composition

Self-heating test

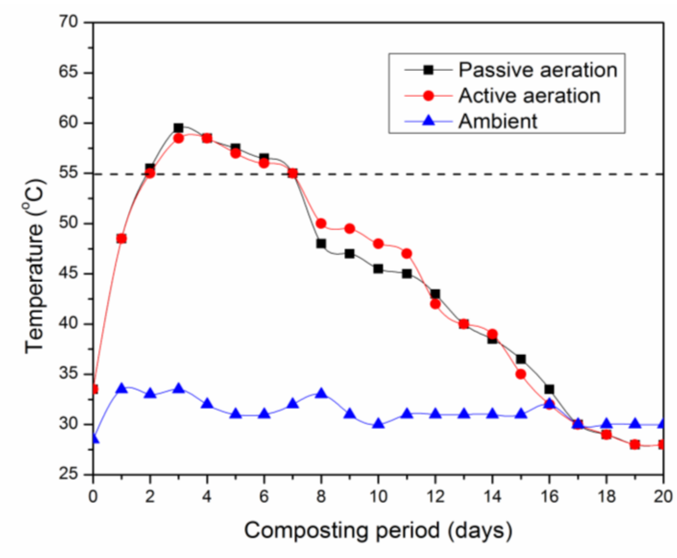


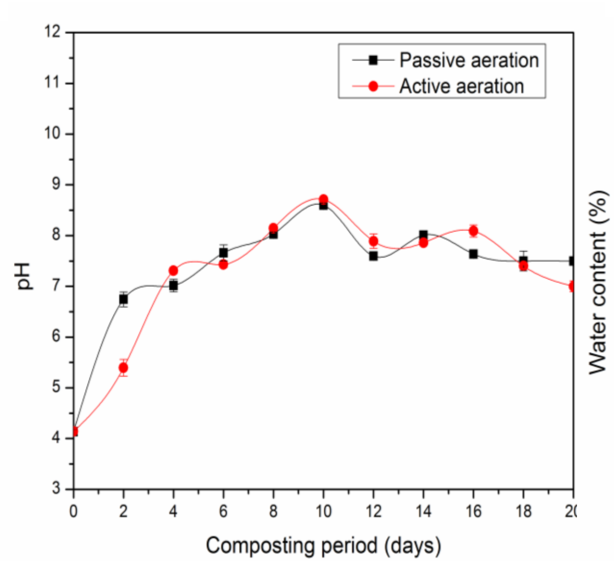
- **Fixed based on self-heating test, conducted in Dewar flasks**
- **Compost mixture with higher temperature (>55°C) & retention (≥3 days) is used**

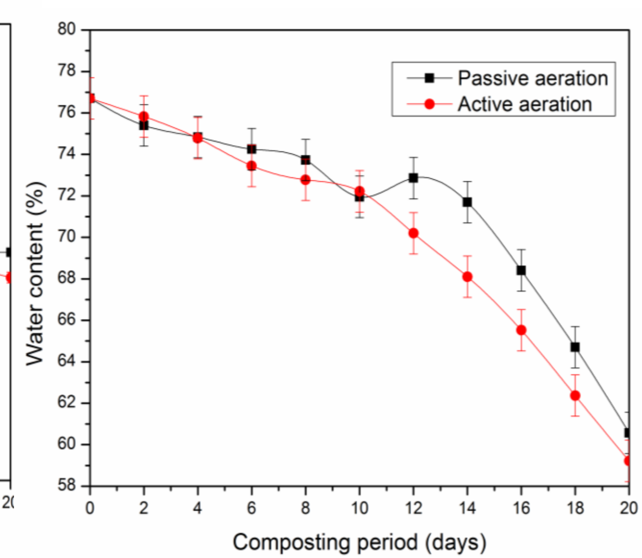
Characteristics of Initial mix

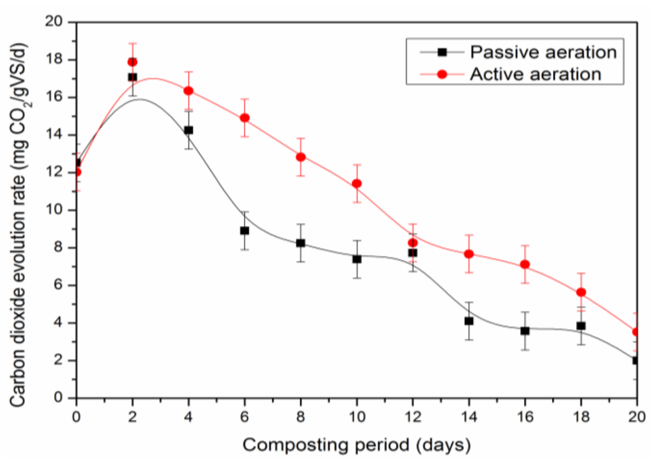
Substrate	Moisture Content (%)	C/N ratio	Mass used (kg)
Vegetable waste	92.6 ± 1.8	15.6±1.5	11.0
Food waste	81.4±2.5	20.4±0.7	2.0
Dewatered septage	60.2±2.7	8.2±0.8	6.5
Coir pith	33.3±1.2	34.5±2.7	1.0
Wood chips	55±0.9	40.9±1.8	2.5
Cow dung	94.3±2.2	9.4±0.9	1.0
Overall Moisture Content (%)			76.8
Overall C/N ratio			15.7

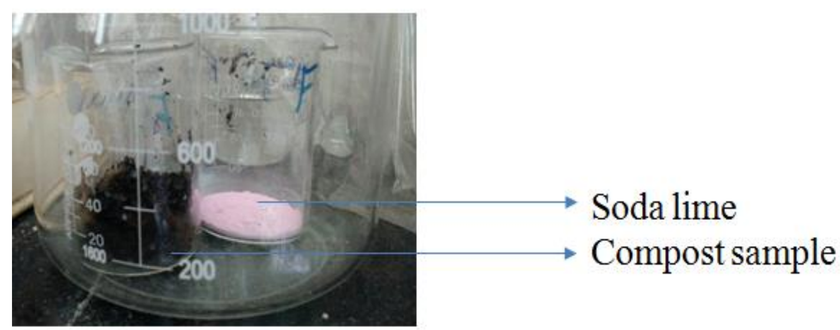
Compost Dynamics and Maturity





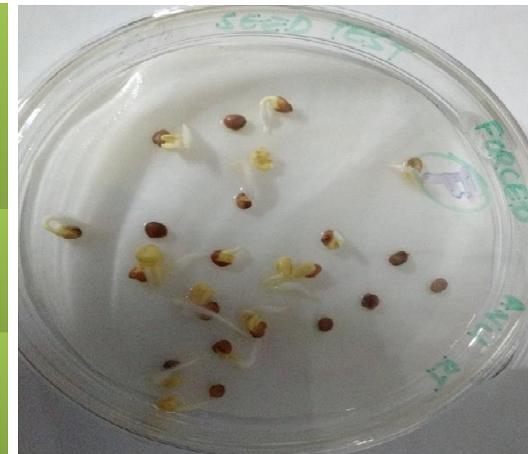






Compost product quality

Parameters	Standard values		Passive aeration	Active aeration
	HKORC[a]	TMECC[b]/ CCME[c]		
Ammoniacal-N (mg/kg dw)	< = 700	75-500	10.3 ±5.3	37.2± 4.8
CO_2 evolution rate (g C/kg VS/day)	< = 2	2-4	2.0 ± 0.2	3.5 ± 0.2
C:N ratio	≤ 25	≤ 25	10.9 ± 0.8	9.8 ± 0.5
pH Value	5.5 - 8.5		8.2 ± 0.1	7.4 ± 0.1
Organic matter (% dw)	> 20	>40	61 ± 0.5	58 ± 0.5
Seed germination index (%)	≥ 80	80–90	135	144
Total N, P, K	≥ 4% dw		4.37±0.5	4.5±0.5



Seed germination test

Ripened compost

[a]HKORC (2005): *Compost and Soil Conditioner Quality Standards for General Agricultural Use*.
[b]TMECC (2002): *Test Methods for the Examination of Composts and Composting*.
[c]CCME (2005): *Guidelines for Grade A Compost Quality*.

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Lessons learned and Summary

- Septage is highly variable in nature
- Drying beds – better sustainable dewatering options
- Co-composting helps in integrated solid waste management
- Addition of bulking material (having higher water holing capacity) reduces leachate production
- Wood chips provides enough FAS and in turn reduce GHG emissions
- In-vessel co-composting produces good quality compost from solid waste at a faster rate

“Bio-waste to Bio-gold”

Thank you for your kind attention!!!